

Chapter 1 – Assessing Students’ Needs for Assistive Technology (ASNAT) Process

Overview of Assessment and Planning Process.....	1
Using the AT Consideration Guide	7
WATI AT Consideration Guide	10
AT Assessment	12
Assessing a Student’s Needs for AT – Where to Start?.....	15
Gathering Information about the Student.....	18
WATI Student Information Guide (Sections 1-12).....	22
Gathering Information about Environments and Tasks.....	45
Using the AT Decision Making Guide.....	52
Using the AT Checklist.....	60
Additional Tools	63
Implementing Trials with AT	64
Products	68

Overview of the Assessment and Planning Process

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This chapter provides an overview of the assistive technology consideration, assessment and planning process that has been implemented throughout Wisconsin and in hundreds of school districts across the country. The term “assessment” is being used rather than “evaluation,” except when specifically quoting IDEA. IDEA states that one of the assistive technology services that a school district must provide is an “assistive technology evaluation”. However, throughout this manual, we will use the term “assessment” rather than “evaluation”, unless directly quoting the law. This is based on the following definition from the Federal Register (July 10, 1993).

Evaluation: A group of activities conducted to determine a student’s *eligibility* for special education.

Assessment: A group of activities conducted to determine a student’s *specific needs*. (Italics added for emphasis.)

We believe that assessment is a more accurate and descriptive term for what needs to occur. It has long been our philosophical belief that there is no “eligibility” criterion for assistive technology. IDEA ’97 supported that philosophy with its requirement that each IEP team “consider” the student’s need for assistive technology. This language remains in IDEA ’04.

The first page in this section contains the definition of Assistive Technology devices and Assistive Technology Services from IDEA.

Following that is an explanation of the forms and process developed by the Wisconsin Assistive Technology Initiative for both “Consideration” and “Assessment”. There are descriptions of the steps for information gathering, decision-making, and trial use. In addition, there are directions on how to use the specific forms for each step of the process.

All products mentioned in this chapter appear in a table at the end of the chapter along with the company that produces them. A list of products and companies is at the end of the each chapter of this manual.

Each of the forms contained in this chapter are included in the appendix as reproducible forms. These may be copied for your use if you maintain the credits as they appear on each page.

Assistive Technology Laws Affecting School Districts

As stated in 300.308, each school district is required to insure that assistive technology devices and services are provided if needed by a student in order to receive a free appropriate public education (FAPE).

Definition of Assistive Technology

300.308 Assistive Technology

Each public agency shall ensure that assistive technology devices or assistive technology services or both, as those terms are defined in 300.5 - 300.6 are made available to a child with a disability if required as a part of the child's

- (a) Special education under 300.17;
- (b) Related services under 300.16; or
- (c) Supplementary aids and services under 300.550(b)(2).

Assistive technology devices and services

300.5 Assistive technology device.

Assistive technology device means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability. The term does not include a medical device that is surgically implanted, or the replacement of such device. (Authority: 20 U.S.C. 1401(1))

300.6 Assistive technology services

Any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes:

- (A) the evaluation of needs including a functional evaluation, in the child's customary environment;
- (B) purchasing, leasing or otherwise providing for the acquisition of assistive technology devices;
- (C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of assistive technology devices;
- (D) coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs;
- (E) training or technical assistance for a child with disabilities, or where appropriate that child's family; and
- (F) training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers or others(s) who provide services to employ, or are otherwise, substantially involved in the major life functions of of that child.. [Authority: 20 U.S.C. 1401(2)]

The reauthorization of IDEA '04 aligned with laws found in No Child Left Behind (NCLB). One such alignment was in the identification of the need to provide alternative text formats to students who had difficulty interacting with text found in standard core content text books. This law impacts assistive technology tool choice as well as the delivery of services. IEP teams must identify the text format that matches a student's need. Additionally, they must select the compatible file format for the device the student will use and the service needed to support the student in accessing these correct files.

300.172(a)(1)

Adopt the National Instructional Materials Accessibility Standard (NIMAS), published as appendix C to part 300, for the purposes of providing instructional materials to blind persons or other persons with print disabilities, in a timely manner after publication of the NIMAS in the Federal Register on July 19, 2006 (71 FR 41084).

Consideration

IDEA '97 added the requirement that each IEP Team consider the need for assistive technology as part of the Consideration of Special Factors.

300.346 (a)(2) Consideration of Special Factors.

The IEP Team shall....

(v) consider whether the child requires assistive technology devices and services.

Lack of Guidelines

Neither the law nor the regulations provided guidelines for school districts in the implementation of these requirements. This may be part of the reason that school districts still struggle to comply with the laws relating to assistive technology. One systematic approach to providing effective assistive technology services is *Education Tech Points* (Bowser & Reed, 1998). This approach uses key questions to help school district staff appropriately address assistive technology throughout the delivery of special education services. *Education Tech Points* provides questions about assistive technology to be addressed during: Initial Referral, Evaluation for Eligibility for Special Education, Extended Assessment, Plan Development, Implementation, and Periodic Review. This manual is available as a free download from the www.wati.org website.

Assistive Technology Roles and Responsibilities

Although school districts have been required since 1990 to specifically provide assistive technology devices and services, we continue to find a range of situations across school districts from:

- No one responsible for AT.
- One person responsible for AT struggling to find time because he or she has little or no reduction in other responsibilities.
- One person responsible for AT with some reduction in other responsibilities.
- A small team (often an SLP, an OT, and a teacher) at the district level responsible for AT with some reduction in other responsibilities.
- A larger, more complete team (usually adds vision and hearing as well as PT and sometimes different types of special education teachers) at district level with some building representation established.
- Well trained AT teams in each building with back up from a district level AT Resource team.

Looking at that list as a continuum, it is easy to understand that educators would struggle to comply with the law in those situations described first. It is nearly impossible to be in compliance in school districts where little or no effort has been made to assign responsibility, honor that responsibility by providing time to carry out duties, and provide training to all who require it.

However, even in the districts where effort has been made to assign responsibility and provide training, there can still be difficulties. What we really must have in every school district is:

A knowledgeable, supportive network of people working together to help every IEP Team choose and provide appropriate AT devices and services.

What does that mean? It means:

1. Every school district employee who works with students with disabilities (including general education teachers) has at least awareness-level knowledge about what assistive technology is and what it does.
2. Every employee who works with students with disabilities and has contact with parents of those students, knows the law about assistive technology, knows district procedures for obtaining assistive technology and assistive technology evaluations, and how to initiate those procedures.
3. All administrators understand and comply with the laws related to assistive technology. They expect assistive technology options to be available in all classrooms.
4. Specific individuals at both the building and district level have been designated with specific responsibilities related to assistive technology and provided the necessary training, resources, and support to carry out those responsibilities.

Even in a small school district, it is possible to identify and train at least one individual in each building to have basic knowledge about assistive technology. That individual can then participate in a network within the district so that he or she is aware of others who have knowledge. It also allows that network of people to collaborate to insure that someone develops greater expertise in specific areas (e.g., augmentative communication, voice recognition, or adapted computer access) and that all know who those individuals are and how to contact them for assistance.

Because IDEA '04 specifically requires each IEP Team to consider the student's need for assistive technology, each IEP Team must have at least one member with sufficient knowledge to appropriately consider that need. In addition to knowing about the assistive technology devices, that individual must also know where to turn for greater expertise when difficult questions arise. This can only happen when there is a district wide effort to create knowledgeable people who are interconnected with each other.

Action Steps

School districts that have not yet done so, must:

1. Provide awareness level training to all employees who work with students with disabilities in any capacity with an expectation of implementation.
2. Provide training on the law to all administrators and monitor their compliance.
3. Designate individuals at the central office and building level to work together to gain more in-depth knowledge.
4. Create learning communities where general education, special education, curriculum, and instructional technology staff continually support efforts to include all students in instruction.
4. Provide resources to keep staff knowledgeable including access to readily available equipment and software. Provide print supports as well as online resources and access to training.
5. Designate specific responsibilities as needed so that everyone clearly understands their role.

It is not so important that a district follow a certain model, but rather that they undertake a systematic course of action, designed to meet the needs of their students with disabilities.

Considering the Need for Assistive Technology

Every IEP Team is required to “consider” the student’s need for assistive technology. When the team “considers” assistive technology, that process should involve some discussion and examination of potential assistive technology. It should not be ignored or skipped over. It should not be someone saying, “Assistive technology? No, he doesn’t need that.” without real discussion. Consideration is defined in the American Heritage Dictionary as “to think carefully about, to form an opinion about, or to look at thoughtfully.” We believe that Congress did not choose that word by accident, but clearly intended that there would be some thought about whether a student might need assistive technology.

This “thoughtful look” should certainly include at least a brief discussion of which assistive technology might be useful and whether it is needed. In order to do that, someone on the IEP team will need to be sufficiently knowledgeable about assistive technology to help lead the discussion. That person may bring along specific resource information about assistive technology to help all team members focus on what assistive technology exists for the tasks that are challenging to the student. That information might be books, catalogs, printouts from a website, or actual hardware or software. Whether resources are brought along or not, there should be a brief discussion of assistive technology during which at least one person displays some knowledge about relevant assistive technology.

Because this discussion should be brief, it should last at least a minute or two, but no more than 15 to 20 minutes. Congress intended that we could do this within the confines of an IEP meeting, so it should not add appreciably to the length of that meeting. If understanding and agreement cannot be reached in twenty minutes, then it is possible that there are questions that need to be addressed in another forum such as an assistive technology assessment.

In addition to talking about the assistive technology itself, there should be a discussion about assistive technology services. School districts are required to provide both the devices and the services, and the “consideration” requirement also includes assistive technology services. Specific assistive technology services may include: an evaluation of the student’s need for assistive technology; training of the student, members of the family or staff on how to use the assistive technology; technical assistance about its operation or use; modification or customization of the assistive technology; and other supports to the school personnel that might be necessary for the assistive technology to be appropriately used. What these other supports might be is not specified in the law. It could include anything that is needed—for example, training on how to add new vocabulary to an augmentative communication device or scan new materials into a software program that reads the text, or time for planning about how and when these things will happen and who is responsible.



The Consideration Guide may be a helpful tool for building consultation teams as they consider what instructional approaches and tools to target to support unidentified students who require interventions at the universal and selected levels.

Using the AT Consideration Guide

- ◆ Consideration is a brief process, one that can take place within every IEP meeting without unduly extending it.
- ◆ It is more than someone saying, “Oh, that doesn’t apply to my students.”
- ◆ At least one person on the IEP Team must have some knowledge about assistive technology, because you cannot “consider” something about which you know nothing.
- ◆ In order to think about whether assistive technology would be helpful or not, the IEP team would have to have already developed the bulk of the IEP in order for them to know what it is they expect the student to be able to do twelve months from now.
- ◆ The annual goals that the student is expected to accomplish will be the focus of the discussion about what assistive technology, if any, might assist or allow the student to accomplish them.

Some of the problems that a student might experience which would lead the IEP team to consider assistive technology as a solution include, but are not limited to:

- ✓ Print size is too small.
- ✓ A student is unable to hear all that is being said.
- ✓ Difficulty aligning math equations.
- ✓ The student often needs text read to him in order to complete an assignment.
- ✓ Handwriting is so illegible that the meaning is impossible to decipher.
- ✓ The effort of writing is so slow or so exhausting that it is counterproductive.
- ✓ The student has difficulty finding key points on web pages.
- ✓ Current modifications are not working.
- ✓ The effort of decoding reading assignments is so difficult that the student loses track of the meaning.
- ✓ Student cannot organize assignments in a way that brings them to completion.
- ✓ The student is “stuck”.

When considering a student’s need for assistive technology, there are only four general types of conclusions that can be reached:

1. The first is that current interventions (whatever they may be) are working and nothing new is needed, including assistive technology. This might be true if the student’s progress in the curriculum seems to commensurate with his abilities.
2. The second possibility is that assistive technology is already being used either permanently or as part of a trial to determine applicability, so that we know that it does work. In that case the IEP Team should write the specific assistive technology into the IEP if it is being used permanently, and document what AT is being explored or trialed, to insure that it continues to be available for the student.
3. The third possibility is that the IEP Team may conclude that new assistive technology should be tried. In that case, the IEP Team will need to describe in the IEP the type of assistive technology to be tried, including the features they think may help, such as “having the computer speak the text as the student writes”. The IEP Team may not know at this point a specific brand or model, and should not attempt to include a product by name, since they do not know if it will perform as expected. Describing the features is the key step for the IEP Team in this situation.

4. Finally, the last possibility is that the IEP Team will find that they simply do not know enough to make a decision. In this case, they will need to gather more information. That could be a simple process of calling someone for help, or going to get some print, digital storage device, or online resources to help them better “consider” what AT might be useful. It could also be an indication that they need to schedule (or refer for) an evaluation or assessment of the student’s need for assistive technology.

Many state education agencies have developed a worksheet or form to help IEP Teams insure that they address all of the Special Factors during the IEP meeting. This Special Factors worksheet or form requires the IEP Team to respond to a series of questions, including this one about assistive technology:

Does the student need assistive technology services or devices? ☐ Yes ☐ No
If yes, specify particular device(s) that were considered.

Because some IEP teams need more guidance than that single question provides, the Wisconsin Assistive Technology Initiative (WATI) has also developed a tool to further guide the IEP Team at this point. It is called the AT Consideration Guide. The AT Consideration Guide leads the IEP Team through a series of questions designed to help them determine whether the student does or does not “need” assistive technology devices or services. Those questions are:

1. **What task is it that we want this student to do, that s/he is unable to do at a level that reflects his/her skills/abilities (writing, reading, communicating, seeing, hearing)?** On the AT Consideration Guide, check each relevant task. Tasks that are not relevant to the student’s IEP are left blank.
2. **Is the student currently able to complete tasks with special strategies or accommodations?** If the answer is yes, strategies and accommodations are described in column A for each checked task.
3. **Is there currently assistive technology (devices, tools, hardware, or software) used to address this task?** (If none are known, review WATI’s AT Checklist.) If any assistive technology tools are currently being used (or were tried in the past, including recent assessment), they are described in column B.
4. **Would the use of assistive technology help the student perform this skill more easily or efficiently, in the least restrictive environment, or perform successfully with less personal assistance?** If yes, column C is completed.

Column C can also be used to explain briefly why something is not going to be tried, even though it is being considered. For instance, the student may recently have begun receiving new direct intervention and the IEP team wants to wait and see what the outcome is or the student has made recent improvements and they feel nothing different is needed. Documenting what was discussed and why it is not being implemented is often important here for review in the future, if someone does not remember clearly what was “considered.”

If it is decided to try assistive technology that has not previously been used by the student, column C provides the place to describe what will be tried. It is important here to plan one or more formal trials. Only a well-designed trial will actually determine what assistive technology will work for a specific student. Only after successful trial use, should the permanent use of assistive technology be written into the IEP.

As noted earlier, one of the outcomes of “consideration” may be the determination that some kind of assessment or evaluation of the student’s need for assistive technology is needed.

The Assistive Technology Consideration Guide can be used to document each of these situations for future reference.

WATI Assistive Technology Consideration Guide

Student's Name: _____

School: _____

1. What task does this student do, that he or she is unable to do at a level that reflects his or her skills/abilities (writing, reading, communicating, seeing, hearing)? **Check each relevant task** below. Please leave blank any tasks that are not relevant to the student's IEP.
2. Is the student currently using special strategies or accommodations to complete tasks? If yes, **describe in Column A** for each checked task.
3. Is there available AT (e.g., devices, tools, software, apps) that could be used to address this task? (If none are known, review WATI's AT Checklist.) If any AT tools are currently being used, **describe in Column B**.
4. Would the use of AT help the student perform this skill more easily or efficiently, in the least restrictive environment, or perform successfully with less personal assistance? If yes, **complete Column C**.

Task	A. If uses special strategies and / or accommodations, describe:	B. If currently uses AT tools, describe:	C. Describe new or additional AT to be tried:
☐ Seating, Positioning, or Mobility			
☐ Communication			
☐ Computer and Device Access			
☐ Motor Aspects of Writing			
☐ Composing Written Work			
☐ Reading			

Task	A. If uses special strategies and / or accommodations, describe:	B. If currently uses AT tools, describe:	C. Describe new or additional AT to be tried:
☐ Mathematics			
☐ Organization			
☐ Recreation and Leisure			
☐ Vision			
☐ Hearing			
☐ Other			

5. Are there AT services (more specific evaluation of need for AT, adapting or modifying the AT, technical assistance on its operation or use, or training of student, staff, or family) that this student needs? If yes, describe what will be provided, the initiation and duration.

Persons Present: _____

Date: _____

Assistive Technology Assessment

Since the 1990 reauthorization of IDEA with its definition of assistive technology services, which included “the evaluation of needs including a functional evaluation, in the student’s customary environment;” there has been a nationwide trend to identify and train staff within each school district to be more knowledgeable about assistive technology. This trend incorporates the following components:

- A change in the **view** of assistive technology assessment: from a one shot, separate event to an **ongoing, continual part of educational planning**.
- A change in **who** conducts the assistive technology assessment: from an expert based at a center to the **local team in the natural setting**.
- Change in the **scheduling** of an assistive technology assessment: from an isolated, one time event to an **ongoing, continual process**, which includes trials with potential assistive technology.
- As a result, there are changes in **support and follow-through**: from limited support and poor follow-through to **meaningful follow-through involving all team members**.

These changes are significant because the research on abandonment of assistive technology indicates that student’s feelings about the assistive technology and the support of family, peers, and teachers are critical factors that determine successful use versus abandonment. Other factors that affect abandonment include having the training necessary to use the devices, being able to use it with little or no pain, fatigue, discomfort, or stress, and having it compatible with other tools and technologies used by the student (American Medical Association, 1996).

This change has created a tremendous need for staff development training for service providers in local school districts across the nation. The changes in the 1997 reauthorization of IDEA which require every IEP team to “consider” the need for assistive technology, has created an even greater need for training, so that all IEP teams will have the needed expertise.

What is the difference between “Consideration” and “Assessment”?

The most obvious differences between Consideration and Assessment are those of depth and duration. Consideration is a short discussion that takes place during the IEP meeting using known information and results in the decision to continue something already being used or to try or not to try assistive technology. Assessment goes into much more detail, looking closely at the students abilities and difficulties and the demands of the environments and tasks. Assessment also includes the acquisition of new information.

We believe that assessment has three parts:

- **Information Gathering**
- **Decision Making**
- **Trial Use**

Information gathering may require specific tests to determine a student’s functional level on a given task, observation in customary environments to document performance as well as environmental demands, and careful review of what has already been tried. The decision-making requires the use of a clearly defined decision making process understood by everyone. If assistive technology appears to be a viable tool, trials to determine exactly what will work are needed.

Who Provides an Assistive Technology Assessment?

When there is a specific request for an assistive technology assessment or the IEP Team determines that one is needed, an assessment of the student's need for assistive technology must be completed. While school districts may vary in their specific procedures, it is essential that a team of people be involved in any AT assessment.

There are **five basic components** that **must** be represented on every team making decisions about assistive technology. They are:

- ◆ A person knowledgeable about the student. That may be **the student** and/or **parents** or other family members.
- ◆ A person knowledgeable in the area of **curriculum**, usually a Special Education Teacher.
- ◆ A person knowledgeable in the area of **language**, usually a Speech/Language Pathologist.
- ◆ A person knowledgeable in the area of **motor**, often an Occupational or Physical Therapist.
- ◆ A person who can commit the district's resources, not only for purchase of devices, but to authorize staff training and guarantee implementation in various educational settings, usually an **administrator**.

There can be any number of additional team members from such backgrounds as:

Audiologist	Technology Coordinator
Counselor	Early Intervention Specialist
Instructional Assistant	Nurse
Physician	Rehabilitation Engineer
Social Worker	Teacher of Hearing Impaired
Teacher of Visually Impaired	Vocational Counselor

This is not an exhaustive list. Each student's team should be unique, customized to reflect the student's unique needs. **Anyone who has the potential to contribute to the decision-making or implementation can be invited to participate on the team.**

Procedures Required

Each school district must have in place a procedure for providing assistive technology assessment. This procedure should include the identification of team members to provide the needed expertise to make an informed decision about assistive technology to meet the student's identified needs.

On the following pages information will be provided about the three-step process of Information Gathering, Decision Making, and Trial Use that comprise the AT Assessment process developed by the Wisconsin Assistive Technology Initiative.

The need for an assistive technology (AT) assessment may occur at any time during the provision of services to students with disabilities. It may come up during the official "consideration" during the IEP meeting, or at any time while a student is receiving special education and related services. Generally the need for an AT assessment is brought up by either the parents or the service providers. (We'll use this term to mean any of the therapists, teachers, assistants, or other individuals paid to provide services in the school). It may be a formal request for an "Assistive Technology Evaluation" or more of a specific question and something more is needed.

The question may be broad such as, “Sally struggles with trying to do all of the required reading and writing in sixth grade. She understands the concepts, but decoding the printed word and trying to spell what she wants to write are so difficult that she is feeling overwhelmed and frustrated. Is there any assistive technology that could help with this?” Or it can be very specific, “Bob is not able to understand the graphics in the social studies book due to his vision.”

In Sally’s case there may be a whole range of hardware (from low-tech to computer-based) and software that will need to be tried for specific reading and writing tasks in her various classes. In Bob’s case only one or two things may need to be tried before a workable solution will be found. In either situation, the team of service providers who work with that student need to have a systematic approach to begin to answer the question.

We have found that people who are new to assistive technology or teams new to the role of “assessing” a student’s need for assistive technology often flounder. They struggle to figure out where to start, what questions to ask, what commercial tests, if any, they might need to use, etc. The Wisconsin Assistive Technology Initiative developed a set of forms to help the team through these difficulties and to help them focus on the specific issues that need to be addressed. The forms that we use include:

- ◆ The WATI Student Information Guide
- ◆ The WATI Environmental Observation Guide
- ◆ The WATI Assistive Technology Decision Making Guide
- ◆ The WATI Assistive Technology Checklist

Assessing A Student's Need for Assistive Technology: Where to Start?

When the question of a student's need for AT leads to an assessment, the first action is to identify a team of people to address that question. If the school district already has an identified team, then a request for their assistance is made. If no one is designated to function as an AT Assessment team, or only one person has been designated, then a team of people with sufficient knowledge to make an appropriate and useful decision must be assembled.

While the number of the team members and their specific expertise will vary with the magnitude and complexity of the question to be answered, there are some specific considerations in selecting the members of the team. It is important that someone on the team understands curriculum. This is often a special education teacher or the regular classroom teacher. If the question involves speech or language, then someone with expertise in language development is needed. This is most typically a Speech/Language Pathologist, but might also be a teacher of the hearing impaired, if that would be appropriate based upon the student's unique needs. Often there are questions about positioning or motor ability. In this case a Physical or Occupational Therapist is needed. And, of course, one or more of these individuals must have knowledge about specific assistive technology that might be appropriate to address the student's needs. There may be any number of other individuals, as needed. For instance if the student has a vision impairment, there would need to be a Vision Specialist involved. If the student has Autism, someone with a background in Autism will be needed. The Wisconsin Assistive Technology Initiative has also developed a manual for addressing the needs of students with AT needs who are on the Autism Spectrum. You may wish to refer to this guide located on the www.wati.org or <https://dpi.wi.gov/sped/program/autism> site. While there may be a core group of people in a school district who routinely address questions about assistive technology, the specific team working together to determine an assistive technology solution will be made up of individuals who collectively can address all of the student's unique needs.

Finally, one or both of the parents, and when appropriate, the student must be active participants in the information gathering and decision-making. If the student can contribute and understand information, then they should participate in meetings along with their parent or parents. Typically a group of three to six or seven individuals will meet to begin the information gathering and decision making stages of the AT Assessment Process. The AT Assessment Directions/Procedure Guide is a basic outline of the steps that need to take place.

WATI Assistive Technology Assessment Directions/Procedure Guide

School District/Agency _____ School _____

Student _____ Grade _____

Team Members _____

	Date Completed	Comments
Getting Information: Step 1: Team Members Gather Information Review existing information regarding student's abilities, difficulties, environment, and tasks. If there is missing information, you will need to gather the information by completing formal tests, completing informal tests, and/or observing the student in various settings. The WATI Student Information Guide and Environmental Observation Guide are used to assist with gathering information. Remember, the team gathering this information should include parents, and if appropriate, the student. Step 2: Schedule Meeting Schedule a meeting with the team. Team includes: parents, student (if appropriate), service providers (e.g., spec. ed. teacher, general ed. teacher, SLP, OT, PT, administrator) and any others directly involved or with required knowledge and expertise.		

Chapter 1 – Assistive Technology Assessment



	Date Completed	Comments
Decision Making: <i>Step 3: Team completes Problem Identification</i> <i>Portion of AT Decision Making Guide at the meeting. (Choose someone to write all topics when everyone participating can see them).</i> The team should quickly move through: Listing the student’s abilities/difficulties related to tasks (5-10 minutes). Listing key aspects of the environment in which the student functions and the student’s location and positioning within the environment (5-10 minutes). Identifying the tasks the student need to be able to do is important because the team cannot generate AT solutions until the tasks are identified (5-10 minutes). (Note: The emphasis in problem identification is identifying tasks the student needs to be able to do, the relationship of the student’s abilities/difficulties and characteristics of the environment of the student’s performance of the tasks.) Step 4: Prioritize the List of Tasks for Solution Generation Identify critical task(s) for which the team will generate potential solutions. This may require a redefining or reframing of the original referral question, but is necessary so that you hone in on the most critical task.		

Chapter 1 – Assistive Technology Assessment



	Date Completed	Comments
Step 5: Solution Generation Brainstorm all possible solutions. Note: The specificity of the solutions will vary depending on the knowledge and experience of the team members; some teams may generate names of specific devices with features that are important, e.g., “needs voice output,” “needs to be portable,” “needs few (or many) messages,” “needs input method other than hands,” etc. Teams may want to use specific resources to assist with solution generation. These resources include, but are not limited to: the AT Checklist, the ASNAT Manual, <i>Closing the Gap Resource Directory</i>, and/or an AT Consultant. Step 6: Solution Selection Discuss the solutions listed, thinking about which are most effective for the student. It may help to group solutions that can be implemented 1) immediately, 2) in the next few months, and 3) in the future. At this point list the names of specific devices, hardware, software, etc. If the team does not know the names of devices, etc., use resources noted in Step 5 or schedule a consultation with a knowledgeable resource person (that is the part of the decision-making that should require the most time; plan on 20-30 minutes here).		

Chapter 1 – Assistive Technology Assessment



	Date Completed	Comments
Step 7: Implementation Plan Develop implementation plan (including trials with equipment) – being sure to assign specific names and dates, and determine meeting date to review progress (follow-up Plan). Reminder: Steps 3-7 occur in a meeting with all topics written where all participants can see them. Use a flip chart, board, or overhead during the meeting, because visual memory is an important supplement to auditory memory. Following the meeting, ensure that someone transfers the information to paper for the student’s file for future reference. Trial Use: Step 8: Implement Planned Trials Step 9: Follow Up on Planned Date Review trial use. Make any needed decisions about permanent use. Plan for Permanent use.		

Gathering Information about the Student

The process for assistive technology assessment developed by the Wisconsin Assistive Technology Initiative incorporates the SETT framework (Zabala, 1994) to help organize the often complex task of assistive technology decision-making. SETT stands for **S**tudent, **E**nvironment, **T**asks, **T**ools. By grouping the information into these categories, the task of selecting assistive technology becomes much more logical.

Without the SETT Framework, trying to gather and sort out all of the information necessary for assistive technology decision-making can be an overwhelming task. With it, the simplicity of gathering and grouping information allows the team to effectively use that information for competent decision-making.

Using the Student Information Guide

As you read through the Student Information Guide, the first thing you note is the questions about what assistive technology is currently being used and what has been used in the past. These are important questions. Unfortunately in our busy lives, it is possible for one service provider to be using assistive technology without others being aware of it. For example the Language Arts teacher may have discovered that Samantha writes much better with voice output on the computer. This may occur because all of the computers in her classroom are capable of providing text to speech. Students can choose to use it or not. She observes over the course of several months that Samantha regularly chooses to work using text to speech and that it has improved both the spelling and grammar in her written assignments. The other teachers and therapists may not be aware of this. Both the documenting and the sharing of that kind of information is essential.

The next section requires a file review to determine what assistive technology, if any, has been tried in the past and what the outcome of that use was. Turnover in staff can cause us to lose track of assistive technology use. Perhaps the most extreme example of this is the case of a team who spent several weeks trying to determine what augmentative communication device might work for a non-speaking student. The staff were all new and neglected to thoroughly review the file until early October, when they were startled to learn that a \$8000 dynamic display, voice output communication aid had been purchased for the student two years earlier. It was in a box, at the back of the classroom closet, safely stored away. Had someone not reviewed the file, they would have spent money on another device, when they already had a very powerful one available. The parent had told them on several occasions that there “used to be something that talked for him,” but they had not tracked down the critical information.

Now at the bottom of page 21, the team selects the sections that they feel they will need to complete. It is recommended that a team new to assistive technology assessment concentrate on only one area of concern at a time. So if the student has a learning disability and they are most concerned about writing. They would proceed to the section on Writing and answer the questions in that section. If they are concerned about more than one task, they may decide to complete more than one section of the Student Information Guide. It is up to the team to determine how many and which sections of the Guide will be helpful to them.

Each of the 12 content sections of the Student Information Guide contain questions relevant to determining the type of assistive technology and the features that might be necessary for a student to utilize assistive technology in the completion of the task. On pages 28 and 29 there are a series of questions about the student's abilities related to computer access. These two pages are not necessary to complete if the student has normal fine motor ability, but are critical if the student has a physical disability that includes fine motor difficulties that would impact their ability to keyboard. In the Section 4 – Motor Aspects of Writing, the first questions address the student's current writing ability. Because much of the assistive technology used to address writing difficulties involves keyboarding, the next question is about the student's current keyboarding ability. The next question is about any assistive technology currently used. Number five on page 31 is concerned with computer use and computer availability. At the bottom of page 31 there is a place to summarize the student's abilities and the concerns related to writing. .

Once the desired sections of the Student Information Guide are completed, the team moves on to page 44. The questions on this page are general and apply to every student. They include questions about behaviors that might impact the student's use of assistive technology any other significant factors that should be noted such as learning style, coping strategies, or interest that the team should remember and consider as they move on with the assessment process.

WATI Student Information Guide

Referral/Question Identification Guide

Student's Name _____ Date of Birth _____ Age _____

School _____ Grade _____

School Contact Person _____ Phone _____

Person Completing Guide _____ Date _____

Parent(s) Name: _____ Phone _____

Address _____

Student's Primary Language _____ Family's Primary Language _____

Disability: (Check all that apply.)

☐ Speech/Language	☐ Significant Developmental Delay	☐ Specific Learning Disability
☐ Cognitive Disability	☐ Other Health Impairment	☐ Hearing Impairment
☐ Traumatic Brain Injury	☐ Autism	☐ Vision Impairment
☐ Emotional/Behavioral Disability	☐ Orthopedic Impairment – Type: _____	

Current Age Group:

☐ Elementary

☐ Birth to Three

☐ Middle School

☐ Early Childhood

☐ Secondary

Classroom Setting:

☐ Self-contained

☐ General Education

☐ Home

☐ Resource Room

☐ Other: _____

Current Service Providers:

☐ Occupational Therapy

☐ Physical Therapy

☐ Speech/Language

☐ Assistive Technology

☐ Other(s): _____

Medical Considerations (Check all that apply)

☐ History of seizures	☐ Fatigues easily
☐ Has degenerative medical condition	☐ Has frequent pain
☐ Has multiple health problems	☐ Has frequent upper respiratory infections
☐ Has frequent ear infections	☐ Has digestive problems
☐ Has allergies to _____	
☐ Currently taking medication for _____	
☐ Other – Describe briefly _____	

Other Issues of Concern _____

Assistive Technology Current Used: (Check all that apply).

☐ None	☐ Low Tech Writing Aids
☐ Manual Communication Board	☐ Augmentative Communication System
☐ Low Tech Vision Aids	☐ Amplification System
☐ Environmental Control Unit/EADL	☐ Computer – Type (platform) _____
☐ Manual Wheelchair	☐ Power Wheelchair
☐ Voice Recognition	☐ Word Prediction
☐ Adaptive Input – Describe _____	
☐ Adaptive Output – Describe _____	
☐ Other _____	

Assistive Technology Tried: Please describe any other assistive technology previously tried, length of trial, and outcome (how did it work or why didn't it work).

AT Tried	Length/dates of trail	Outcome

Has the WATI Consideration Guide been completed for this student? If so, please attach it.

REFERRAL QUESTION

What task(s) does the student need to do that is currently difficult or impossible, and for which assistive technology may be an option? _____

Based on the referral question, select the sections of the Student Information Guide to be completed. (Check only those that apply).

☐ Section 1 Seating, Positioning and Mobility	☐ Section 7 Mathematics
☐ Section 2 Communication	☐ Section 8 Organization
☐ Section 3 Computer and Device Access	☐ Section 9 Recreation and Leisure
☐ Section 4 Motor Aspects of Writing	☐ Section 10 Vision
☐ Section 5 Composition of Written Material	☐ Section 11 Hearing
☐ Section 6 Reading	☐ Section 12 General

Now proceed to the Sections you checked and fill in the answers to the questions.

WATI Student Information Guide

SECTION 1 Seating, Positioning, and Mobility

1. Description of Current Seating: (Check all that apply.)

- ☐ Seating allows feet to be flat on floor.
 - ☐ Chair seat is ½" from back of bent knee.
 - ☐ Desk height is 1-2" higher than elbow when arm is bent at 90° angle.
 - ☐ When used, top of desktop monitor is 2-3" below eye level.
 - ☐ Seating provides adequate trunk stability.
 - ☐ Seating facilitates readiness to perform task.
 - ☐ There are questions or concerns about the student's seating. They are: _____
-

2. Student behavior when seated: (Check all that apply).

- ☐ Student uses active learning position when appropriate.
 - ☐ Student chooses alternative positions when given a chance (e.g., bean bag chair, standing, lying down).
 - ☐ Student frequently falls out of chair.
 - ☐ Student changes position with high frequency.
 - ☐ Student gets in and out of seat more than expected.
 - ☐ Student frequently slumps over desk.
 - ☐ Student frequently props head up with hands.
 - ☐ Student dislikes some positions, often indicates discomfort in the following positions: _____
-

The discomfort is communicated by? _____

- ☐ The student has difficulty using table or desk – specific example: _____
-

3. Characteristics of current Seating and Positioning of Student (Check all that apply.)

- ☐ Sits in regular chair.
- ☐ Sits in regular chair w/ pelvic belt or footrest.
- ☐ Sits in chair with non-slip surface.
- ☐ Sits in adapted chair – list brand or describe: _____
- ☐ Sits in seat with adaptive cushion that allows needed movement.
- ☐ Sits comfortably in wheelchair ☐ part of the day ☐ most of the day ☐ all of the day.
- ☐ Spends part of day out of chair due to prescribed positions.
- ☐ Spends part of day out of chair due to specific or general discomfort.
- ☐ Uses many positions throughout the day, based on activity.
- ☐ Has few opportunities for other positions.
- ☐ Uses regular desk/workstation.

-
- ☐ Uses desk with height adjusted.
 - ☐ Uses tilted surface on which to work.
 - ☐ Uses tray on wheelchair for desktop.
 - ☐ Uses adapted table.
 - ☐ Current seating interferes with the following activities: _____
-

4. Student characteristics related to seating and positioning: (Check all that apply.)

- ☐ Student exhibits good positioning when: _____
- ☐ Student leans to the ☐ right ☐ left.
- ☐ Student holds head, arms, or other parts of the body a certain way, describe: _____
- ☐ Student has specific positioning ☐ all day ☐ only at these times: _____
- ☐ Student expresses issues or concerns about seating/positioning.
- ☐ Student requires support positioning at the hips.
- ☐ Student has difficulty achieving and maintaining head control, best position for head control is: _____
- ☐ Student can maintain head control for _____ minutes in _____ position.

Summary of Student's Abilities and Concerns Related to Seating and Positioning:

This section is for students with mobility issues. (Skip if student does not have mobility issues.)

1. Current mobility: (Check all that apply.)

☐ Crawls, rolls, or creeps independently	☐ Is pushed in manual wheelchair
☐ Uses wheelchair for long distances only	☐ Uses manual wheelchair independently
☐ Uses power chair	☐ Needs help to transfer in and out of chair
☐ Transfers independently	☐ Has difficulty walking
☐ Walks with assistance	☐ Has difficulty walking up stairs
☐ Has difficulty walking down stairs	☐ Needs extra time to reach destination
☐ Walks independently	☐ Walks with appliance
☐ Uses elevator key independently	☐ Other: _____

2. The student has the following skills, either emerging or mastered: (Check all that apply.)

☐ cause and effect	☐ spatial relations	☐ problem solving
☐ ability to interact with the environment		☐ motivation/initiation

3. Concerns about mobility. Student: (Check all that apply.)

☐ Is extremely tired after walking	☐ Requires a long time to recover
☐ Seems to be having more difficulty lately	☐ Complains about pain or discomfort
☐ New schedule/location requires more time	☐ Other: _____

4. The student is unduly distracted by: (Check all that apply.)

☐ Visual clutter	☐ Fluorescent lighting vs. full-spectrum lighting
☐ Classroom and background noise	☐ Tactile stimulation
☐ Awareness of physical space	☐ Other: _____

5. The student has issues with the following that may impact the use of power mobility:
(Check all that apply.)

☐ Behavior	☐ Strength	☐ Coordination	☐ Vision
☐ Fatigue	☐ Other physical abilities: _____		

6. The student's best access points other than the hand for operating a power mobility device is:

☐ chin	☐ head	☐ foot	☐ mouth	☐ eyes	☐ tongue

7. The student can operate a power mobility device using: (Check all that apply.)

☐ joystick	☐ switch-adapted proportional joystick	
☐ switch control (with and without proportional access)	☐ sip and puff	
☐ tongue-activated keypad	☐ proximity switch	☐ scanning with a switch

8. The student needs to change in position in space in order to: (Check all that apply.)

☐ reduce risk of pressure sores	☐ restructure weight distribution
☐ increase sitting tolerance	☐ other: _____

9. The student needs to change position in the following ways: (Check all that apply.)

☐ tilt	☐ recline	☐ elevate leg rests	☐ elevate seat	☐ stand

10. The student needs assistance with: (Check all that apply.)

☐ transfers	☐ changing positions	☐ accessing mobility device

11. Student needs access to: (Check all that apply.)

☐ AAC device	☐ electronic aid to daily living (EADL)	☐ computer/mobile device

Summary of Student's Abilities and Concerns Related to Power Mobility:

WATI Student Information Guide

SECTION 2 Communication

1. Student's Present Means of Communication

(Check all that are used. Circle the primary method the student uses).

☐ Changes in breathing patterns	☐ Body position changes	☐ Eye gaze/eye movement
☐ Facial Expressions	☐ Gestures	☐ Pointing
☐ Sign language approximations	☐ Sign language (type: _____ # signs _____ # combinations _____ # signs in a combination _____)	
☐ Vocalizations, list examples _____		
☐ Vowels, vowel combinations, list examples _____		
☐ Single words, list examples & approx. # _____		
☐ 2-word utterances	☐ 3-word utterances	
☐ Semi-intelligible speech, estimate % intelligible with familiar partner: _____ with unfamiliar partner: _____ in familiar context: _____ in unknown context _____.		
☐ Communication board	☐ Tangibles	☐ Photos
☐ Combination symbols/words	☐ Words	☐ Symbols
☐ 2 symbol combinations – list examples _____	☐ Visual Scenes	
☐ 3 or more symbol combinations – list examples _____		
☐ Communication book/binder – number of pages in book/binder _____		
Does student navigate to desired page/message independently? ☐ yes ☐ no		
☐ Schedule board(s) – list examples _____		
☐ Speech Generating device(s) – please list _____		
☐ Multiple overlays or levels – list examples _____		
☐ Partner Assisted Scanning – please describe strategies and communication system _____		

☐ Intelligible speech	☐ Writing	☐ Other _____
Comments about student's present means of communicating: _____		

2. Purposes of Communication: (List examples after each one checked.)

☐ Greeting _____
☐ Requesting _____
☐ Demanding _____
☐ Interacting socially _____
☐ Social etiquette _____
☐ Denials/rejections _____
☐ Shared information, including joint attention _____

3. Those Who Understand Student's Communication Attempts (Check best descriptor).

	Most of the time	Part of the time	Rarely	Not Applicable
Strangers	☐	☐	☐	☐
Teachers/therapists	☐	☐	☐	☐
Peers	☐	☐	☐	☐
Siblings	☐	☐	☐	☐
Parent/Guardian	☐	☐	☐	☐

4. Current Level of Receptive Language

Age approximation: _____

If formal tests used, name and scores: _____

If formal testing is not used, please give an approximate age or developmental level of functioning. Explain your rationale for this estimate: _____

5. Current Level of Expressive Language

Age approximation: _____

If formal tests used, name and scores: _____

If formal testing is not used, please give an approximate age or developmental level of functioning. Explain your rationale for this estimate. _____

How many symbols/signs/words does the student use regularly without a model/prompt? _____

Does the student combine symbols/signs/words without a prompt? ☐ Yes ☐ No

6. Communication Interaction Skills

Desires to communicate ☐ Yes ☐ No

To indicate *yes* and *no* the student:

☐ Shakes head ☐ Signs ☐ Vocalizes ☐ Gestures ☐ Eye gazes

☐ Points to board ☐ Uses word approximations ☐ Does not respond consistently

☐ Can a person unfamiliar with the student understand the response? ☐ Yes ☐ No

(Continued on next page)

7. Does the student: (check best descriptor)

	Always	Frequently	Sometimes	Seldom	Never
Turn toward speaker?	☐	☐	☐	☐	☐
Get other's attention?	☐	☐	☐	☐	☐
Interact with peers?	☐	☐	☐	☐	☐
Show awareness of listener's attention?	☐	☐	☐	☐	☐
Initiate interactions?	☐	☐	☐	☐	☐
Ask questions?	☐	☐	☐	☐	☐
Respond to communication interaction?	☐	☐	☐	☐	☐
Ask for clarification from communication partner?	☐	☐	☐	☐	☐
Repair communication breakdowns?	☐	☐	☐	☐	☐
Change language according to needs of listener?	☐	☐	☐	☐	☐
Take turns with communication partner?	☐	☐	☐	☐	☐
Require verbal prompts?	☐	☐	☐	☐	☐
Require physical prompts?	☐	☐	☐	☐	☐
Maintain communication exchange?	☐	☐	☐	☐	☐
Terminate communication?	☐	☐	☐	☐	☐

Describe techniques student uses for repair (e.g., keeps trying, changes message, points to first letter, etc.)

8. Student's Needs Related to Device/Systems (Check all that apply).

- ☐ Walks ☐ Uses wheelchair ☐ Carries device under 2 pounds
☐ Drops or throws things frequently ☐ Needs digitized (human) speech
☐ Needs device w/large number of words and phrases
☐ Requires scanning
☐ Requires auditory preview
☐ One reliable switch site ☐ More than one reliable switch site
☐ Other: _____
-

9. Pre-Reading and Reading Skills Related to Communication (Check all that apply).

- ☐ Yes ☐ No Object/picture recognition
☐ Yes ☐ No Symbol recognition (tactile, Mayer-Johnson, Rebus, etc.) Number of symbols _____
☐ Yes ☐ No Auditory discrimination of sounds
☐ Yes ☐ No Auditory discrimination of words, phrases
☐ Yes ☐ No Selects initial letter of word
☐ Yes ☐ No Follows simple directions
☐ Yes ☐ No Sight word recognition Number of words _____
☐ Yes ☐ No Recognizes environmental print
☐ Yes ☐ No Puts two symbols or words together to express an idea
List any other reading or pre-reading skills that support communication _____
-

10. Visual Abilities Related to Communication (Check all that apply).

☐ Maintains fixation on stationary object	☐ Looks to right and left without moving head
☐ Visually recognizes people	☐ Scans matrix of symbols in a grid
☐ Visually recognizes common objects	☐ Scans line of symbols left to right
☐ Visually recognizes photographs	☐ Visually shifts horizontally
☐ Visually recognizes symbols or pictures	☐ Visually shifts vertically
☐ Needs additional space around symbol	☐ Looks at communication partner
☐ Requires high contrast symbols or borders	☐ Benefits from "zoom" feature

Is a specific type (brand) of symbols or pictures preferred? _____

What size symbols or pictures are preferred? _____

What line thickness of symbols is preferred? _____ inches

Does student seem to do better with black on white, white on black, or a specific color combination for figure/ground discrimination? _____

From what size field can the student make appropriate selections? _____

Explain anything else you think is significant about the communication system the student currently uses for his/her needs: (Use additional page if necessary) _____

11. Sensory Considerations:

Does the student have sensitivity to:

- ☐ Velcro
- ☐ Synthesized (computer generated) voices
- ☐ Volume
- ☐ Switch feedback (clicking noise)
- ☐ Tactile sensations
- ☐ Other

Explain student's reaction to any of the checked items _____

12. What are the communication expectations for the student in different environments?

School (regular and special ed., with peers, formal and informal – such as lunchroom settings)

Home _____

Community (stores, restaurants, church, library, etc.) _____

Summary of Student's Abilities and Concerns Related to Communication including past AT used to support student's communication _____

WATI Student Information Guide

SECTION 3 Computer and Device Access

1. Computer and Device Use

List current computer and device use: _____

What AT has been tried previously? _____

What difficulty is the student having with current method of access? _____

2. Current Computer Access – How does the student currently access the computer?

☐ Doesn't access the computer	☐ Adapted keyboard/mouse: _____
☐ Regular keyboard/mouse/touchpad	☐ Specialized Software: _____
☐ Touch type with two hands	☐ Head: _____
☐ Hunt/peck with one hand	☐ Speech recognition: _____
☐ Touch type with one hand	☐ Switch scanning: _____
☐ Hunt/peck with one hand	☐ Touchscreen: _____
☐ Eye gaze	☐ Other: _____

3. Current Device Access – type of device _____

How does the student currently access the device?

☐ Doesn't access a device	☐ Uses assistive touch features to access
☐ 2 hand touch and hardware buttons	☐ Speech recognition
☐ 1 hand touch and hardware buttons	☐ Single switch access
☐ Single finger touch gestures	☐ Multi switch access
☐ Multi finger touch gestures	☐ Adapted keyboard: _____
☐ Head pointer access	☐ Eye gaze
☐ Other _____	

4. Physical Abilities

Does the student have limitations to range of motion? ☐ Yes ☐ No

Does student have abnormal reflexes or abnormal muscle tone? ☐ Yes ☐ No

If abnormal, is it high or low? ☐ high ☐ low

Does student have difficulty with accuracy? ☐ Yes ☐ No

Does student fatigue easily: During activities? ☐ Yes ☐ No Throughout the day? ☐ Yes ☐ No

Describe how physical abilities affect computer use. _____

Is the student's speech clear? ☐ Yes ☐ No Is the student's speech consistent? ☐ Yes ☐ No

Has scanning been tried? ☐ Yes ☐ No If yes, did it work? _____

5. Motor Control

Does the student have voluntary, controlled movement of the following? (Check all that apply)

☐ Right hand	☐ Right arm	☐ Right leg	☐ Right foot
☐ Left hand	☐ Left arm	☐ Left leg	☐ Left foot
☐ Head	☐ Eyes	☐ Mouth	☐ Voice
☐ Fingers	☐ Other: _____		

What is the student's most consistent voluntary movement?

6. Positioning

How is the student positioned for computer or device access?

- ☐ Regular classroom chair ☐ Regular chair with adaptations: _____
- ☐ Specialty chair: _____
- ☐ Wheelchair: _____
- ☐ Other: _____

7. Sensory

Does the student have any issues with hearing? ☐ Yes ☐ No

Does the student have any issues with vision? ☐ Yes ☐ No

Describe how sensory issues/abilities affect computer use. _____

8. Literacy - At grade level is the student currently performing in:

Reading? _____ Spelling? _____ Writing? _____

At what grade level are the student's:

Math skills? _____ Computer skills? _____

9. Summary of Students Abilities and Concerns Related to Computer and Device Access

WATI Student Information Guide

SECTION 4 Motor Aspects of Writing

1. Current Writing Ability (Check all that apply).

☐ Scribbles	☐ Pretend writes
☐ Prints name	☐ Scribbles with a few recognizable letters
☐ Holds pencil, but does not write	☐ Prints a few words
☐ Writes on 1" lines	☐ Copies from book (near point)
☐ Writes independently and legibly	☐ Copies from board (far point)
☐ Uses space correctly	☐ Copies simple shapes
☐ Sizes writing to fit spaces	☐ Writing is limited due to fatigue
☐ Writes cursive	☐ Writing is slow and arduous
☐ Writes on narrow lines	☐ Can maintain place on paper
☐ Can read work he has written	☐ Can fit answers in allotted space

2. Current Writing Needs (Check all that apply).

☐ Single words	☐ Short phrases	☐ Sentences	☐ Paragraphs	☐ Essays/papers
☐ Fill in blanks	☐ Take notes	☐ Other: _____		

3. Current Keyboarding Ability (Check all that apply).

☐ 10-finger typing (functional speed)	☐ Uses alternate keyboard: _____
☐ Multi-finger typing (functional or slow)	☐ Uses access software: _____
☐ One-finger typing (functional or slow)	☐ Uses touch window
☐ Does not currently type	☐ Uses head or mouth stick
☐ Activates desired key on command	☐ Uses switch to access computer
☐ Accidentally hits unwanted keys	☐ Uses scanning to access computer
☐ Requires arm or wrist support to type	☐ Other _____

4. Computer Use (Check all that apply).

- ☐ Has never used a computer
- ☐ Uses a computer: ☐ rarely ☐ occasionally ☐ frequently ☐ daily
- ☐ Uses a computer at: ☐ home ☐ school
- ☐ Uses computer for: ☐ word processing ☐ internet ☐ spell checking
- ☐ Uses computer for the following subjects or tasks: _____
- _____
- ☐ Student has potential to use computer but has not for the following reason: _____
- _____

5. Assistive Technology Currently Used (Check all that apply).

- ☐ Adapted pencils-pencil grips
- ☐ Adapted papers
- ☐ Writing templates
- ☐ Adapted/portable keyboards
- ☐ Computers with accessibility features
- ☐ Adaptive Software: text-to-speech; word prediction; voice recognition _____
- ☐ Scanned worksheets
- ☐ Other _____

6. Computer Availability

The student has access to the following computer(s):

- ☐ PC ☐ Macintosh ☐ Chromebook ☐ Tablet ☐ Other _____
- ☐ Desktop ☐ Laptop

Location: _____

Summary of Student's Abilities and Concerns Related to Writing _____

WATI Student Information Guide

SECTION 5 Composition of Written Material

1. Typical of Student's Present Writing (Check all that apply).

☐ Words, but not identifiable	☐ Writes with symbols	☐ Short words
☐ Short phrases	☐ Complex phrases	☐ Sentences
☐ Short paragraph 2-5 sentences	☐ Longer paragraphs	☐ Multi paragraphs

2. Difficulties Currently Expressed by the Student (Check all that apply).

☐ Understanding that words have meaning	☐ Answering questions beyond yes/no	
☐ Finding facts	☐ Understanding that sentences require parts (nouns and verbs)	
☐ Getting started with a sentence starter	☐ Adding information to a topic	
☐ Sequencing information	☐ Integrating information from 2 or more sources	
☐ Relating information to a topic	☐ Determining when to begin a paragraph	
☐ Generating ideas with or without a graphic organizer	☐ Working with peers to write	
☐ Planning content	☐ Using academic vocabulary	☐ Using transitional words
☐ Using basic core words	☐ Summarizing writing for different audiences	
☐ Other: _____		

3. Strategies for Composing Written Materials Student Currently Utilizes (Check all that apply).

☐ Sentence starters	☐ Picture cues	☐ Story starter
☐ Transitional words (first, next)	☐ Preset choices or plot twist	
☐ Webbing or concept mapping	☐ with pictures	☐ without pictures
☐ Templates to provide the format or structure (both paper and electronic)		
☐ Outlines	☐ Other: _____	

4. Aids/Assistive Technology for Composing Written Materials Utilized by Student (Check all that apply).

☐ Picture cards	☐ Color cues for grammar	☐ Writing with symbols
☐ Word cards	☐ Word wall list	
☐ Prewritten words on cards or labels	☐ Spell check/Dictionary/Thesaurus	
☐ Whole word apps or software	☐ Word prediction	☐ Scanning Pen
☐ Voice to text on phone or other device		

Summary of Student's Abilities and Concerns Related to Composing Written Material

WATI Student Information Guide

SECTION 6 Reading

1. The Student Demonstrates the Following (Check all that apply. Add comments to clarify).

- ☐ Engages in joint attention with adult caregiver to activities (e.g. songs, stories, games and/or toys)
- ☐ Shows an interest in books and stories with an adult
- ☐ Shows an interest in looking at books independently
- ☐ Associates pictures with spoken words when being read to
- ☐ Realizes text conveys meaning when being read to
- ☐ Recognizes connection between spoken words and specific text when being read to
- ☐ Pretend writes and "reads" what he or she has written, even if scribbles
- ☐ Recognizes and reads environmental print
- ☐ When asked to spell a word, gets first consonant correct, but not the rest of the word
- ☐ Demonstrates sound manipulation skills including:
 - ☐ Initial and final sounds in words
 - ☐ Initial letter names/sounds
- ☐ Recognizes, names, and prints the alphabet (if motor skills are limited, may use alternative means rather than printing to demonstrate knowledge of the alphabet)
- ☐ When asked to spell a word, gets first and last sounds correct
- ☐ Demonstrates sound-symbol relationship
- ☐ Isolates individual phonemes: consonants, vowels, blends, digraphs (i.e., initial, final, medial)
- ☐ Applies phonics rules when attempting to decode printed words
- ☐ Remembers/recognizes visual patterns made by words or letter combinations (e.g., "-ing")
- ☐ Demonstrates phonemic awareness to identify similar and dissimilar patterns in words
- ☐ Sound blends words
- ☐ Reads and understands words in context
- ☐ Recognizes familiar words in different contexts
- ☐ Remembers previously taught words
- ☐ Uses specific reading strategies: _____
- ☐ Uses inventive spelling most of the time
- ☐ Uses conventional spelling most of the time
- ☐ Reads and understands sentences
- ☐ Composes sentences using nouns and verbs
- ☐ Reads fluently with expression
- ☐ Reads and understands paragraphs
- ☐ Composes meaningful paragraphs and using correct syntax and punctuation

2. Difficulties Experienced by Student (Check all that apply. Add comments for clarification).

Student has difficulty physically accessing (e.g., positioning, opening, turning pages):

- ☐ Single sheets of paper ☐ Books ☐ Magazines ☐ Multi-page worksheets

Student has difficulty understanding language based on:

- ☐ English Language Learner ☐ Limited Background experiences

Student has sensory difficulties with:

- ☐ Visual clutter ☐ Fluorescent lighting ☐ Background noise
☐ Tactile sensitivity ☐ Personal space ☐ Other: _____

Student experiences difficulties with:

- ☐ Auditory processing ☐ Short term memory ☐ Working memory

Student experiences ☐ general fatigue ☐ visual fatigue

Student has difficulty decoding:

- ☐ Worksheets ☐ Content textbooks ☐ Trade books ☐ Tests
☐ Websites or other digital text
☐ Modified curriculum, describe: _____
☐ Recreational text

Student has difficulty comprehending:

- ☐ Worksheets ☐ Content textbooks ☐ Trade books ☐ Tests
☐ Websites or other digital text
☐ Modified curriculum, describe: _____
☐ Recreational text

3. Student's Performance is Improved by (Check all that apply).

☐ Smaller amount of text on page	☐ Enlarged print
☐ Word wall to refer to	☐ Pre-teaching concepts
☐ Graphics/pictures to communicate ideas	☐ Text rewritten at lower reading level
☐ Bold type for main ideas	☐ Reduced length of assignment
☐ Additional time	☐ Being placed where there are few distractions
☐ Visual cues and schedule	☐ Frequent movement breaks
☐ Spoken text to accompany print	☐ Color overlay or colored text/background
☐ Increased spacing between words/lines	(List color _____)
☐ Symbol or Rebus supports to text	☐ Other _____

4. Reading Assistance Used

Please describe the non-technology based strategies and accommodations that have been used with this student

5. Assistive Technology Used

The following have been tried. (Check all that apply. Add comments for clarification).

- ☐ Highlighter, marker, template, or other self-help aid in visual tracking
☐ Changed background color to change contrast between text and background

-
- ☐ Human voice via recorded text, or talking books to “read along” with text
- ☐ Digital audio files (.mp3, iPod, etc.)
- ☐ Talking dictionary or talking spell checker to pronounce single words
- ☐ Handheld pen scanner to read difficult words or phrases
- ☐ Electronic text from
- ☐ internet ☐ publisher ☐ scanned text ☐ other _____
- ☐ Computer/device with text-to-speech software to speak:
- ☐ single words ☐ sentences ☐ paragraphs ☐ entire document
- ☐ Handheld device to read electronic books
- ☐ Electronic books from Bookshare or other digital source

Explain what seemed to work or not work with any of the above assistive technology that has been tried.

6. Student Sills:

Approximate age or grade level of reading skills: _____

Cognitive ability in general:

- ☐ Significantly below average ☐ Below average ☐ Average ☐ Above average

7. Computer/Device Use:

Student has access to: ☐ PC ☐ Macintosh ☐ Chromebook ☐ Tablet

Student uses a computer/device: ☐ Rarely ☐ Frequently

☐ Daily for one or more subjects/periods ☐ Every day, most of the day

For the following purposes: _____

Student is able to manipulate electronic text using: ☐ trackpad ☐ mouse ☐ swipe left/right

Other: _____

Summary of Student's Abilities and Concerns Related to Reading

WATI Student Information Guide

SECTION 7 Mathematics

1. **Student is Able to:** (Check all that apply).

Read Math

☐ Recognize numerals	☐ Recognize math signs
☐ Understand math related language and vocabulary	
☐ Gain meaning from numbers, shapes, and other representational formats	
☐ Recognize three-dimensional object from multiple angles	
☐ Interpret visual representation (e.g., charts, graphs, grids)	
☐ Switch from one representational format to another (e.g complex numbers vs. fractions)	
☐ Read/understand equations	☐ Other: _____

Understand Math Concepts

☐ Counting	☐ One-to-one correspondence
☐ Basic math facts	☐ Money
☐ Time	☐ Units of measurement (e.g., size, distance, volume)
☐ Percents/decimals	☐ Points on graphs
☐ Arrange objects in groups according to size, color, shape, etc.	
☐ Other: _____	

Solve Math Problems

☐ Choose correct math operation		
☐ Complete operational steps include: ☐ simple addition		
☐ simple subtraction	☐ complex addition	☐ complex subtraction
☐ multiplication	☐ division	
☐ Apply action steps from/to a story problem		
☐ Organize and apply multiple steps to solve problems		
☐ Convert mixed numbers/fractions		
☐ Apply functions and formulas		
☐ Other: _____		

Write and Represent Math

☐ Write legible numbers	☐ Align numbers vertically
☐ Draw math figures	☐ Organize work on a page
☐ Understand and use place value	☐ Align steps of a problem
☐ Represent concepts in alternate formats (e.g., graphs, charts, or geometric shapes)	
☐ Write simple math equations	☐ Write complex math equations
☐ Fill in numbers/data in graphs	☐ Other: _____

2. Problems Student Experiences (Check all that apply)

- ☐ Visual-spatial processing
- ☐ Fatigue
- ☐ Low working memory
- ☐ Explaining math thinking either verbally or in writing
- ☐ Using language of math to express ideas
- ☐ Testing conclusions by asking appropriate questions
- ☐ Other: _____

3. Assistive Technology Tried (check all that apply).

☐ Adapted manipulatives	☐ Alternate calculator
☐ Adapted stamp (e.g., numbers, shapes)	☐ Large print
☐ Adapted watch/clock	☐ Talking
☐ Adapted measuring devices	☐ Graphing
☐ Adapted paper	☐ Math graphic organizer
☐ Enlarged paper	☐ Math specific writing, drawing software
☐ Graph paper	☐ Digital math toolbars for writing equations
☐ Onscreen keyboards or calculators	☐ Math software to help visualize, script visual math concepts
☐ Virtual manipulatives	
☐ Voice recognition for math notation	
☐ Other: _____	

4. Strategies Used

Please describe any strategies that had been used to help.

Summary of Student's Abilities and Concerns Related to Math

WATI Student Information Guide

SECTION 8 Organization

1. Difficulties Student has with Organization (Check all that apply).

Self management

- ☐ Unable to self-regulate behavior and attention
- ☐ Easily distracted

Time management

- ☐ Arrives late
- ☐ Misses deadlines
- ☐ Poor transitions between activities
- ☐ Struggles to settle down after transitions or when it is work time

Materials management

- ☐ Messy work and storage areas
- ☐ Lost papers and projects
- ☐ Can't find work tools such as book, scissors, or markers quickly

Information Management

- ☐ Breaking a large project into smaller steps
- ☐ Organizing notes or review items
- ☐ Completing multi-step tasks

2. Assistive Technology (Check all that apply).

Self

- ☐ Fidgets
- ☐ Sitting on a therapy ball, bounce, or stiz cushions
- ☐ Pressure or weighted vest
- ☐ Concentration CD's or MP3's

Information

- ☐ Folders
- ☐ Tabs/Post Its
- ☐ Highlighters
- ☐ Study guides
- ☐ Handheld recorders
- ☐ Digital organizers
- ☐ Search tools/engines
- ☐ Bookmarking tools
- ☐ Graphic organizers
- ☐ Manipulatives/Instructional Tutorials
- ☐ Animations

Materials

- ☐ Folders/containers/bins/boxes
- ☐ Checklists
- ☐ Coding
- ☐ Filing
- ☐ Portable electronic storage
- ☐ Computer based electronic storage

Time

- ☐ Clock analog vs. digital
- ☐ Adapted clocks and watches
 - ☐ Talking readout
 - ☐ Large numbers
 - ☐ Visual cue
 - ☐ Timed reminder message

Schedules

- ☐ Picture
- ☐ Worded
- ☐ Calendar-based
- ☐ Digital scheduler
- ☐ Digital reminder

3. Summary of Student's Abilities and Concerns Related to Organization

WATI Student Information Guide

SECTION 9

Recreation and Leisure

1. Difficulties Student Experiences Participating in Recreation and Leisure (Check all that apply.)

☐ Understanding cause and effect	☐ Following complex directions
☐ Understanding turn taking	☐ Communicating with others
☐ Handling/manipulating objects	☐ Hearing others
☐ Throwing/catching objects	☐ Seeing equipment or materials
☐ Understanding rules	☐ Operating TV, VCR, etc.
☐ Waiting for his/her turn	☐ Operating computer
☐ Following simple directions	☐ Other _____

2. Activities Student Especially Enjoys _____

3. Adaptations Tried to Enhance Participation in Recreation and Leisure _____

How did they help? _____

4. Assistive Technology Tried (Check all that apply.)

☐ Toys adapted with Velcro [®] , magnets, handles etc.	
☐ Toys adapted for single switch operation	
☐ Adaptive sporting equipment, such as lighted or beeping ball	
☐ Universal cuff or strap to hold crayons, markers, etc.	
☐ Modified utensils, e.g. rubber stamps, rollers, brushes	
☐ Ergo Rest or other arm support	
☐ Electronic aids to control/operate TV, VCR, CD player, etc.	
☐ Software to complete art activities	☐ Games on the computer
☐ Other computer software	Other _____

Summary of Student's Abilities and Concerns in the Area of Recreation and Leisure

WATI Student Information Guide

SECTION 10

Vision

A vision specialist should be consulted to complete this section.

1. Date of Last Vision Report _____

Report indicates (please address any field loss, vision condition, etc.) _____

2. Visual Abilities (Check all that apply.)

- ☐ Read standard textbook print
- ☐ Read text if enlarged to (indicate size in inches) _____
- ☐ Requires specialized lighting such as _____
- ☐ Requires materials tilted at a certain angle (indicate angle) _____
- ☐ Can read using optical aids; list: _____
- ☐ Currently uses the following screen enlargement device _____
- ☐ Currently uses the following screen enlargement software _____
- ☐ Recognizes letters enlarged to ____ pt. type on computer screen
- ☐ Recognizes letters enlarged to ____ pt. type for ____ minutes without eye fatigue.
- ☐ Prefers ☐ Black letters on white ☐ White on black ☐ _____ (color) on _____
- ☐ Tilts head when reading
- ☐ Uses only one eye: ☐ Right eye ☐ Left eye
- ☐ Uses screen reader: _____
- ☐ Requires recorded material, text to speech, or Braille materials

3. Alternative Output

Currently uses (Check all that apply.)

- ☐ Slate and stylus
- ☐ Talking calculator
- ☐ Braille calculator
- ☐ Braille notetaker
- ☐ Electric Braille
- ☐ Refreshable Braille display
- ☐ Tactile images
- ☐ Screen reader
- ☐ Braille translation software: _____

Chapter 1 - Assistive Technology Assessment



Level of proficiency (Check the one that most closely describes the student.)

☐ Requires frequent physical prompts	☐ Requires frequent verbal cues
☐ Needs only intermittent cues	☐ Uses device to complete tasks independently
☐ Trouble-shoots problems related to device	

4. Writing/Handwritten Materials (check all that apply)

☐ Writes using space correctly	☐ Writes on line
☐ Writes appropriate size	☐ Reads own handwriting
☐ Reads someone else's writing	☐ Reads hand printing
☐ Reads cursive	☐ Skips letters when copying
☐ Requires bold or raised-line paper	☐ Requires softer lead pencils
☐ Requires colored pencils, pens, or paper point	☐ Requires felt tip pen ☐ Thin point ☐ Thick point

Summary of Student's Abilities and Concerns Related to Vision

WATI Student Information Guide

SECTION 11

Hearing

A hearing specialist should be consulted to complete this section.

1. Audiological Information

Date of last audiological exam _____

Hearing loss identified

Right Ear	☐	Mild	☐	Moderate	☐	Severe	☐	Profound
Left Ear	☐	Mild	☐	Moderate	☐	Severe	☐	Profound

Onset of hearing loss _____ Etiology _____

2. Unaided Auditory Abilities (Check all that apply.)

☐ Attends to sounds	☐ High pitch	☐ Low pitch	☐ Voices	☐ Background noises
☐ Discriminates environmental vs. non-environmental sounds				
☐ Turns toward sound				
☐ Hears some speech sounds				
☐ Understands synthesized speech				

3. Student's Eye Contact and Attention to Communication (Check best descriptor.)

☐ Poor	☐ Inconsistent	☐ Limited	☐ Good	☐ Excellent

4. Communication Used by Others

Indicate the form of communication generally used by others in each of the following environments.
(Check all that apply.)

	School	Home	Community
☐ Body language	☐	☐	☐
☐ Tangible symbols	☐	☐	☐
☐ Gestures	☐	☐	☐
☐ Speech	☐	☐	☐
☐ Cued speech	☐	☐	☐
☐ Picture cues	☐	☐	☐
☐ Written messages	☐	☐	☐
☐ Signs and speech together	☐	☐	☐
☐ Signed English	☐	☐	☐
☐ Contact (Pidgin) sign language	☐	☐	☐
☐ American Sign Language (ASL)	☐	☐	☐

5. Level of Receptive Proficiency in Each Environment

	School	Home	Community
☐ Understands single words	☐	☐	☐
☐ Understands short phrases	☐	☐	☐
☐ Understands majority of communications	☐	☐	☐

Chapter 1 - Assistive Technology Assessment



6. Student Communicates with Others Using (Check all that apply)

☐ Speech	☐ American Sign Language	☐ Body language
☐ Signs and speech together	☐ Gestures	☐ Written messages
☐ Signed English	☐ Picture cues	☐ Contact (Pidgin) sign language
☐ Other _____		

Level of expressive communication:

☐ Single words	☐ Combination of words	☐ Proficient

7. Is There a Discrepancy Between Receptive and Expressive Abilities?

- ☐ Yes ☐ No

If yes, describe further. _____

8. Services Currently Used (Check all that apply)

- ☐ Audiology _____ ☐ Note taker

Educational interpreter using: ☐ ASL ☐ Transliterating ☐ PSE ☐ Oral

9. Equipment Currently Used (Check all that apply.)

☐ Hearing aids	☐ Cochlear implant	☐ Telecaption decoder
☐ Vibrotactile devices	☐ Classroom amplification system	☐ TTY/TDD
☐ FM system	☐ Other _____	

10. Present Concerns for Communication, Writing, and/or Educational Materials

☐ Cannot hear teacher/other students	☐ Cannot respond to emergency alarm
☐ Cannot participate in class discussions	☐ Cannot benefit from educational videos/programs
☐ Displays rec./exp. language delays	☐ Cannot use telephone to communicate

11. Current communication functioning (Check all that apply)

- ☐ Desires to communicate
- ☐ Initiates interaction
- ☐ Responds to communication requests
- ☐ Reads lips
- ☐ Appears frustrated with current communication functioning
- ☐ Requests clarification from communication partners ("Would you please repeat that?")
- ☐ Repairs communication breakdown (Keeps trying, changes message)

12. Current Reading Level _____

Summary of Hearing Abilities and Concerns _____



WATI Student Information Guide

Section 12

General

Are there any behaviors (both positive and negative) that significantly impact the student's performance?

Are there significant factors about the student's strengths, learning style, coping strategies or interests that the team should consider?

Are there any other significant factors about the student that the team should consider?

Does student fatigue easily or experience a change in performance at different times of the day?



Gathering Information about Environments and Tasks

Effective, appropriate decisions about assistive technology can only be made when teams are well informed about the unique characteristics of the environments in which the student spends time and the tasks that are being done in those environments (Zabala, 1994). The Wisconsin Assistive Technology Initiative strongly encourages observing the student in several environments with a specific focus on describing the environment and the activities/tasks in which the target student and other students are engaged. The Environmental Observation Guide is a tool for that purpose.

Consider all customary environments, including the classroom and other school environments, such as the lunchroom, playground, assemblies, etc., the home, and any relevant community sites such as shopping malls, restaurants, church, scouts or other groups. Information to be gathered can be guided by specific questions such as these:

- What equipment and materials, including technology supports, are available in each environment?
- Who are the primary people interacting with the student?
- How is instruction or direction delivered?
- What modifications are typically made in various environments?
- What is the student's position and location in room?
- Where are the things the student needs to see, such as chalkboard, overhead, etc.?
- What is the lighting and sound like in the setting?
- How are transitions accomplished? Are there concerns?

Teams may modify or add to these questions, they are provided only as a starting place.

There are many different types of Environmental or Classroom Observation Guides. This manual includes two versions. Remember that you can adapt either of or both these to fit your needs.

Using the Environmental Observation Guide

The Environmental Observation Guide instructions was developed by the National Assistive Technology Research Institute (2001), modified and used with permission.

The Environmental Observation Guide forms draw the observer's attention to what is going on in the activity and setting. Teams may modify or add to these questions. They are provided only as a starting place.

Prior to the observation:

Clarify the purpose of the observation:

- Record successful assistive technology use in educational environments
- Observe a student using assistive technology in educational environments
- Record characteristics of the educational environments

Select a time and place:

- Review the student's IEP for specifics about the student's AT use.
- First preference – Schedule the observation for the place and time indicated in the IEP as to when AT is supposed to be used during the day.

- Second preference – If it is not specified in the IEP, talk to a teacher to schedule a time and place when the student uses AT the most during the day.
- Third preference – If the student uses the AT across the entire day, observe in the setting where he spends the most amount of his instructional day

Meet with the teacher(s), therapists, and assistants to determine:

- What will happen in the class that day; Is it a typical day?
- What the student using assistive technology will be doing that day.
- Inform them what you will be doing during the observation.

During the observation:

Record observations:

- Complete the environmental assessment checklist.
- Record direct student observation field notes.
- Record impressions and comments.
- Record time markers in the observation notes to determine length of activities.
- Participate in the class only if invited to do so.

After the observation:

Thank the teacher for allowing you to observe.

If time allows in the teacher's schedule:

- Probe for additional information directly related to your observations for clarity.
- Share a brief summary of what you saw.

Provide the teacher with a copy of the observation summary when completed.

Conduct the teacher interview at a mutually agreed upon time.

The observer's role is to capture what is occurring, not to make decisions or even formal recommendations; that comes later in the decision-making part of the assessment process. During the observation(s), the observers are simply gathering information.

Environmental Observation Guide

Student's name: _____

School: _____

Observer: _____

Date of Observation: _____

Type of class: _____

Directions: Complete this Environmental Assessment Checklist before beginning

Describe the environment: Record short responses in the space provided.

Special or general education classroom?	
Specialty classroom (Specify: e.g., P.E., computer lab)	
Therapy room? (Specify)	
Number of teachers in class?	
Number of aides in class?	
Number of volunteers in class?	
Number of students in the class?	
How many days per week is the program?	
How many hours/day?	
Is the atmosphere busy or quiet?	
Are there large open areas or small divided sections?	
How are the desks arranged?	
Is the furniture sized for students?	
Are materials accessible, appropriate, varied, interesting?	
Is special equipment available (i.e., chairs with arm supports)?	
Where is the classroom located in relationship to the cafeteria, therapy, outdoor play areas, etc.?	
Are bathrooms located in or outside the classroom?	

Sensory Stimulation: Judge the level of sensory stimulation and record it with a check in the corresponding box. Enter comments or notes that clarify your responses if needed.

	Excessive	Balanced	Reduced	N/A	Comments
Auditory					
Hallway					
Street					
Other classrooms					
Other students					
Instructional media					
Teacher aides/volunteers					
Other (specify):					

Sensory Stimulation: continued

	Excessive	Balanced	Reduced	Comments
Visual				
Color				
Clutter/busy				
Art/decorations				
Visual information				
Lighting				
Other (specify):				

Persons Present During Observation: For each person on the list, put a check in the appropriate column indicating their level of participation.

Persons	Participating	Observing	Not Present
Student			
Special Educator			
General Educator			
Peer Tutors (How many? _____)			
Instructional Assistant #1			
Instructional Assistant #2			
Instructional Assistant #3			
Personal Attendant			
Speech-Language Pathologist			
Occupational Therapist			
Physical Therapist			
School Psychologist			
Parent			
Volunteer			
Administrator			
AT Specialist			
Other (specify):			

Notes:

Access to Assistive Technology: Record the presence or absence of **EACH TYPE** of assistive technology by placing a check in the corresponding box. Record the AT found in the classroom as a whole, not just the AT used by the target student.

Types	Present-Not Used	Present-Used	Not Present
Communication cards/boards			
Digitally recorded communication devices			
Electronic communication devices			
AT for activities of daily living			
Adjustable seating (not a wheelchair)			
Positioning equipment			
Amplification			
Visual signaling devices			
Braille/brailled materials			
Magnifiers			
Notetaking devices/keyboards			
Speech output devices/computers			
Handwriting aids			
Alternate/adapted keyboards			
Alternate/adapted mouse			
Computer switch interface			
Touch window			
Talking word processor			
Word prediction			
Text or screen reader			
Portable word processor			
Transfer aids - Hoists/lifts			
Mobility aids (not wheelchairs)			
Adapted environment (e.g., doors, fixtures, furniture)			
Electronic equipment for instruction (calculator, e-books)			
Adapted instructional materials			
Instructional software			
Computer stations			
Adapted art/craft materials			
Adapted sports/recreation equipment			
Adapted toys			
Wheelchair – Manual or Power			
Other (specify):			

WATI Classroom Observation Guide

Classroom(s) _____ Teacher _____

Student _____ Date _____ Time Observer _____

Task: Ex: Writing a report, working on SMART Board, aligning mat problems, researching topic in media center. Directions: Given Visually or verbally Time: to complete task	General students' response: How does the rest of the class respond to the directions? How do they complete their work?	Target Student Response: Do you notice any difference in how the target student handles the directions? How do they begin, maintain, and end the task? Was the time for the activity sufficient?	Barrier to task completion: What do you notice about the environment that might affect the target student's work? Ex: How the directions were delivered, time to complete the task, different learning style.	Potential Adaptations: What pops into your head as a solution that you might bring to the brain storm session during the ASNAT meeting?	Questions: What information do you need? What questions do you have for the teacher/student/parent?
Task: Directions: Time:					
Task: Directions: Time:					
Task: Directions: Time:					



Environmental Observation Summary

Activity/Task(s) observed:

Ways that typical students participated:

Ways the target student participated:

Barriers to target student's participation:

Adapted from:

Wirkus-Pallaske, M., Reed, P., & Stokes, S. (2000). *Wisconsin Assistive Technology Initiative*. Oshkosh, WI: Wisconsin Assistive Technology Initiative.

Center for Instructional Development and Research. (1998). Classroom observation. *CIDR Teaching and Learning Bulletin*, 1(4), Available online: <http://depts.washington.edu/ObsTools.htm>

Pearson, L. (no date). *Apraxia guide: Classroom observation checklist*. Available online: <http://hometown.aol.com/lynetteprs/myhomepage/profile.html>

Using the AT Decision-Making Guide

When the members of the team who have been assigned to gather information have completed their tasks, the team is ready to come together for the next step. The information gathering may have included reviewing the files, contacting previous service providers, completing a specific test that someone felt would provide important information, or observing. In decision making this information will be used to guide the direction and content of the decision.

Decision-making takes place at a meeting. The tool to be used is the AT Decision-Making Guide. This guide is a single page that leads the team through a five-step decision making process. Using an effective decision-making process requires team members to acquire and use a variety of skills that are separate from the technical skills they may have needed during the data gathering stage. These include communication skills and group process skills. The communication skills include, but are not limited to active listening, negotiation, providing non-threatening feedback, and accepting criticism without becoming defensive. The last skill area is group process. It includes following a schedule, reaching consensus, and a variety of tasks that become important when working as part of a team, one of the most important being the effective use of a formal group decision making process.

The key elements or steps of an effective decision making process include:

- 1. Problem Identification:** The identification and definition of a specific problem
- 2. Solution Generation:** The suggestion of possible solutions
- 3. Solution Selection:** The evaluation of suggestions and choosing of a solution to create an action plan
- 4. Implementation:** The carrying out of the plan
- 5. Follow up:** Meeting again to evaluate the solution

It may sound strange to suggest that various members of the team might be on different steps of the process. However, it is not unusual for team meetings to be conducted in an informal manner with information presented verbally and with little attention paid to focusing on the specific steps of the decision-making process. When this occurs, individual styles of thinking and communicating can lead to one team member seeking very specific and minute details of the problem. At the same time another team member may be thinking of great solutions and still another is wondering how soon the meeting will be over or what to serve for dinner that night. There are several very simple, but effective strategies for improving and formalizing the decision-making process being used by a team when making assistive technology decisions. The AT Planning Guide provides a structure for doing so.

Throughout the Decision Making Process:

Present information in written as well as spoken format where everyone on the team can see it.

This requires that the key facts be written on a board, flip chart, overhead projector or butcher paper in large print that is visible to all participants. Some team members may feel that this takes unnecessary effort to write every idea up on a board, but it is an extremely effective way to keep each person focused on which step the team is addressing. As information is shared, it is written on the board or chart visible to all. If one of the team members is distracted by something they have forgotten to do, or is called out

of the meeting for a telephone call, they can quickly “catch up” on what was said when they are able to refocus on the discussion. At the same time, if a group member contributes a solution before the team has finished contributing all the information necessary to identify the problem, the recorder can quickly note the “suggested solution” under **Solution Generation**, and redirect the entire group back to completing **Problem Identification**.

Create a shared group memory. Recording what is being said where it is visible to all adds visual memory to auditory memory and doubles the likelihood that everyone will remember in the same way the information that was discussed. This helps create a shared group memory, one that is very similar across all members of the group. It greatly increases the likelihood of follow through from team members.

Share roles and responsibilities. Team members may be hesitant to take a leadership role in conducting team meetings. Rotating roles from one meeting to the next is an effective way to share this responsibility. At each meeting one team member can serve as **facilitator**, while another is **recorder**, and still another acts as **timekeeper** to keep the group moving through the discussion. It is important that the team move at a pace that will allow the most time at the most important discussion points and keep the team from getting side tracked or bogged down (Fox & Williams, 1991). In addition, this rotation of roles helps insure that each team member recognizes and respects the contribution each of these participants makes to effective decision-making.

During Problem Identification:

Address not only the characteristics of the student, but also of the environments in which the student functions, and the tasks that need to be done. Many times when technology is abandoned, it is because only the physical, psychological, and social characteristics of the student are addressed, with little or no attention paid to the settings in which the device will be used or the specific tasks that the student really needs to address (Cook & Hussey, 1995). The SETT framework (Zabala, 1994) helps team members to focus on the **student** (their personal characteristics and interests), the **environment** (including physical characteristics of the setting as well as instructional activities and arrangements), and the **task** (which are the specific activities that the target student needs to be able to do in each environment). This focus is helpful in clearly identifying and defining the problem so that the team has a clear focus to guide them as they generate appropriate alternatives and solutions.

During Solution Generation:

When generating solutions, use brainstorming rules to create a climate of trust. An important factor in generating a variety of useful alternatives during Solution Generation is to create a climate of trust by following brainstorming rules. This means that all suggestions are written on the board or chart, no comments are allowed and no judgments are passed. The goal is to generate as many ideas as possible. As the flow of ideas slows, it is a good idea to persevere a little longer. Often the second wave of ideas is the most innovative. If everyone is feeling sluggish and suggestions are few, energy may be increased by putting a two-minute time limit in place to get things started. This short time limit combined with writing everything where it can be seen increases the creativity and allows the group to explore as many options as possible. Additional time can be added if the group agrees, but the short time period helps bring that creative, right side of the brain into action.

If the solutions generated by the team do not include assistive technology, or include only a very few items, the team may need to utilize additional resources. Additional resources can provide an overview of the types of assistive technology solutions that would be appropriate for the student and task for which they are problem solving. Resources may include a person, as mentioned earlier or print, digital, or online resources. In the next section **Using the AT Checklist and other Resources**; several resources that might be helpful are discussed.

During Solution Selection:

During Solution Selection, encourage combining, sequencing and prioritizing. As alternatives are discussed and evaluated, it may become apparent that some items are the same thing in different words or that others make an excellent sequence of steps. New suggestions may be added at any time. This is the place for the team to really discuss the value and relationship of the many suggestions. As individual suggestions are discussed, it is often helpful to group them into “Things we can do tomorrow,” “Things we can do in a month,” and “Things we may want to consider later.” The Action Plan is then created to include a timeline and persons responsible for each of the solutions or steps that were selected.

Obtain consensus from all participants before adjourning meeting. When several people work together to reach a decision, there will be many different ideas presented. In ideal situations, the Solution Selection will result in a unanimous agreement about what specific suggestions should be selected for the action plan. However, life is far from ideal. When unanimous agreement is not reached, it is critical that the team arrive at consensus about the action plan that will be implemented. In order to assure consensus, the facilitator must poll individual team members, asking them if they will support this plan even though they may have personally preferred another solution. When the facilitator fails to poll members for consensus, they may believe they have unanimous agreement, but actually have **majority rule** (a few team members dominating the discussion, while others strongly disagree, but do not speak up), **minority rule** (one team member dominating the discussion, while others disagree and do not speak up), or **authority rule** (no one questioning what the administrator suggested, even though they disagree). When one of these occurs, the chances of successful implementation are decreased.

During Implementation:

When implementation takes place, follow the plan completely. For that to happen, everyone on the team needs to be aware of the plan and his/her role in it (Prentice & Spencer, 1985). Unfortunately this does not always happen if teams do not utilize the strategy of writing down important information during each step of the process. Without that “group memory” important details and key responsibilities are easily forgotten or overlooked while meeting the myriad demands of work in school districts. Implementation is the step of the decision making process that tells us whether the solutions we selected are good ones.

One planning tool we have found useful is Joy Zabala’s *The SETT Framework Part II A* and *Part II B*. This is a guide that allows a team to compare the potential effectiveness of selected tools using the same criteria.

THE SETT FRAMEWORK - PART II - A

Developing a Descriptor of an Assistive Technology Tool System and Brainstorming Tools that May Address Identified Student Needs

STUDENT: _____ AREA OF ESTABLISHED NEED (See SETT: Part I): _____

Enter one important descriptor or function in each column									
Enter one possible tool in each row									

List one tool on each line.

Name one observable skill that you would see in each square if the tool was supportive during the task. Ex., increase in complex sentences, less spelling errors, longer written assignments, more novel thoughts expressed.

Use a numerical system to match the tasks the team wants supported by the technology to the technology that has most of those features. SETT IIB is the place to document the selected tools and how they can be obtained, as well as the training required to utilize them. It must be remembered that for a tool to be integrated, it must first be learned and integrated into the student's curriculum.

For example, use 1 = not effective to 5 = very effective. The team can decide on how many numbers to use and must define what they represent. At the end of the trial period, all rows are added to determine which tool was most effective.

SETT SCAFFOLD FOR TOOL SELECTION – PART 1 - IDENTIFYING TOOLS

Develop Descriptors of an Assistive Technology Tool System that Addresses Needs and Identify Possible Tools

STUDENT: _____ AREA OF ESTABLISHED NEED (See SETT: Part I): _____

STEP 1: Based on S-E-T data, enter descriptors or functions needed by the student across the shaded top row - 1 descriptor per column

STEP 2: Enter promising tools in the shaded left column - 1 tool per row

STEP 3: For each tool, note matches with descriptors and functions to help guide discussion of devices and services

USE ADDITIONAL SHEETS IF NECESSARY

Descriptors →									
Tools ↓									

KEY: S= Systemically available tools - Currently available to ALL students served by this system
P= Programmatically available through special education services or other services for which this student is qualified
A= Additional tools that need to be acquired for this student.

For Follow up:

Follow up on a planned schedule. At a set interval after implementation, follow-up or monitoring must take place. This is another area where school teams frequently fail. The school year can slip quickly by while one team member waits on another to do something; or bad weather, illnesses, and absenteeism take their toll. If monitoring does not take place according to the original plan, a variety of problems can crop up and be overlooked as each team member focuses on their own assignment, but does not have the opportunity to get the “big picture” that comes from a team discussion.

Using the AT Decision Making Guide will guide the team through the steps of the process. Following these simple, but effective steps can be extremely useful to teams in the schools as they strive to make appropriate and effective assistive technology decisions for the students they serve.

WATI Assistive Technology Decision Making Guide

Area of Concern _____

PROBLEM IDENTIFICATION-(SAMPLE)

Student's Abilities/Difficulties	Environmental Considerations	Tasks
• Writing/use of hands • Communication • Reading/academics • Mobility • Vision • Hearing • Behavior • Other	• Classroom • Playground • Lunch room • Home, etc. In each: • Technology equipment available • Room arrangement, lighting • Sound • Activities, etc	• Produce legible written material • Produce audible speech • Read text • Complete math problems • Participate in recreation/leisure • Move independently in the school environment
Sensory Considerations		Narrowing the Focus
Vision/Hearing/Tactile (hyper/hypo)		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision Review Checklist	Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Date Length Person Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Using the AT Checklist

In some cases team members are not fully aware of all the assistive technology that might be available to assist with the task that is of concern. In that case there are several tools and resources that can be used to assist them. One of those tools is the AT Checklist. The AT Checklist is a concise listing of assistive technology arranged by the task for which it would be utilized. Categories are: Seating, Positioning and Mobility; Communication; Computer Access; Motor Aspects of Writing, Composition of Written Material; Reading; Mathematics; Organization; Recreation & Leisure; Activities of Daily Living; Vision; Hearing; and Multiple Challenges.

Within each of these categories suggested assistive technology is arranged in a hierarchy from the simplest, low-tech alternatives to more complex or high-tech items. They are arranged this way because the developers shared a belief that we want to select the simplest alternative that successfully assists the student. Many years ago we had a number of experiences where service providers immediately jumped to the most complex solution without first trying other alternatives. The hierarchical arrangement of the items in the AT Checklist is in response to this type of thinking. For example, just because a student has difficulty with writing, does not mean that the first thing we try would be voice recognition. While voice recognition is exciting and very appealing, there are other, simpler tools that should be tried first to see if they work.

You will note that each section also includes a space to write in new assistive technology. Since many new products are introduced each year, it is important to be able to add new items. The final section of the AT Checklist is a place to write comments that the team has as they utilize the Checklist. These may include something that has been tried or a plan to try a sequence of items. It is always important to capture in writing the discussions that take place as team members work together to arrive at an assistive technology decision.

WATI Assistive Technology Checklist

Seating, Positioning and Mobility

Seating and Positioning

- ☐ Standard seat/workstation at correct height and depth
- ☐ Modifications to standard seat or desk
- ☐ Alternative chairs
- ☐ Adapted/alternate chair, sidelyer, stander
- ☐ Custom fitted wheelchair or insert

Mobility

- ☐ Walking devices
- ☐ Grab bars and rails
- ☐ Manual wheelchair
- ☐ Powered scooter, toy car or cart
- ☐ Powered wheelchair w/joystick or other control
- ☐ Adapted vehicle for driving

Communication

- ☐ Concrete Representation
- ☐ Simple speech generating device
- ☐ Speech generating device with levels
- ☐ Speech generating device with icon sequencing
- ☐ Speech generating device with dynamic display
- ☐ Text based device with speech synthesis

Computer Access

- ☐ Positioning of student
- ☐ Standard Keyboard/Mouse with accessibility/access features built into the operating system
- ☐ Standard Keyboard/Mouse with adaptations
- ☐ Rate enhancement
- ☐ Alternate Keyboard/Mouse

- ☐ Onscreen keyboard
- ☐ Voice recognition software
- ☐ Eye Gaze
- ☐ Morse Code
- ☐ Switch Access
- ☐ Other: _____

Motor Aspects of Writing

- ☐ Environmental and seating adaptations
- ☐ Variety of pens/pencils
- ☐ Adapted pen/pencil
- ☐ Writing templates
- ☐ Prewritten words/phrases
- ☐ Label maker
- ☐ Portable word processor
- ☐ Computer with accessibility features
- ☐ Computer with word processing software
- ☐ Alternative keyboards
- ☐ Computer with scanner
- ☐ Computer with word prediction
- ☐ Computer with voice recognition software

Composition of Written Material

- ☐ Picture Supports to write form/about
- ☐ Pictures with words
- ☐ Words Cards/Word Banks/Word Wall
- ☐ Pocket Dictionary/Thesaurus
- ☐ Written templates and Guides
- ☐ Portable, talking spellcheckers/dictionary/thesaurus
- ☐ Word processing software
- ☐ Word prediction software
- ☐ Digital templates
- ☐ Abbreviation expansion
- ☐ Word processing with digital supports
- ☐ Talking word processing
- ☐ Multimedia software with alternative expression of ideas
- ☐ Tools for citations and formats

- ☐ Voice recognition software

Reading

- ☐ Standard text
- ☐ Book adapted for access
- ☐ Low-tech modifications to text
- ☐ Handheld device to read individual words
- ☐ Use of pictures/symbols with text
- ☐ Electronic text
- ☐ Modified electronic text
- ☐ Text reader
- ☐ Scanner with OCR and text reader
- ☐ Text reader with study skill support

Mathematics

- ☐ Math manipulatives
- ☐ Low-tech physical access
- ☐ Abacus/Mathline
- ☐ Adapted math paper
- ☐ Adapted math tools
- ☐ Math smart chart, math scripts
- ☐ Math tool bars
- ☐ On-screen calculator
- ☐ Alternative keyboards/portable math processors
- ☐ Virtual manipulatives
- ☐ Math software and web simulations
- ☐ Voice recognition math software

Organization

Self-Management

- ☐ Sensory regulation tools
- ☐ Movement and deep pressure tools
- ☐ Fidgets
- ☐ Auditory
- ☐ Visuals

Information Management

- ☐ Tabs
- ☐ Sticky notes, index cards
- ☐ Highlighters
- ☐ Key words

- ☐ Study guide
- ☐ Task analysis
- ☐ Digital highlighters and sticky notes
- ☐ Handheld scanners/electronic extraction
- ☐ Electronic organization
- ☐ Study grid generators/grading rubric
- ☐ Online search tools
- ☐ Online web trackers
- ☐ Online sorting file tools
- ☐ Digital graphic organizers
- ☐ Online manipulatives, interactive, tutorials, animations

Time Management

- ☐ Checklists
- ☐ Paper planners/calendars
- ☐ Schedules (visual)
- ☐ Portable, adapted timekeepers
- ☐ Electronic reminders
- ☐ Digital planners (PDA) cell phones
- ☐ Web-based planning tools

Material Management

- ☐ Low-tech organizers
- ☐ Checklists
- ☐ Container system
- ☐ Coding system
- ☐ Electronic filing and storage
- ☐ Portable electronic storage
- ☐ Computer-based tools

Recreation and Leisure

- ☐ Typical toys/puzzles/balls/utensils/instruments adapted: adjustable equipment; flexible rules; add visual/auditory clarity
- ☐ Specially designed utensils/equipment
- ☐ Electronically/mechanically adapted utensils and equipment

- ☐ Electronic aids- remote controls, timers, CD players, speech generating devices
- ☐ Computer-facilitated and computer-based activities
- ☐ Online and virtual recreational experiences

Vision

Computer Access

- ☐ Color scheme
- ☐ Large operating system features
- ☐ Built-in magnification
- ☐ Fully-featured magnification
- ☐ Magnification with screen reader
- ☐ Screen reader
- ☐ Screen reader with Braille device

Reading

- ☐ Glasses
- ☐ Color Filter
- ☐ Slantboard
- ☐ Large print
- ☐ Optical Magnifier
- ☐ Electronic Magnifier
- ☐ CCTV
- ☐ Monocular
- ☐ CCTV
- ☐ Audio text
- ☐ Computer-based reading software
- ☐ Electronic Braille notetaker

Writing

- ☐ High contrast pen
- ☐ Portable word processing device
- ☐ Typing with audio support
- ☐ Braillewriter
- ☐ Typing with Braille support
- ☐ Electronic Braille note taker
- ☐ Voice recognition

Mathematics

- ☐ Large print measuring tools
- ☐ Large key calculator
- ☐ Tactile measuring devices
- ☐ Abacus
- ☐ Talking calculator
- ☐ Models or 2D and 3D geometric shapes
- ☐ Tiger embossed, PIAF Tactile representation

Pictorial Information

- ☐ Enlarged format
- ☐ CCTV
- ☐ Models or objects
- ☐ Tactile graphics
- ☐ Tactile-audio graphics

Mobility

- ☐ Cane
- ☐ Monocular
- ☐ Braille/talking compass
- ☐ Electronic travel device
- ☐ GPS device

Note taking

- ☐ Slate and stylus
- ☐ Tape or digital recording device
- ☐ Computer-based recording software
- ☐ Electronic Braille note taker

Hearing

Hearing Technology

- ☐ FM
- ☐ Infrared
- ☐ Induction Loop
- ☐ 1:1 Communications
- ☐ Personal amplification

Alerting

- ☐ Visual or vibrating alerting devices

Communication

- ☐ Telecommunication supports
- ☐ Closed captioning

- ☐ Person to person
- ☐ Classroom/group activities
- ☐ Voice to text/sign
- ☐ Real-time captioning

Additional Tools for the Team as They Select Appropriate Assistive Technology

Closing the Gap Resource Directory and Online Searchable Database

Once the common vendors are known, the next useful tool is the *Closing the Gap Resource Directory*. The Resource Directory is published each spring as the February/March issue of the Closing the Gap newsletter. It is an excellent tool for school teams. The first step in using the Directory is to go to the Producers Section, which is near the back of the directory. In the Producers Section, team members can look at each of the vendors obtained from the Product Description Section of Resource Directory.

In our example, Don Johnston Incorporated was one of the common vendors listed for talking word processors. Looking up Don Johnston Incorporated reveals a long list of products. Scanning that list reveals *Write:OutLoud*®, which sounds like it might be a talking word processing. Turning to the Software section of the Resource Directory provides a description of this talking word processing software, including price, type of computer it runs on, system requirements, and other valuable information.

Closing the Gap also has a [searchable database](#) on its website. Annual subscriptions are required to use the online version but there is a free 14-day trial. The same type of information is included there; once the name of a product or the type of product is known, more information can be obtained from the website.

QIAT Listserv

Quality Indicators of Assistive Technology (QIAT) is a voluntary organization of AT professionals from around the world who share both ideas and questions. This group is a wonderful resource when looking at the needs of students with AT needs. They provide a collegial support network of some of the finest minds and pioneers in the field of assistive technology. Post questions to this listserv, or share ideas and resources. Dr. Joy Zabala was the creator of the site. <https://qiat.org/qiat-list/>

AAC TechConnect

AAC TechConnect has created Device Assistant, a resource designed to provide information on nearly 100 AAC devices currently on the market from major manufacturers. (Information is provided in cooperation with all of the manufacturers.) You can use a feature-match tool to search for a device, and also do side-by-side comparisons. A subscription fee is required, but there is a 14-day free trial. The site was created by Debby McBride, MS, CCC-SLP.

Implementing Trials with Assistive Technology

In order to determine which assistive technology will work effectively for a student, that student must have an opportunity to try the assistive technology. In some cases, a brief trial during a short visit with one of the team members reveals an effective solution. More typically, a longer trial of several days, weeks, or in some cases, months is necessary. Whether the trial is short or long, documenting the student's performance while they try the assistive technology is critical.

Included are two planning tools that can help the team as they prepare for a more extensive trial with one or more assistive technology devices. The Assistive Technology Trial Use Guide is a form that guides the team through a sequence of important questions that must be addressed prior to implementing trial use of assistive technology and after the trial.

WATI Assistive Technology Trial Use Guide

Student: _____ Age: _____ Placement/Classroom: _____

AT to be trialed: _____ Length of trial: _____

If trial is successful, we expect to see the student be able: _____

Acquisition of AT for Trial:

Source of the AT to be Trialed	Person Responsible	Date(s) Available	Date Received	Date Returned

Operation and Training:

Person primarily responsible to operate (or learn to operate) this AT: _____

Others to be trained	Nature/Content of Training Required	Date Begun	Date Completed

WATI Assistive Technology Trial Use Summary

Student _____ Age _____ Date Completed _____

Person(s) Completing Summary _____

Task Being Addressed During Trial _____

Criteria for Success _____

AT Tried	Dates Used	Criteria Met?	Comments (e.g. advantages, disadvantages, preferences, performance)

Recommendations for IEP: _____

Products Mentioned in Chapter 1

Product	Vendor
AAC Feature Match	Doug Dodgen & Associates
EvaluWare	Assistive Technology Inc.
Write:OutLoud [®]	Don Johnston Incorporated

Chapter 2 - Assistive Technology for Seating, Positioning and Mobility

Introduction.....	1
Seating and Positioning Background Information	2
Seating and Positioning SETT Process and Decision Making Guide	6
Decision Making Guide	7
Decision Making Guide Expanded.....	8
Continuum	10
Continuum Expanded.....	10
Mobility Background Information.....	13
Mobility SETT Process and Decision Making Guide	19
Decision Making Guide	20
Decision Making Guide Expanded.....	21
Continuum	23
Continuum Expanded.....	24
Writing Assistive Technology in the IEP	25
Feature Match	26
Resources	28
Products	32

Assistive Technology for Positioning, Seating, and Mobility

Karen J. Stindt MS OTR ATP, Penny R. Reed, Ph.D., and Marcia Obukowicz, OTR

Positioning, seating and mobility play a critical role in a student's ability to function in the academic setting. The first section of this chapter provides information on positioning and seating. The second part of this chapter addresses mobility. If a student requires special positioning, seating and mobility, an occupational or physical therapist on the team may be the best person to take the lead in determining the appropriate options.

Each of the sections of this chapter contains background information, current information and questions to guide you through the SETT process and the decision making guide, as well as a continuum for positioning and seating, and another continuum for mobility. Following that are references and information on resources for the specific items discussed in this chapter, including resources for further information on the topics discussed.

Assistive Technology for Seating and Positioning

Introduction

Students are required to assume many different physical positions during the school day. Most students have no problems managing the multiple positions that are required; from standing and walking to get where they need to go to sitting in various places throughout the day (desk, floor, lunch room, library, playground, etc.). However, when a child has physical challenges ranging from slight to severe, this automatic task can have a significant impact on their daily functioning. Focusing their attention on trying to maintain their body position takes attention away from academics and learning. Children with mild motor involvement may have problems that manifest in excessive movement in and around their seat and desk. Children with significant motor issues may have difficulty managing all aspects of their body including, head control, trunk control (required for a stable base to work from), and positioning of their extremities.

The seating and positioning part of this chapter is organized in accordance with the Decision Making Guide following the SETT format (Student, Environment, Tasks and Tool). The Student section will assist you in determining skills and abilities required by the student to address seating and positioning issues. The Environment section poses questions to consider concerning the impact of the students environment, the teachers expectations, and how the environment might impact on the choice of assistive technology. The section on Tasks discusses what is required of the student that the student is unable to perform at a level consistent with their academic needs and the goal of the task in order to appropriately choose an assistive technology solution. Following Tasks is a section on Tools beginning with the continuum of assistive technology to be considered organized from low to high technology. This is followed by a more extensive listing of tools and strategies under the continuum subtitles. The chapter concludes with a discussion of a feature match process. Chapter appendices include sample IEP objectives, references, resources, and product charts.

Seating and Positioning: Background

This section will focus on the basic body positions that are necessary in the school setting. The first part will address students with mild disabilities and the second part will address the students with significant motor impairment. This introduction is not mean to be all inclusive but to give the reader a basic understanding of some of the positioning issues seen in the school setting.

Students with mild disabilities

Students with mild disabilities have seating and positioning issues that are often overlooked as the focus of their program is on academics. However, these children may benefit from addressing their seating and positioning so that they can focus on learning. Some of the behaviors that indicate this may be an issue are: falling out of their chair; frequent changes of position; getting in and out of their seat beyond what is allowed; slumping over their desk; wrapping their legs around the legs of the chair; or propping themselves on other surfaces such as the desk or holding their head on their hand. These are indicators that there may be issues with core strength, muscle tone, fatigue, vision or other problems.

Desk/Workstation

One of the first issues to address is the desk or workstation. A workstation consists of many components and you must consider all to achieve an optimal workstation. The student's seating in relation to the workstation and the task is the first key component. Traditionally, seating guidelines have focused on the following:

- Feet resting on the floor - ankles dorsiflexed to 90 degrees
- Knees flexed 90 degrees
- Hips flexed 90 degrees
- Hips well back in chair
- Both arms resting comfortably on desk without causing shoulders to shrug

If the child is able to fit in the chair within these parameters, then the chair is an appropriate fit. This does not mean, however that this is the expected position for the student to be in during learning. Some seating and positioning experts (Bundonis 2003, Kangas 2000, Lange 2000) have found that active learning positions vary from this by bending the knee slightly from 90 degrees with the feet on the floor (feet may be asymmetrical), bending the trunk slightly forward at the hips and holding the elbows slightly more than 90 degrees. This position is similar to the one we assume before rising out of a chair without actually getting up. It offers a more dynamic support structure for the upper body, arms, and hands while engaged in activities at a desk.

A second component is the relationship of the chair to the work surface where the task is to be performed. Desk and chair heights are an area that can be easily overlooked. Adjust the chair and table height as needed to obtain proper positioning. A chair that is too high will cause the feet and legs to dangle from the seat of the chair or the child to slide forward with back rounded. A chair that is too low will also cause the child to sit in a position that will interfere with optimal

use of the arms and attending. A chair in which the seat depth is too long will cause the child to slump forward and be unable to use the back of the chair to support themselves.

Chair and table height adjustments are not just for students with motor impairments. All activity workstations should be reviewed for the students expected to work at them. Computer labs are a good example, especially at the elementary level. These students range in age and size making it hard to set chair and desk heights that fit that range (Strup, 2003). Adjustable seating and tables can decrease position issues and make computer activities a lot more comfortable for everyone. Monitors should be positioned at eye level or slightly below. When a monitor is too high students may have to extend their heads back to an uncomfortable position so the eye can look up to the screen. Additional information can be found in the article *Getting it Right: Computer workstation ergonomics for children* (Strup, 2003).

Increasing movement/alternate positions within typical seating

Students who move about the classroom may benefit from adjustments in their current seating to incorporate continued movement to keep them engaged. Students who fall out of their chair may need modifications to allow them to get movement in their chair and incorporate frequent changes of positions. They may also benefit from scheduling breaks to get in and out of their seat. Adding alternative seating (floor, beanbag chair, etc.) can break up long work sessions. Allowing the student to seek alternative way to support themselves such as laying on their desk, wrapping their legs around the legs of the chair, or propping themselves on other surfaces such as the desk may actually increase their learning. Additionally, holding their head on their hand, sitting on their feet and putting weight on their arms may also give them additional support beyond what is traditionally provided. Some classrooms allow students to work while lying prone (on their stomachs) on the floor. This gives maximum support for the trunk and arms and may make it easier to focus on the academic task they are trying to do.

Work or writing surface

In a typical work station the writing surface is horizontal. However, an angled writing surface may help students by providing a more optimal position in which to write. It encourages the student to position the hand with the wrist extended making it easier to grasp a writing utensil. It may also help with copying tasks. The eyes move from a vertical to the horizontal writing surface during copying tasks. For some, the visual information gets lost in the transition, greatly slowing the information transfer. By angling the writing surface the eyes stayed on the same plane and the copying may be done faster and with greater accuracy.

Students with significant disabilities

Students with significant disabilities often have one or more positioning/seating devices. They may use a walker, wheelchair, stander or other positioning device. There are several factors to consider: position within their seat; seat location; and accessing materials.

Positioning within the seat

Traditionally, seating guidelines have focused on the following:

- Feet resting on the floor - ankles dorsiflexed to 90 degrees
- Knees flexed 90 degrees
- Hips flexed 90 degrees
- Hips well back in chair
- Both arms resting comfortably on desk without causing shoulders to shrug

This provides anatomical and symmetrical positioning but may not be the best position for active engagement. Kangas and Lange, experts in the area of seating and positioning especially with regards to wheelchairs, promote alternatives to this position (Kangas 2000, Lange 2001b). They promote active learning positions that vary from the 90, 90, 90 position. The active learning positioning is described as bending the knee slightly from 90 degrees with the feet placed asymmetrically on the floor, bending the trunk slightly forward at the hips and holding the elbows slightly more than 90 degrees. This position is similar to the one we assume before rising out of a chair without actually getting up and offers a more dynamic support structure for the upper body, arms, and hands while engaged in activities at a desk.

The maintenance of the 90, 90, 90 position may still be beneficial for children when the task is safe transportation. On the bus or in situations in which the surface is uneven, systems that hold children in the 90, 90, 90 position with straps, bars, vests, etc. will protect them in the case of an accident, sudden stop or bump on an uneven surface. For more information on safe transportation, read *Safe Transportation for Students Who Use Wheelchairs on the School Bus* (Shutrump, S., Manary, M., Buning, M. 2008). However, it is becoming more acceptable to discontinue the strapping when the child is not being transported and is engaged in activity. Then the student can have some movement within the seating system.

Karen Kangas (2003) states, “Seating for anyone, cannot be a singular posture, and any singular posture without any inherent mobility within that system, cannot assist an individual in becoming independent in any task”. One seating solution is not adequate because students cross environments within and outside the primary classroom. Multiple seating and positioning options must be identified, each providing a dynamic situation that allows the student to progress toward independence.

Variables for Positioning within the Seat

There are many aspects to consider when determining the optimal seating and positioning for a student (Berner, T. (2007) Lange (2000e) 2000h, 2001b, 2007a). An OT approach to seating and positioning can be found in the Gregorio-Torres (2006) article *Wheelchair and Seating Evaluation*. Gregorio-Torres addresses the factors of seating including: medical; physical; ADL/IADL; environmental; and mobility. The importance of posture evaluation and body measurement is explained with regards to determining optimal seating. There are devices for positioning the pelvis, trunk, head, and extremities. The positioning chart at <http://www.atilange.com> takes each area and identifies the part of the body, problem, possible cause, suggestions for intervention and goals of the intervention. Starting at the pelvis and moving through trunk, hips, knees, ankles and feet, shoulders,

elbows and upper extremities and the head and neck area, this chart systematically organizes the body and how to best support it (Pedersen, Lange 2001).

Once the body has been positioned within the wheelchair, then other aspects of the wheelchair may be considered to facilitate optimal functioning of the student. There are systems that offer tilt in space and/or recline (Lange 2000c, 2000d). Changing the seating angle is also an area that may need to be addressed (Lange 2001a). Cushion choice may also affect the total positioning package (Lange 2007b). More detailed information can be found on these topics in the *Focus On* articles by Michelle Lange in *OT Practice*.

To gain a more in depth understanding of some of the wheelchair features, RESNA (2005, 2007, 2008) offers several position papers to help the reader gain additional information on features of seating with in wheelchairs. In addition to case studies, the position papers address the features of wheelchairs including elevating seat devices, wheelchair standing devices, tilt, recline and elevating leg rests. Standing and seat elevating features assist the student with activities of daily living (ADLs). The standing feature also assists the student with issues of range of motion/contractures, bone mineral density, vital organ capacity, circulation, tone, pressure sores, and skeletal deformities. There are also benefits to being in a standing position that include access to community environments, and vocational and recreational activities. Tilt and recline components of a wheelchair seating system may be necessary to address issues of postural alignment, function, physiology, transfers and biomechanical issues, contractures or orthopedic deformities, edema, tone, pressure relief, comfort or dynamic movement. For some students these features may be manual, but for other students providing power tilt, recline and elevating leg rests may give them control over these features.

Seat Location in Environment

For a student with physical issues it is important to consider a seating assignment with clear pathways to key areas they need to access such as exits, teachers desk, or shelves with frequently used classroom materials.

For students with attention or visual processing issues consider seating that offers clear sight lines to boards, wall references or other teaching areas. Keep clutter on the board and walls to a minimum. Items hanging from the ceiling can be difficult for a student to filter out. Use color or borders to highlight key visual areas. Be aware of visual field cuts (lack of vision in part of the visual field) and position the student to minimize their effect. Talk with your OT or vision specialist for more specific information or ideas.

Accessing Materials

It is important to position students so they can easily obtain materials. Desk organizers or clip on holders for pencils can keep writing and fine motor tools ready and easily accessible. Easy in-and-out storage folders can be strapped to the desk or chair to keep homework and notes located in one area. Nearby surfaces or an additional desk that can

hold adapted equipment such as angle boards or provide room for additional storage may also be helpful.

Larger equipment or assistive technology devices such as an augmentative communication device or laptop computer can be positioned on a wheelchair or table by:

- Securing it to the lap tray or other work surface with Velcro™ or other temporary gripping material until the optimum location is determined and then permanently fastening it to a lap tray or table.
- Purchasing a mounting system specifically designed to mount the device on a wheelchair; mounting systems can be adjustable or permanently positioned depending on the needs of the student.

Remember that a device should be positioned within an individual's optimum physical and visual range. Placing a device on a slant board may facilitate positioning.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies
- Implementation Plan to assign trials, dates, responsibilities and data collection
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Seating, Positioning and Mobility

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities and difficulties related to seating, positioning and mobility? - Does the student have strengths in any areas that would facilitate their seating and mobility? - Does the student have issues in: - Physical-Muscles- strength or weakness; Coordination or other physical issues? - Stability- trunk, extremities; standing, seated or other position? - Endurance-fatigues easily? - What is the student currently using for: - Seating? Positioning? Mobility? Transfers?	What environmental considerations impact seating and positioning? - Where is the student expected to move about? - Do different locations require the same or different types of seating or mobility? - Does the child have an environmental preference? - Does the child require physical assistance in some areas, but not others? (restroom, classroom, bus, etc.)	What task(s) do you want the student to do once they are <i>seated</i>? - Use hands? - Use device or learning tool - Stay on task? - What task(s) do you want the student to do once they are moving? - Get to and from class? - Move around in the classroom? - Participate in daily activities? - What does the child need to be provided with to be as independent as possible in regards to: seating, positioning, mobility? - Does the child need assistance with transfers, changing positions, accessing mobility or other devices?
Sensory Considerations		Narrowing the Focus
Hypersensitivity or hyposensitivity to stimuli such as visual clutter, different lighting; classroom and background noise; tactile stimulation-surfaces; awareness of physical space / personal space; other individual specific sensitivities		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision	Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Date/Length/Person Responsible
		Follow-Up Plan Who & When-- Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties – Seating and Positioning

As a team, discuss what the student's abilities and difficulties are related to seating and positioning. Please complete and review Section 1 of the WATI Student Information Guide: Seating, Positioning and Mobility (Chapter 1, page 22).

Seating and positioning issues may be very evident or subtle. Some questions to help elicit information about the concerns in the area of seating and positioning are listed below.

- When does the student exhibit good/poor positioning?
- Does the student lean in a certain direction?
- Does the student hold their head, arms or other parts of their body in a certain way?
- Does the student have positioning issues all day or just at certain times?
- Where does the student have good/poor positioning?
- Does the student express issues or concerns about their position?
- Does the current seating and positioning promote or interfere with any activities?
- Does the student have safety issues with regards to seating and positioning?
- Are there barriers to seating and positioning within various locations around the school?

Sensory Considerations

Some students are adversely affected by environmental stimulation which other students can filter out or ignore. Some common factors which can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space
- Other individual specific sensitivities

Although these factors are not directly related to seating and positioning, they impact the student's ability to focus on instruction and learning so should always be considered.

Some questions to ask may include:

- Does the child respond differently to surfaces that have different types of tactile input?
- Are there issues with skin sensitivity due to tolerance of fabrics, splinting material, etc.?

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations – Seating and Positioning

As a team, discuss and write on chart paper any environmental considerations that might impact the student's seating and positioning, such as auditory or visual distracters, placement in the classroom, number of different environments or any other environmental impacts. Some questions you may want to ask include:

- What positions are required in different environments?
- What positioning/seating do most children use in the different environments?
- Which environments could have multiple types of seating available?
- Are some environments more amenable to different positioning devices than others?

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment in which the student will be.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Tasks – Seating and Positioning

As a team, discuss and write on chart paper the tasks that the student needs to do. One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what types of seating and positioning does the student need to have in order to perform the daily tasks? These are some questions to consider:

- What are the seating and positioning requirements for the various tasks throughout the student's day?
- Are there times that the student could use different types of seating and positioning?
- What are the most important tasks that the student must do each day?
- How does the seating and positioning of the student interfere with or support the tasks the student is required to do each day?

A Continuum of Considerations for Assistive Technology

Seating and Positioning

Standard seat/workstation at correct height and depth



Modifications to standard seat or desk



Alternative chairs



Adapted/alternate chair, sidelyer, stander



Custom fitted wheelchair or insert

Standard seat at correct height and depth

Many chairs and desks are adjustable. This can be the first way to try and fit them to the student. Often there are unused chairs and desks that can have the seat or desk height lowered permanently by cutting off the legs. Lateral support or foot support can be added to the chair if you or your maintenance person is handy with tools, equipment and parts that may be available at the school.

In the computer lab, adjustable seating and tables can decrease position issues and make computer activities a lot more comfortable for everyone. Ergonomic support such as wrist pads, smaller keyboards for young hands and angled footrests also add support. Monitors should be positioned at eye level or slightly below so students do not have to extend their heads back in an uncomfortable position to see the screen.

Modifications to standard seat or desk

Stabilizers

Nonslip surfaces - *Dycem*[®] or other type of non-slip surface can be applied to the seat of the chair to prevent sliding.

Theraband - *Theraband* stretched between the legs of the chair gives the student an additional way to stabilize their feet besides wrapping their feet around the legs of the chair.

Seat cushions - Seat cushions such as the *Disc cushion* or *disco junior* offer another way to prevent slipping. Some are inflatable to different levels, or the surface can be smooth or bumpy, depending on what suits the specific student.

Foot support – Put support under a student's feet to raise them and prevent the feet from dangling. Cardboard or wooden boxes can be used. Attaching them to the chair will insure that they are in the correct position when the child is sitting in the chair.

Desk or table top modifications to help stabilize - Changing the angle of the writing surface can provide stability to help compensate for low tone, abnormal reflexes or poor grip patterns. The wrist, when bent back into greater extension, can use tendon positions (called tenodesis) to assist or strengthen the grip while holding a writing tool. Use a slant board or by turn a three-ring binder sideways to achieve this affect.

Chairs with arms - Old wooden student chairs may have arms on the side that can be used to help students get lateral support, as well as using the boundaries of the chair to remind them to remain upright or to move themselves back into an upright position.

Additional stabilizers - Cushions, bolsters, rolled towel, blocks can also be used as needed to assist in positioning.

Movement enhancers

Seat cushions Seat cushions such as the *Disc cushion* or *disco junior*, while adding a nonslip surface, can also allow movement in the chair. The level of air in the cushion gives different degrees of movement that can help the child to stay alert.

Chair leg modifications Another way to provide movement while seated in the chair is to put a tennis ball on opposite chair legs. This makes the chair uneven and allows rocking in a safe manner as opposed to tipping up on two legs.

Alternative chairs

T-stool - A T-stool is a one-legged stool, often made from 2x4 lumber, in the shape of the letter “T”. Although it may seem counterproductive to try and balance while working at a desk, some students focus and attend better when their body is engaged.

Beanbag chair - For students with fatigue issues you may want to find alternate work environments within the school day that allow the body to rest and yet still participate in classroom activities. A beanbag or bolster chair may be used for listening or silent reading activities.

Ball chairs - For students that have difficulty attending, sitting on a therapy ball or bouncy cushion can increase attention level for some deskwork activities.

Other Chairs - In therapy and special education catalogs there are numerous types of chairs that may assist students in sitting. Consult with your special education teacher, OT or PT to review these catalogs to see what is available. There are a multitude of devices. It is no longer necessary to try and make something for the student if it can be purchased.

Adapted/alternate chair, sidelyer, stander - Many companies also specialize in positioning equipment to meet the challenges of students with significant motor issues. Your OT or PT can be consulted to find appropriate types of devices for these students to encourage positional changes throughout the day.

Custom fitted wheelchair or insert

The industry that manufactures wheelchairs and seating systems has expanded significantly. There are premade systems as well as systems that are molded to fit the students’ unique needs. Your OT or PT can help you find and fit positioning systems for students. Also wheelchair vendors will have additional expertise in these areas.

Types of support available include: head, trunk, hips, knees, and feet. Additionally, lap trays or other components may be added to the chair to increase positioning.

Narrowing the Focus – Seating and Positioning

As a team, identify by circling or other means those few tasks the student needs to do that seating and positioning will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools and Strategies – Seating and Positioning

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for seating and positioning. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

Solution Selection: Tools and Strategies – Seating and Positioning

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan – Seating and Positioning

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify objectives and criteria of performance to determine the effectiveness of the trials.

Assistive Technology for Mobility

Background

Classrooms are not static. Students need to move in, around or between them throughout the school day. For students with mobility issues, transitioning can add some additional challenges. Key areas to assess are school building accessibility, movements within the classroom, moving around a building, grounds and community and safe transport to and from the school or to and from school events. After the environment is assessed, the individual student's needs for mobility is the next area to assess. It is also important to understand the issues and barriers surrounding the provision of mobility devices for students.

School Accessibility

The Americans with Disabilities Act (ADA) has encouraged many schools to address accessibility. Room numbers in Braille, ramps on the side walk, wheelchair-friendly thresholds and elevators to reach upper levels are now in place at many schools so that all children can participate in rooms that were once not accessible to them. Additional information on ADA access requirements can be found on the ADA web page www.ada.gov.

Movement in the classroom

Envision a typical classroom. How are the desks arranged? Where are the key materials located? How many items are strewn on the floor? How wide is the space between desks? Are there clear pathways? Would you be able to negotiate the room with your eyes shut or roll through it in a wheelchair without bumping into things?

When a student with physical or visual issues arrives in the classroom it is critical to create an environment that accommodates their movement issues. When the issue is physical, what kind of equipment will the student be using to get around the room? They will need to move from desk to teachers' desk to small group tables. Are there pathways to these key areas that are clear and large enough to accommodate a walker or wheel chair as it goes past? Will the student need to transfer to and from a desk? Do they need rest breaks from the chair? Do they need varied seating for different school tasks? Is their workspace high enough to allow the wheel chair to wheel underneath the table? Working with the school's OT or PT can help to address these issues.

For a student with a visual impairment, many of the same questions may be asked. The student may use a cane to help them negotiate around the many potential obstacles in the classroom. Key tools like reference materials, desks or the pencil sharpener may need to stay in the same location. Creating materials, signs, and labels in a larger font or in contrasting colors make them easier to see and read. They also may need to be in accessible formats such as audio or Braille. Students may need to be seated within the classroom where glare from windows and lighting are not an issue while working on a computer or retrieving information from a white board. Materials on the floor that may not be "seen" and could trip the student. Working with the vision specialist can help address specific issues.

Moving around the building and/or community

Students with visual impairments will often work with an orientation and mobility (OM) instructor when they begin to travel around the building and out in the community. These instructors may be able to offer some helpful tips to use. Students may be working with tactile or auditory maps or compasses as they learn to find their way. Electronic location systems, such as GPS, can also help a student pinpoint where they are and locate a specific destination.

Efficiency of movement between locations, access to play ground equipment or some school locations may be affected by fatigue and/or pain for students with physical issues. Pain can come from many sources. Students may be fitted with orthotics or braces that help stabilize and/or position parts of the body as it moves. A therapist or doctor usually fits these. Bunched socks or a growth spurt can cause skin to breakdown so care givers should attend to complaints of pain or discomfort. They should also alert family, other caregivers and medical staff about reports of pain so that adjustments can be made, as needed. Pain may also come from lack of movement so frequently repositioning the student within their seating or between positioning devices may help relieve pain and may prevent possible skin breakdown with students who have limited sensitivity. Students may also use a walker or crutches. Allowing extra time for these students to move between classes or locations if needed is helpful. Lots of walking with braces or crutches can result in fatigue and make it difficult for the student to keep pace with peers. Using alternate transport such as wagons, tricycles or sleds to go out to the playground or on field trips can help decrease fatigue and make the trip much more enjoyable. Alternating between different types of mobility may also decrease fatigue. For example, using the wheelchair for long distances and crutches within the classroom is one way to reduce the fatigue component.

For students who have difficulty standing and moving on their own, a variety of wheeled vehicles, such as manual wheelchairs and strollers, may offer them increased movement opportunities around the school. For those students who can control where they go by steering or switch controls, a scooter or powered wheelchair can offer increased independence with regards to mobility. Special seating systems can be fitted by a therapist or doctor to help position a child for maximum function. Powered mobility is now being accessed by switches so even students with severe motor and or cognitive impairments can learn how to move within their environment using a powered wheelchair device (PMD).

Transportation

Students may ride a bus to school and use their wheelchair or a specialized seating system to maintain upright posture or safe positions while being transported on the bus. ADA requires that transportation be available for people who use mobility devices. For students who are unable to transfer into a vehicle seat a WC19-compliant wheelchair can enhance safety. WC19-compliant wheelchairs are tested to with stand frontal impact and have demonstrated structural integrity and crashworthiness. They have four labeled and easily identified securement points for the tie down straps. Additional information on WC19-compliant wheelchairs is available at www.nercwts.org. This site lists all the wheelchairs that are currently WC19-compliant as well as industry standards for WC18 wheelchair tie down and occupant restraints and WC20-crash tested seating systems for wheelchairs to insure safe transportation of students.

Individual mobility

Some students require different types of AT to enable them to move independently around their environment. They may require devices to position their feet or legs (AFOs), external devices to help them balance while walking (crutches) or they may require a wheeled mobility device, either powered by themselves or by mechanical needs. Many improvements have been made in both the manual wheelchairs and power wheelchairs. However, there are multiple issues and barriers to using mobility devices.

Issues/ Barriers

When using AT for mobility, there are numerous factors to consider. Carden, Potgieter and Woods (2006) surveyed therapists who work with students that need to use mobility devices, and identified a number of reasons that there is difficulty in using mobility devices. In researching the area of powered mobility for students, they found a lack of randomized controlled research. However, several themes arose in their search for literature to address the issue of powered mobility. Parental perspective and acceptance of disability, prediction for potential and/or maintenance of ambulation, the use of powered mobility as a therapeutic tool, the use of powered mobility with very young children, and lack of knowledge or access to equipment by the therapists were all factors in using powered mobility.

Parental issues

The issue with use of mobility devices from a parental perspective is that it is often seen as a last resort when the child has exhausted all other means of independent ambulation. Parents may think that by providing mobility they are giving up on ambulation. As often seen with voice output devices, parents and even professionals have made the assumption that if the device does the talking (or walking) for them, they will not learn to do it for themselves. Research does not support this reasoning in either the use of AAC or with mobility devices. Although considered logical deductive reasoning, if you use something to do the activity for you, you may not develop the skills. Bottos and Gerickle (2003) as cited by Carden et al point out the opposite—providing mobility through the use of a manual or powered wheelchair does not impede the development of ambulatory skills. Also, ambulation potentials can often be predicted by age three and even though students are able to ambulate either independently or with external aides, this does not mean that this skill will be maintained through adolescence and/or adulthood.

Another barrier in acquiring a mobility aid is that it is also a major milestone in the adjustment to and acceptance of the student's disability. Along with the thoughts of "giving up" on walking, use of a mobility device is a visual indicator that a student is disabled. Many parents of young children with disabilities are only beginning to go through the stages of grief associated with the acceptance of their child's disability. They may not be ready to make this step emotionally. It is important to educate them on the importance of using mobility device not only to move but also as a therapeutic intervention. Movement using a device can impact the student's cognitive, social, emotional and communication skills, just as development of movement impacts these areas of a typical student's development (Hardy 2003).

Early use of mobility devices

Early learning is impacted by movement. Therefore the early use of mobility devices can impact the students learning. The student's potential for ambulation can be predicted as early as age three. Even students with motor skill deficits who are able to walk may not be able to maintain this skill as they continue to grow through adolescence and into adulthood. Provision of mobility through manual or powered means does not impede the development of ambulation skills (Bottos and Gerickle, 2003). Just as most people use multiple means for transportation—walking, biking, public transportation, driving or other means to get where they need to go—so can the student with disabilities use multiple methods to get where they need to go.

Many authors have begun to address the unique needs of using powered mobility with students and very young children. The consensus is that powered mobility should be considered as an option even for, if not especially for, young children [(Bundonis, 2003); (Buning, Angelo, & Schmeler, 2001); (Deitz, Swinth, & White, 2002); (Durkin, 2002); (Escobar, Leslie, & Wright-Ott, 2002); (Furumasu, Treft, & Guerette, 2002); (Hardy, 2004); (Kangas, 2006); (Lange, 2000f); (Lange, 2000g); (Meyer, 2008); and (Nilsson, & Nyberg, 1999)].

Professional issues/barriers

The professionals who work with students with disabilities have a wide range of perspectives when it comes to the use of powered mobility. In their survey of therapists beliefs, (Carden et al., 2006) found several areas that impacted the decision-making process. Therapists' beliefs regarding readiness, safety, "driving" ability, powered mobility as a last resort, and full functioning before seeking funding were assessed and responses varied widely. Barriers to the therapists' prescription of powered mobility included a lack of confidence, lack of consistent format or framework, lack of trial equipment, difficulty in setting up access to powered devices for students with complex issues, lack of knowledge of whether or not the powered mobility could or would interfere with self ambulation and very long wait time frames (up to a year) to get funding for powered mobility devices.

Readiness/Safety

Therapists' beliefs about readiness for powered mobility varied widely. Readiness factors may include physical, cognitive, and sensory skills as well as a minimum age. Some students have been excluded because of these issues. However, more and more students are being considered for powered mobility despite significant issues in these areas. Mobility is not driving and students can, in a controlled situation, learn to move safely through their environment before they are allowed to roam free. Just as a parent stops their child from harming themselves if they crawl towards an open stairway, the powered mobility beginner can be assisted to be safe in learning to use a powered mobility device. The use of a safety switch or kill switch accessible to the caregiver will allow them to immediately cut off power to the wheelchair in the event of a safety concern.

Last resort

Some professionals also believe that mobility (powered or manual) may interfere with ambulation skills. Lack of access to evidence-based practice information or research articles can prevent the therapist from understanding the positive outcomes associated with the use of PMDs. PMDs have been shown to positively impact cognitive, social, emotional, and communication

skills. In addition to the lack of evidence supporting the belief that PMD will prevent or interfere with ambulation (Carden et al., 2006) cite Bottos and Gerickle (2003) in their findings that provision of mobility does not interfere with the development of a student's ambulatory skills.

Framework Issues

Cardin et al. (2006) also noted that therapists were concerned about the lack of a format or framework with which to evaluate the potential for powered mobility use. Trial and error, observation and simple checklists were cited as ways to assess the students, but varied between therapists based on experience, access to equipment and other factors. The lack of access to trial equipment, access methods, and seating and positioning equipment also impacted the prescriptive recommendations of powered mobility. Therapists also had concerns about the possible negative effect of powered mobility on ambulation indicating an inconsistent knowledge of powered mobility's influence on this skill.

Funding Issues

Funding is also a central issue. The time it takes to locate funding, use funding or the lack of funding as a guideline often impact who receives powered mobility. Schmeler, Boninger, Cooper, & Vitek (2002) provide a peer review of literature for justifications of seating and mobility interventions with their aim to "provide strategies in using evidence to justify the interventions". Despite the fact that it is likely that the majority of a practitioner's knowledge base comes from clinical experience and less on higher levels of evidence such as peer-reviewed research, it is paramount for those writing justification for funding to be familiar with literature that supports evidence-based practice in this area. This research addresses the importance of providing funding sources with evidence to support the provision of wheelchair seating and mobility interventions. Schmeler et al review targets, specifically ultra-lightweight manual wheelchairs, powered mobility, pressure reducing seat cushions and the clinical application of pressure mapping, as well as tilt, in space and recline seating. These areas are supported with evidence-based practice and or research that can help the practitioner who is writing a justification for these specific types of seating and mobility.

Funding is also influenced by the inability of therapists to have adequate time for the student to try the powered mobility. The student may need an extended amount of time to fully determine if they will be able to learn how to use the PMD. The funding sources may not pay for even a short trial loan. Often funding sources will not approve the prior authorization for payment unless the student has demonstrated proficiency. However, the student is unable to demonstrate proficiency without access to the device. Working with vendors to obtain trial PMDs may give some students enough time to demonstrate proficiency. Developing a program similar to WATI's *Independence By Design* wheelchair loan service may be another way to assist students with obtaining a longer trial access to a PMD.

Independence By Design was developed by WATI Director Jill Gierach with the assistance of Karen Kangas and Lisa Rotelli from *Adaptive Switch Labs (ASL)*. The goal of the initiative was to obtain 2 PMDs outfitted with digital head arrays, and train WATI OT staff on their use, both the PMD and the digital switches to access them. The procedures and forms were created, and supporting data was collected. For those interested in pursuing this model, please contact WATI. Current changes in technology have made using PMDs with many types of students with varied

skills much more easily accessible for therapists or others interested in determining if PMD would be beneficial to their student.

Access Issues

Another barrier to providing powered mobility to students is the need for a variety of access methods, ranging from the most common such as the joystick to digital switches. The joystick is often the first type of access tried, as it is readily available. If the student can be successful with it then there is no need to look further. However, the joystick can be difficult for many students with motor disabilities. Before looking further at other types of access methods, one avenue that can be considered is the use of programming changes. By changing the parameters of the different types of control, students may be more successful with the joystick. In the past, the wheelchair suppliers and vendors have maintained sole access to the controller or programmer of the powered wheelchair. However, as they see the benefit for more frequent changes in the control parameters, therapists are being given access to and training in the adjustment of the parameters. *Independence By Design (IBD)*, the WATI-sponsored powered wheelchair trial, has focused on giving the school staff and parents access to the control parameters and training on how to maximize these settings to increase student success in safely exploring their environment with their powered mobility device. The parameters of a powered wheelchair that most affect learning how to use the access method are: forward speed, forward acceleration, forward brake, reverse speed, reverse acceleration, reverse braking, turn speed, turn acceleration, turn deceleration, power level, torque. The fine tuning of these parameters can be an essential key to making the PMD responsive to the student but at the same time, not scaring the student by going too fast or reacting to quickly or slowly.

There are many different types of access or controls for PMDs. Ramsey (1999) and Sweet-Michaels (1999) also address the variety of access methods for controlling a powered wheelchair. Besides the joystick, the use of a switch-adapted proportional joystick, switched control (with and without proportional access), sip and puff, tongue activated keypad and the use of scanning with a switch are other examples of access methods. Different access points including the hand, chin, head, foot, mouth and tongue can be used. Different types of mounting devices, lap trays and other accessories can also be used to help meet the mobility access piece for more complex students.

Access to AT

When addressing powered mobility devices, another factor to consider is whether or not the student will need access to additional AT such as alternative augmentative communication (AAC), environmental control unit (ECU) or the computer. Lange (2000a) in the article *Interfacing Assistive Technology With Power Wheelchairs* provides examples of various AT and what to consider when in addition to a PMD, the student may also need other AT.

Feature Match

The use of powered mobility is a multifaceted decision-making process. Involving the entire team and including the parents or other care givers is vital for success. The feature match at the end of this chapter is a checklist of items that may need to be considered when determining what features of the powered mobility would be the best match for the student.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Seating, Positioning and Mobility

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities and difficulties related to seating, positioning and mobility? - Does the student have strengths in any areas that would facilitate their seating and mobility? - Does the student have issues in - Physical-Muscles- strength or weakness; Coordination or other physical issues? - Stability- trunk, extremities; standing, seated or other position? - Endurance-fatigues easily? - What is the student currently using for: - Seating? Positioning? Mobility? Transfers?	What environmental considerations impact seating and positioning? - Where is the student expected to move about? - Do different locations require the same or different types of seating or mobility? - Does the child have an environmental preference? - Does the child require physical assistance in some areas, but not others? (restroom, classroom, bus, etc.)	What task(s) do you want the student to do once they are <i>seated</i>? - Use hands? - Use device or learning tool? Stay on task? - What task(s) do you want the student to do once they are moving? - Get to and from class? - Move around in the classroom? - Participate in daily activities? - What does the child need to be provided with to be as independent as possible in regards to: seating, positioning, mobility? - Does the child need assistance with transfers, changing positions, accessing mobility or other devices?
Sensory Considerations		Narrowing the Focus
Hypersensitivity or hyposensitivity to stimuli such as visual clutter, different lighting; classroom and background noise; tactile stimulation-surfaces; awareness of physical space / personal space; other individual specific sensitivities		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision	Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Date/Length/Person Responsible
		Follow-Up Plan
		Who & When-- Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties - Mobility

As a team, discuss what the student's abilities and difficulties are related to mobility. Please complete and review Section 1 of the WATI Student Information Guide: Seating, Positioning and Mobility (Chapter 1, page 22).

What method(s) is the student currently using to move?

- What does the student need in order to move within and around his educational setting?
- What strengths does the student demonstrate that could assist with mobility?
- Does the student have any of the following skills either emerging or mastered: cause and effect, spatial relations, problem solving, ability to interact with their environment, motivation/initiation.
- What is the student's level of alertness?
- Are there behavioral issues (positive or negative) that could impact mobility?
- Is the age of the student a factor? (Students as young as 10-12 mos. can be considered for mobility devices.)
- Are there issues with strength, coordination, fatigue or other physical abilities?

Sensory Considerations

Some students are adversely affected by environmental stimulation which others can filter out or ignore. Some common factors which can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space
- Other individual specific sensitivities

Although these factors are not directly related to mobility, they impact the student's ability to focus on instruction and learning so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations - Mobility

As a team, discuss and write on chart paper any environmental considerations that might impact the student's mobility such as auditory or visual distractions, placement in the classroom, number of different environments or any other environmental impacts.

Environmental considerations pertinent to the student's success may include:

- What are the areas the student needs to move in (maneuver about the room/school, travel from class to class, the number of class changes, sufficient time for transitions)?
- Are there adults that need proximity to the student (lecture or small group, the ratio of adults to students, does the student have an adult specifically to aid them)?
- What are the teacher expectations?
- Is the student positioned in clear view of the teacher, the board, or displays?
- Is there sufficient light, and is the board free of glare?
- Are there auditory factors such as the ability to hear the teacher; the level of auditory stimulation in the room, talkative/distracting students nearby, excessive noise outside the room?
- Does the student need background music in order to focus?
- Is there visual stimulation either in or outside the room or distracting clutter?
- Is the student able to organization their desk/workstation?
- What are the physical aspects of their work area such desk, chair, access to materials?
- Does the student need assistance with positioning to maintain good trunk stability?
- Do materials need to be stabilized for them to prevent materials from falling on the floor?

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each of the student's environments.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time.

Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Tasks - Mobility

As a team, discuss and write on chart paper the mobility tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do?

- How do the student's mobility issues impact their daily task performance?
- What tasks does mobility impact in a positive or negative way?
- Where does the student need to move on a daily basis within the classroom and between classrooms?

Narrowing the Focus - Mobility

As a team, identify by circling or other means those few tasks the student needs to do for mobility that will have the most impact.

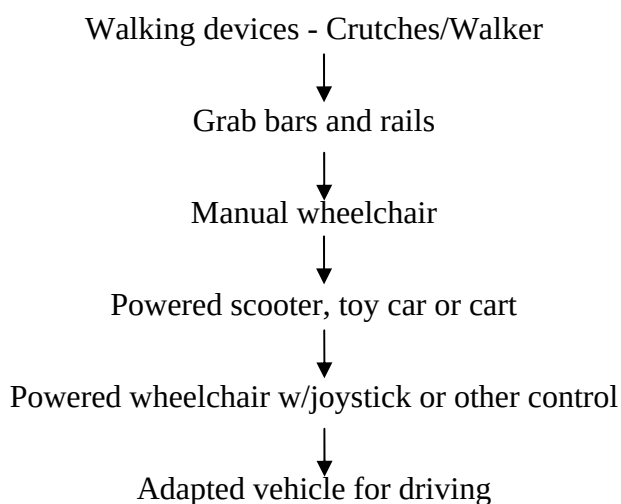
After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools and Strategies - Mobility

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for mobility. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A Continuum Of Considerations for Assistive Technology - Mobility



Walking devices: Crutches/Walker - Students who have difficulty with strength, balance or coordination may benefit from using external devices to support and stabilize them while they learn to walk or move from place to place. The PT will be able to assess and recommend the appropriate device as well as be able to correctly fit it and train others in its use.

Grab bars and rails - Since the advent of the ADA, most public restrooms have been equipped with grab bars and rails. These allow students who need additional support and stability to be as independent as possible. The height and diameter may influence the ability of the student to use the bars effectively. Grab bars may be also added to classroom areas.

Manual wheelchair - Students who have upper extremity strength and coordination but lack the necessary strength, coordination and balance in their legs may be able to use a manual wheelchair. Sometimes the wheelchair can be used for long distances to supplement students who are ambulatory for short distances.

Powered scooter or cart - Students who have use of their arms may benefit from using a powered scooter or cart. Generally less expensive than a powered wheelchair, this can give mobility to some students who are in need of powered mobility. Another alternative is the powered mobility car. The *GoBot* is an example of this type of mobility designed to give young children the ability to move while standing upright.

Powered wheelchair - Some students with significant motor disabilities may need to have a powered wheelchair to access their environment. Many new innovations have been designed to allow even the most motorically- or cognitively-challenged students to be able to access the controls to engage a powered wheelchair. There is a movement to get very young children into powered wheelchairs so they can begin to explore their environment through mobility. Students can control the wheelchair through innovations that allow a single-switch user to access the controls of the powered wheelchair.

Adapted vehicle for driving If a student is interested in pursuing driving a car, the student should be referred to an OT who specializes in driving evaluations and adaptations.

Solution Selection: Tools and Strategies - Mobility

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan - Mobility

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify objectives and criteria of performance to determine the effectiveness of the trials.

Writing AT into the IEP

There are many correct ways to write AT into the IEP. It must be considered on the special factors form of the IEP and a listing of AT may be included there. It may be included as a related service and maybe also be included as a supplemental aid or service. (Purcell & Grant, 2002, 2004, 2007) and (Bateman & Herr, 2003) state many examples of writing present level of performance, objectives and goals.

The following is a four-step formula for writing an IEP goal.

Time Frame: In 36 weeks

Conditions: given a movement cushion

Behavior: Eric will stay seated

Criterion: during writers workshop

Another example would be the following:

Given access to a power wheelchair (condition), the student will move 10 feet forward (behavior) by hitting a switch (criterion) to get to a preferred place or activity 5 or more times within 10 minutes (time frame).

Feature Match

The following chart is an example of a way to organize the variables one may consider when assessing seating, positioning and mobility. By reviewing this checklist, the team can discuss the various components and issues with the vendor, funding source or any other interested persons. It is not meant to be all inclusive, but rather to generate ideas about what the child could benefit from in the area of seating, positioning and mobility.

Area	Specific issue	Concern Yes or No	Rationale or question
Family issues			
	Needs		
	Funding		
	Aesthetics		
	Transportation		
	Preferred vendor		
Environmental	Home		
	School		
	Community		
Physical parameters			
	Size		
	Weight		
	Growth		
	Width		
	Seat depth		
	Seat height		
	Power for other devices		
Manual W/C	Access		
	Ability to collapse		
Power W/C			
	Access: joy stick, switches, sip puff		
	Power tilt		
	Power recline		
	Sit to stand		
Seating			
	Pelvis		
	Trunk		
	Neck		
	Head		
	Legs		
	Feet		
	Cushion		
	Tilt		
	Recline		

Chapter 2 – Assistive Technology for Positioning, Seating, and Mobility



	Elevating seat		
	Elevating leg rests		
	Sit to stand		
	Seat belt, Sub ASIS bar		
	Lateral support		
	Chest support		
	Head rest, support, strap		
	Arm rests, support, strap		
	Foots rests, support, strap		
Seating purpose			
	Functional use of head, arms		
	Transportation		
	Prevent address deformity		
Modifications			
	Need for short term modifications eg coat		
	Need for long term modifications eg growth		
Vision			
Vendor	Contact info		
	Access to trials		

(K. Stindt 2009)

Resources

Check list for choosing a wheelchair

http://www.healthcare.uiowa.edu/cdd/multiple/wc/wc_list.asp

Manual of Checklist for manually propelled wheelchairs

http://www.wheelchair.se/dokument/manual_english.pdf

Comparison of w/c electronics 6-1-08 M. Lange

http://atilange.com/New_wheelchair_electronics,%20final%20version,%206.08.pdf

List of support walkers and mobility devices Part of the Escobar article

http://www.seatingandmobility.ca/ISS2002/ToSunnyHill2/iss2002html/031_SELFInitiatedMobility.htm

Web sites

<http://callcentre.education.ed.ac.uk/>

Resources, publications, Smart wheelchair

<http://www.daneverard.co.uk/mobility/article01.php>

Support for early powered mobility

<http://www.atilange.com/index.htm>

Resources- positioning chart, Powered w/c electronics comparison chart, MULTI-FUNCTION ELECTRONIC AIDS TO DAILY LIVING Comparison Chart

<http://www.wheelchairnet.org/>

WheelchairNet is a virtual community for people who have a common interest in (or in some cases a passion for) wheelchair technology and its improvement and successful application.

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Products

Product	Vendor
Desk-a-Doo	Walker Enterprises
Dycem [®]	Sammons Preston Rolyan
GoBot	Innovative Products Inc.
Velcro [™]	Available locally
FitBall Balance Disc	Pocket full of therapy
FitBall Seating Disc Jr.	Pocket full of therapy
Move 'N' Sit Wedge [®] Seat Cushions	Pocket full of therapy
Bumpy Disc Junior Seat Cushion	Pocket full of therapy
"T" stool	School Specialty/Abilitations
Ball chairs	Pocket full of therapy
Bean Bag chair	Available locally
Thera-band	Thera-band
Switches	Adapted Switch Labs

Chapter 3 – Assistive Technology for Communication

Introduction.....	1
Getting Started with AAC.....	2
Using the Decision Making Guide	6
Decision Making Guide	7
SETT Process	8
AT Continuum for Communication.....	27
Continuum Expanded.....	28
SETT Solution Selection.....	41
Other Assistive Technology supports.....	49
Answer Board.....	51
References and Resources	52

Introduction to Chapter 3 - Assistive Technology for Communication

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Communication is who we are and who we will become!

Communication is a complex process that uses different forms and serves different purposes based on the context, the intent of the communication, and the communication partner. It is the method of exchanging information and ideas between communication partners or across a group of communication partners. Communication is the process of exchanging information about our wants/need, experiences, ideas, thoughts and feelings. The basic elements of a successful communication exchange requires that there be a

- sender (communicator)

- receiver (communication partner)

- shared understanding of the communication mode being used

- reason (intent) for the communication exchange to take place

Communication is a multi-modal process, which can include speech, vocalizations, gestures, facial expressions, as well as a variety of electronic (high-tech) and non-electronic (low-tech) assistive technology. Individuals with complex communication needs (CCN) have few of the conventional means of communication. The goal for students with CCN should not be to find an assistive technology (AT) solution to a student's communication problem but rather to provide AT that enables the student to efficiently and effectively engage in a variety of communication interactions with various communication partners.

This chapter provides guidelines and best practices for assessing the communication strengths and needs of students with CCN in a systematic and functional way. The process matches student's strengths and communication needs with the features of assistive technology for communication purposes. Along with this assessment and feature match approach, this chapter presents different intervention strategies, techniques and suggestions that will support and facilitate students' communication. Caregivers, teachers, and speech language pathologists must be reminded of the motto of a handyman "to do a job right you need the right tool(s)". The same notion can be made about communication; you need the right communication tool, be it a high-tech or low-tech tool (communication system) to successfully complete a communication job.

Chapter 3 – Assistive Technology for Communication

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Getting Started with AAC

Augmentative/Alternative Communication (AAC) refers to the methods used to maximize the communication abilities of individuals whose natural speech is either temporarily or permanently impaired. These methods involve the use of aided and/or unaided symbols. Aided symbols require some type of tangible representation. Examples include: real objects, Picture Communication Symbols, letters and/or words. These can be presented on a non-electronic communication board or displayed on an electronic communication device. Unaided symbols are those that are produced using the individual's body and may include gesture, sign and/or fingerspelling (ASHA, 2002).

Regardless of the symbol set selected or the display used, it is critical to keep in mind that augmentative/alternative communication systems are not meant to replace speech. Many families fear that the introduction of an augmentative/alternative communication system means that professionals are “giving up on speech”. Nothing could be farther from the truth. Millar, Light and Schlosser conducted a meta-analysis of research published between 1975 and 2003 on the impact of speech before, during and after using AAC. Of those studies that met the criteria for evidence-based analysis, none of the individuals lost speech production as a result of using AAC. Some of the subjects did not increase their production, but most (89%) had at least modest increases in speech production (Millar, Light & Schlosser, 2006). Linda Burkhart made this statement in her book *Total Augmentative Communication in the Early Childhood Classroom* (Burkhart, L, 1993, p.37)

By providing a child with a variety of means to communicate, including speech, the pressure to produce speech is diminished. In the past, clinicians and parents worried that giving a child another means to communicate would hinder speech development. Children who are given augmentative skills develop speech as quickly as the control group and often surpass them.

Several reasons are cited for this phenomenon. The pressure to produce intelligible speech may be reduced knowing that the child has an alternative way to say something. The use of augmentative communication systems allows the child's language skills to continue to grow and develop. Using speech is the easiest way to communicate. If the child is able to use it, they will choose speech over an alternative form of communication. There is research that supports introducing AAC at an early age *before* a student experiences communication failure because of a lack of speech production or intelligibility (Ronski & Sevcik, 2005).

For those who cannot use speech effectively, there exists a wide range of augmentative communication system options. These range from simple communication boards or displays presented on paper to high tech electronic systems with voice output. No one system can meet all

of an individual's needs. For example, a student may be able to use head nods to clearly and efficiently communicate yes and no to caregivers. However, when discussing course choices for the coming academic year with family and teachers, an electronic system with the option of spelling and accessing pre-stored messages may be more appropriate and efficient.

The success of any communication system is highly dependent upon the skills of the communication partners. The communication partners need skills such as modeling the use of the system, interpreting the symbols selected by the communicator and even low-level technical problem solving. Often when a communication system is introduced, it is the first time a student has ever seen or used such a thing. From an intervention standpoint, it is helpful to think of how an individual learns a foreign language. One would not give a student a Spanish/English dictionary and expect them to be a proficient Spanish speaker. That proficiency would be gained only through listening to the language and by repeated practice with an experienced Spanish speaker. The same holds true for learning to use an augmentative communication system. Good communication partners will provide modeling and feedback as to the accuracy and efficiency of the communication attempts in addition to actually using the system itself to communicate with the student.

To increase the chances of success in learning a new system, activity-based intervention should be used. This model relies on selecting initial intervention activities that are highly motivating to the student, occur regularly and present multiple opportunities for communication. One way to identify these activities is for the team working with the student to use an ecological inventory, that is to make a list all the activities that the individual engages in throughout the day. Consideration should also be given to activities that occur in environments other than school. Once the activity list has been generated, the team can prioritize the activities depending on their potential for communication opportunities for the student and motivation by the student to engage in those activities.

Vocabulary Selection

Regardless of the activities selected for intervention, success with an augmentative/alternative communication system is highly dependent on appropriate vocabulary selection. Motivation plays a huge role in selecting appropriate vocabulary. Many times, teams begin with vocabulary such as “eat”, “drink” and “bathroom”. While these may be key statements in the eyes of caregivers, for most augmentative communication students, these basic needs are met whether communication occurs or not. Therefore, their motivation to communicate these basic needs is greatly reduced. Bruce Baker (2005) proposed the following “motivation formula”:

$$\frac{\text{Motivation}}{\text{Physical effort, cognitive effort, time}}$$

This formula illustrates that when the **motivation** to communicate a message is greater than the physical effort, cognitive effort and time to compose it - communication will occur. However, if the **effort or time** required to produce a message is greater than the motivation to communicate it, communication will not occur. Motivation comes from the student when he/she realizes that communication can be a powerful and pleasurable thing. For example, it can be highly motivating to say “Tickle me” using a single message device.

When considering motivational messages, it is important that the content reflects age appropriate language. Most preschoolers do not say “I want more milk please” and the average teenager speaks differently with friends than with adults. Students want to sound like their peers. Listen to other students or ask peers to provide age appropriate messages. University of Nebraska-Lincoln has core vocabulary lists for young children to adults - <http://aac.unl.edu/>.

Vocabulary selection can impact how the student is viewed by their communication partner. For example, a preponderance of “I messages” (e.g., “I want to go outside, I want to wear that”) may have a tendency to turn the listener off. Keeping the communicative intent of those messages but rewording them to be more engaging can have a positive impact on listener response (e.g. Let’s go outside!, Purple is my favorite color—I want to wear my purple shirt today”).

Another decision to make when selecting vocabulary for a student’s communication system is whether to use words, phrases or sentences. Each message type has advantages and disadvantages. One advantage to a word based system is that the student can say what they want in the way they want. The drawback is that it takes time to compose messages word-by-word. While using phrases or sentences can speed up message composition, the student may be limited by vocabulary that does not exactly match the message they wish to communicate. For example, they might be thirsty for chocolate milk but only have a generic message requesting milk. First they would use their generic milk message. Then they would have to find a way to clarify that they wanted chocolate milk. In a phrase-based system, this could be exceedingly difficult. Thus the advantage to phrases and sentences is potentially improving the speed of communication. The disadvantage would be whether the selected messages are specific enough to meet the student’s needs.

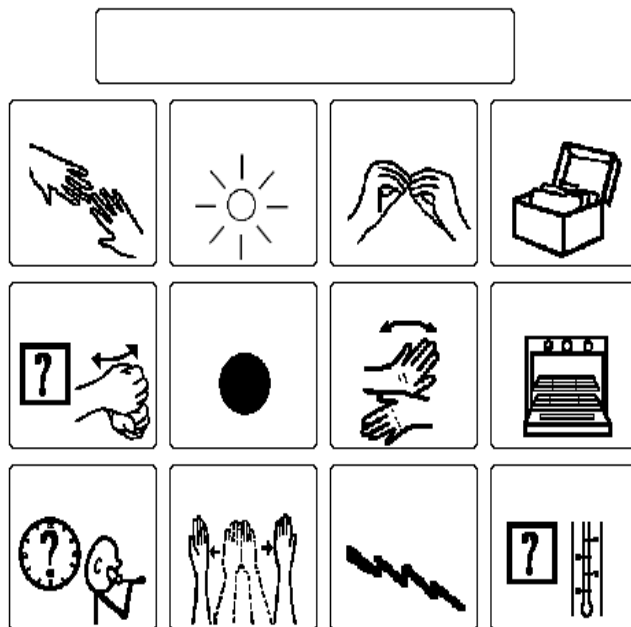
The most versatile communication system has a combination of words or even letters to create novel words **and** phrases or sentences of the most frequently used messages. The addition of clarifying messages (“That’s not exactly what I meant”) helps clear up communication breakdowns even more.

Vocabulary Representation

Unless the student has good reading skills, the vocabulary selected will need to be represented with some type of symbol. Examples include photos, line drawings, *Picture Communication Symbols* (PCS™), *Unity*® Symbols, *SymbolStix*®, *DynaSyms*® or other symbol sets (*Imagine Symbols*®, *PixAide*™ rebus symbols, etc.). *Picture Communication Symbols* are those used with the popular *Boardmaker*® software from Mayer-Johnson. Many assume that boards made with these or any other symbol set will be easy for the student to understand and interpret. One way to “see” these as the nonreader “sees” them is to print the symbols without the accompanying text. Using this version, try to decipher what the pictures represent. Present the wordless version to someone who is not familiar with this program and ask them to name all the pictures/messages shown. It is highly likely that you will come up with some very interesting answers. It is believed that one of the reasons for this is that when literate individuals encounter these boards, they look past the pictures to the text. This is in no way meant to discredit the *Picture Communication Symbols* or any other picture set, it is just to create an awareness that pictures are not necessarily easy to understand if the individual using them can not read.

Chapter 3 – Assistive Technology for Communication

This is a communication board made with Boardmaker symbols without text labels. What message would you attach to the symbols? See the same board with the text labels inserted at the end of the chapter. (Page 50)



The Picture Communication Symbols ©1981-2008 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.

To complicate the picture issue, Schank (1972) divided words into two categories: those that are picture producers (e.g. car, cat, house) and the non-picture producers (e.g. hard, fun). Only 10% of the 330 most frequently used words by preschoolers fall into the picture producer category. The rest, are non-picture producers. Learning any words in this category will require the use of memory and metaphor. Many of these metaphors come from life experiences, which may be limited for many students (e.g., a finger with a string around it means you have something important to remember). That symbol may only be meaningful to adults of a certain age!



Unity® symbol for “remember” (Unity is a registered trademark of Semantic Compaction Systems and the icons are used by permission)

Janice Light’s (2005) research indicates that symbols we select should reflect the child’s understanding of the concept (rather than an adult’s) and be taught and used within meaningful contexts. It may be that photos of familiar people, events and activities are more meaningful to a young communicator than traditional black or colored line drawings.

There is an AAC “myth” that students must go through a hierarchy of symbols starting with real objects and ending with letters and words in order to learn to communicate effectively. Romski and Sevcik (2005) suggest that there is not a specific representational hierarchy that individuals “must” progress through. In fact young children don’t seem to discriminate between abstract and more concrete symbols for communication and appear to treat them all the same. It is however, important to determine what types of symbols are meaningful to the student. Many students effectively use a combination of real photos, picture communication symbols and words/phrases in their communication system.

One of the AAC “myths” we have tried to debunk is that AAC is synonymous with technology and the team’s most important task is to find the “perfect” device. Nothing is further from the truth. You will notice that we refer to a student’s “communication system” in this chapter. An effective system should include a variety of technologies and strategies that can include speech, vocalizations, signs, and low to high tech interactions and technologies. No one device can possibly meet the needs of an individual in all settings. Just as “typical communicators” use a variety of communication systems (i.e., body language, sighs, printed and spoken words/phrases/sentences, “IM’s”, email, tone of expression, etc.) our students who use augmentative communication need to have the fullest variety of communication options available to them in all settings. The Decision Making Guide and SETT process can help your team start to identify which communication system is most appropriate in each setting.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student’s progress.

Again, this is intended as a guide; during the actual assessment process, each category should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Communication with others

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to the area of communication? • Review Student Information Guide (Chapter 1, page 23) • Current communication mode(s) • Expressive/Receptive Language Skills • Communication Interaction Skills • Feature Match for access and physical considerations • Literacy Skills • Visual Considerations • Other challenges /concerns?	What environmental considerations impact the student's communication? • Communication partners • Partner Behaviors/Attitudes • Daily Schedule • Daily communication opportunities • Technology Availability • Multiple Systems/modalities • Vocabulary to support environment • Other challenges/concerns	What communication task(s) do you want the student to do? • Communication Functions of: • Initiating • Continuing • Commenting • Ending • Repairing • Requesting • Denials/rejection • Exchanging Information • Social Etiquette • Social Closeness
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts Communication? (i.e., visual, auditory, tactile)		Specific communication task(s) identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Refer to Communication Continuum Brainstorming Only No Decision	Use a Feature Match Process to Discuss & Select Idea(s) from Solution Generation	AT Trials/Services Needed: • Date • Length • Training of communication partners • Communication Objectives • Data collection • Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date

Important: It is intended that you use this as a guide. Each category should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to communication. Please complete and review Section 2 of the WATI Student Information Guide: Communication (Chapter 1, page 23).

Current Communication Modes

An augmentative communication system does not replace the student's current communication modes, but rather augments or supports them. Students should be encouraged to use multiple means of expression including: gestures, signs, body language, eye gaze, vocalizations, facial expressions and other natural means of expression. Even when a student has a "high tech" communication device/system, a low-tech back-up system should always be in place. There are times when the advanced system isn't available, convenient or operating correctly. There are also times when medical conditions change and the student will need to use other means of access. Low- and no-tech versions of frequently used messages should be easily available to the student and the communication partners. When a student uses reliable signs and gestures to communicate, they should be encouraged to continue to do so even in the presence of an electronic communication device. Michael B. Williams, a long time AAC user has said

No one communication mode, no AAC device, no low-tech board, no gestures, signs or speech, could possibly meet all my communication needs all of the time. I use multiple communication modes. I communicate in many ways. I select the best mode depending on the location, with whom I am communicating and the purpose and content of the communication. (Williams, 2004)

How is your student currently communicating? Is he/she using traditional methods of communication (vocalizations, verbalizations, gestures, symbols) or non-traditional methods (behavioral outbursts, perseverative utterances or behavior(s), physically abusive behaviors, self-stimulation, etc.). When a student presents challenging behaviors, one of the first questions the team should ask is "What is the student trying to communicate?" Is it adult attention, frustration with a task/activity, desire for a change, or some other communicative message? The team may want to go through the steps of a functional behavioral assessment (FBA) to help identify the student's communication message and teach an appropriate alternative. Wisconsin school teams can start by going to the Department of Public Instruction's Special Education Subject Reference page on Functional Behavioral Assessment <http://dpi.wi.gov/sped/sbfba.html>.

Expressive and Receptive Language Skills

Although many students who use or need an augmentative communication system are difficult to assess using standardized measures, most members of the team can contribute information regarding the student's abilities such as the student's current communication skills and strategies:

- What are the student's current expressive language skills?
 - How does the student communicate?
 - What types of "messages" does the student communicate?
 - What is the intelligibility of the student with familiar and unfamiliar partners?
 - What is the student's intelligibility within an unknown context?

Chapter 3 – Assistive Technology for Communication

- What is the clarity of the gestures the student uses?
 - How many symbols/signs/words does the student use regularly without a model/prompt?
 - Does the student combine symbols/signs/words without a prompt?
 - Does the student attempt to repair communication breakdowns? If so, how?
 - Does the student reliably indicate “yes” & “no”?
- What are the student’s current receptive language skills?
 - Does the student attend to communication partners?
 - Does the student “follow directions” (to the best of their physical ability)?
 - Is the student aided by visual supports (i.e., objects, symbols, pictures, words)?
 - Does the student respond appropriately to yes/no questions?
 - The student makes appropriate selections from a field of _____ choices?
 - Does the student recognize communication breakdowns?

Some standardized assessments lend themselves to adaptations such as cutting apart the plates from the *Peabody Picture Vocabulary Test* (PPVT™) so that the student can eye gaze to the correct picture.

Communication Interaction Skills

Besides the expressive and receptive language skills noted above, consider the student’s pragmatic skills. A student who uses an alternative communication system needs to learn the social “rules” of communication. Some of those skills include:

- Attention to the communication partner
- Communication turn-taking
- Awareness of communication topics and topic shifts and topic maintenance
- Awareness of different communication styles with different partners (e.g., using slang with peers, but not teachers)

While some of these pragmatic skills seem very advanced, beginning communicators can and do learn these skills at their level by playing games, “sharing”, using simple communication devices to tell “knock-knock” jokes and other fun and motivating activities. Does the student show an indication of having some/all of these pragmatic language skills?

Motivation for Communication

We cannot overstate the need for motivating messages! Rather than looking at the *student’s* motivation, look at the motivation factor of the messages. Reluctant communicators have to **want** to communicate. The way to make that happen is by using fun messages during motivating activities. Motivation comes from internal sources, so messages are going to be different for a preschool boy compared to an adolescent girl (“ewww, gross!”, “Did you see *American Idol* last night?”). The team can interview family members, peers, and oftentimes the student will “tell” you which topics are their favorites. One student went into “full extension” whenever Clay Aiken’s name was brought up in the classroom. The team quickly discerned that he was a highly motivating topic for this reluctant communicator. They developed stories about him on a *LITTLE Step-by-Step*™ communicator, created a topic page about Clay in her communication book, used

Chapter 3 – Assistive Technology for Communication

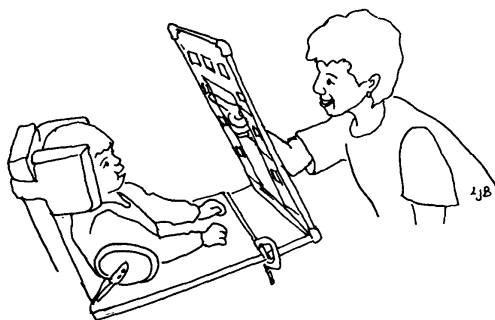
his picture as a “choice” of things to talk about, etc. Janice Light (2005) suggests that you use motivating topics and activities that sustain social interactions and incorporate popular characters, music/sound effects, laughter, decorations...in other words, have fun!

Another communication interaction skill that frequently arises is the issue of intentionality. While there are no prerequisites that a student needs to acquire before being considered for a communication system (Blackstone, 2006), some students may need to be taught skills and strategies that make communication meaningful such as pointing, gazing, turning towards a partner or vocalizing in response to stimuli. Sometimes our first “communication lesson” is to teach a student the connection between their actions and the response they get from the environment (including communication partners).

Access

Access refers to how the student will physically operate the system. This can range from a student selecting the desired message (direct selection) to using 1 or more switches to scan to the message and then selecting it (indirect selection). Direct selection can be achieved using a body part such as hand, finger, foot, head, eyes or by holding a “pointer”. Many students prefer to use a direct selection approach even when they have physical limitations. Keyguards can help students isolate messages/symbols/keys visually and physically. Many devices come with a variety of keyguards depending on the size or number of messages on the overlay or they can be customized for a student. School district tech classes are a great resource for making custom keyguards out of Plexiglas.

Eye gaze is a system where objects, pictures, words, letters or symbols are placed in such a way that the student can communicate by looking at the desired item. In low-tech eye gaze systems, the communication partner is positioned so they can see both the target and the student’s gaze. Depending on the student’s ability to visually track, scan, control head and/or eye movements and hold their gaze, the adult may have to make accommodations such as holding symbols/objects loosely by their face and moving them apart so the student can “follow their choice”. Another low-tech strategy is the 3-point eye gaze system in which the student looks at their partner to signal that they are ready to select a message, looks at their desired choice, then returns their gaze to the partner to indicate the final selection. Additional considerations are whether the student will be moving to a computer based eye gaze system where they need to learn to “dwell” or maintain their gaze on their choice, so need to keep a steady gaze on their selection. Regardless of the system, it is important to remember to: place frequently used messages in the same location every time (to increase motor automaticity); accept the student’s first response (don’t ask again just to confirm the message); as soon as possible give the student an option of saying they don’t want any of the choices (“something else”, “not here”); and to be flexible depending on “good days” and “bad days”.



Low-tech eye-gaze system (Burkhart, p 1993). Used with permission.

Computer-based eye gaze systems use a camera to “read” the student’s eye movements and select the message based on the length of time the student’s eyes dwell or stay on a message. A “head-mouse or Head Pointer” system is different from eye gaze. The student wears either a reflective dot on their head or glasses or some type of “head gear” affixed with an infrared transmitter. Using wireless technology, a head mouse translates the movements of the student’s head into movements of the computer mouse pointer or is recognized by the AAC system. The head mouse system integrates with “dwell” technology so that when the student maintains their “point” on a target for a specified length of time, it is interpreted as a mouse click or direct selection. It can help to train a student to “nose point” to their desired choice in anticipation of a head-mouse system.

Even with options such as eye gaze and head mouse systems, some students are not able to directly select messages because of physical limitations. Those students may need to use a low to high tech scanning system. Scanning can be done with or without technology. Partner assisted scanning does not involve technology. The communication partner systematically presents message choices to the student as they name or point to the potential messages. The message choices could be represented with objects, photos, symbols, letters, words or phrases. These can be presented individually or as a grouping. For example four topics could be presented as individual options or as groupings such as “family members”, “teachers”, “friends at school”, “friends from church”. The partner gradually narrows down the selections until the student signals when the desired message is reached. The student’s signal can be a gesture, vocalization, eye blink or any reliable indicator that the student can make volitionally. While initially time-consuming, familiar partners and students can quickly communicate in any setting using this method. Pragmatically Organized Dynamic Displays (PODD) (Burkhart & Porter, 2006) communication boards are paperboards that are organized much like “high tech” dynamic screen communication devices and are very effective when used with partner-assisted scanning strategies. The boards have main categories, “branch” to topics, have “quick chat” messages, and operational commands. Linda Burkhart has resources, examples and handouts about PODDs and a link to the commercial product (<http://www.lburkhart.com/handouts.htm>).

Other students may use an electronic communication system with built-in scanning capabilities. The device scans the messages in a selected scan pattern. Scanning speed, pattern, and mode can usually be adjusted to meet the physical, visual and cognitive skills of the student. The student selects the desired message by activating a switch. Some of the scanning patterns that are common to systems include:

Chapter 3 – Assistive Technology for Communication

- **Linear** - the scan indicator moves item by item in a linear pattern.
- **Row-Column** – after scanning starts, one row at a time is highlighted. When the row with the desired item is highlighted, the student activates the switch and each item in that row is then individually scanned.
- **Block** - scan is similar to Row-Column, but instead of presenting one row at a time, a particular group of items (block) is highlighted. When that group is selected, the device automatically scans a smaller grouping such as a row or individual items.
- **Auditory** - used in conjunction with any of the visual scan patterns. The student hears a message prompt.

The scan mode refers to the way the switch is used to start, stop, and maintain the scan and to select the target item.

- **Automatic Scanning** - The student activates and releases the switch to start the scan and then waits while each item is presented. The device automatically advances in the set scan pattern and speed. When the desired message is reached, the student activates the switch again to select the message, which is then spoken by the device.
- **Inverse Scanning** -The student maintains or holds the switch while the items are presented in the set scan pattern and speed. The student lifts up or releases the switch when the desired message is reached. The device automatically speaks the message.
- **Step Scanning** -The switch is activated and re-activated to advance the cursor item by item. Once the desired item is highlighted, the student ceases activating the switch for a specified length of time and the message is spoken by the device.
- **2 Switch Step Scanning** - One switch advances the scan with each activation, the second switch (in a different location) selects the item. For more information about this scanning technique see the article on Linda Burkhart’s website, *Two Switches for Success: Access for Children with Severe Physical and/or Multiple Challenges* (<http://www.lburkhart.com/handouts.htm>).

While scanning might be less physically demanding for some students, the cognitive demands are usually higher than when a student directly selects the message. The student must visually locate the target message, maintain attention to the display, anticipate when the scan indicator will highlight the target message (when using automatic or inverse patterns), physically ready their body to activate the switch at the correct time, and then activate the switch when the target message/row/column/block is highlighted. If the student “misses” the message, not only does the entire procedure need to be repeated, but the student must wait for the scanning pattern to start from the beginning. Increasing the scanning speed on a device can reduce the amount of time it takes to scan the entire array, but may make it more difficult for the student to accurately activate the switch. For more information please refer to the access chapter in this manual. Not every scanning capable device offers all of the scanning options mentioned such as 2 switch scanning, auditory prompts, row/column scanning, etc. Some devices highlight the entire message symbol to let the student know where the scanning indicator is, other devices only use a small light to indicate the scan indicator location. These are all important factors that need to be considered when setting up a scanning system for a student.

An alternative access method for students with physical limitations is Morse code. Compared to some of the difficulties students encounter with scanning, Morse code may be a viable alternative. Many AAC devices have removed Morse code as an input method, but *Words Plus* has continued to support that input method. If a student can accurately use two switches, Morse code can be used with the proper devices.

Digital switches offer more flexibility in programming, sensitivity and placement than most mechanical switches. For more information about switch options including digital switch capabilities, please see Chapter 4 – Assistive Technology for Computer Access.

Regardless of the switch type or location, it is important to stress the communication activity and message, not the switch activation. Adults can frequently be heard prompting a student to “hit the switch”. Thus, “hitting the switch” becomes the focus of the activity instead of the **message** the switch activates. Use natural cues such as expectantly waiting for a student to activate the switch or when a full model is necessary, use cues that focus on the communication such as “tell me”.

Making Choices

The student’s ability to make choices increases their communication options, allows them to control their environment, increases engagement and improves their behavior (Stafford, 2005). The student can make choices using real objects, photos, line drawings, or using a speech-generating device. Another alternative for “choice making” is when the communication partner presents auditory choices. Choice making options should be presented throughout the day. Whenever possible present as many choice options to the student as they can cognitively, physically and visually discriminate between. When a student is only given two choices, it is difficult to know whether the student really selected that choice. When there are only two choices, the range of chance is between 25%-75% that the student will select the preferred item. When the communication partner increases the number of choices for the student, there is a better chance that the student is making a “real” choice. Choices can and should include more than “milk” or “juice”. They can be integrated into all classroom activities, including choices such as who to sit next to, what to do next, who to walk by, which book to read, who answers the next question, who is assigned to which job, which route to go to the library, what sweater to wear, what to eat next... the list is unlimited!

Literacy

When a student is using a communication system, literacy skills need to be considered. All symbols should have clear text labels for both the student and the communication partner. Little is known about how communication symbols affect literacy development (Light, 2003). However, when students use symbols as their communication system, they are using a different mode of expressive communication (written, graphical, pictorial) than a “typical” communicator. Therefore, consideration should be given to their current skill levels as well as their ability to learn:

- Phonemes in words.
- Sight vocabulary of words.
- Sight vocabulary of symbols (e.g., stop sign).
- Environmental print.

Chapter 3 – Assistive Technology for Communication

- Initial letters of words.

Janice Light and David McNaughton (2006) have completed one study about the literacy requirements for students who use AAC and are still investigating further issues through AAC-RERC (<http://aac-rerc.psu.edu/index-1023.php.html>). A summary of their findings follows:

- We need to allow sufficient time for literacy instruction for AAC users.
 - The average student in 1st-3rd grade receives 90 minutes of literacy instruction.
 - The AAC user needs to receive at least the minimum with up to 40 minutes more of literacy instruction.
- Instructional content should be based on the National Reading Panel's recommendations (2000) and should include:
 - Direct instruction in basic skills.
 - Reading interesting text to students.
 - Phonological awareness skills.
 - Letter-sound correspondence.
 - Reading and understanding books and other text.
 - Early writing experiences.

Further studies have resulted in the development of literacy instruction curriculum. *Accessible Literacy Learning (ALL)* is specifically designed for the AAC user and based on the work of Light and McNaughton (2006). *Tango to Literacy* is another instructional literacy curriculum that has been developed specifically for the AAC user.

Students can use their communication device for writing as part of their literacy instruction and for written communication. Many of the “high tech” communication systems are built on a computer platform with all the standard capabilities including word processing, word prediction and more. If the student will be using their communication device for written output, please review the ASNAT chapters on access and composition of writing. Also review the operating system requirements of the communication system to check for compatibility with computers, printers, Internet accessibility, etc. For more information about literacy, please refer to the ASNAT Reading Chapter. For specific information about literacy assessment and instruction for students with complex communication needs, a new resource is available by Soto and Zangari (2009) *Practically Speaking: Language, Literacy & Academic Development for Students with AAC Needs*.

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as:

- Voice type and volume on the device
- Velcro noise and/or sensation
- Weight of the communication system
- Tactile sensations
- Visual layout (e.g., color, white space, font style, glare)
- Switch feedback (audible click)

Chapter 3 – Assistive Technology for Communication

- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Awareness of physical space
- Other individual specific sensitivities

Although these factors are not directly related to communication, they impact the student's ability to focus on instruction and learning so should always be considered. The student's communication system could be customized to reduce or increase sensory stimulation as appropriate for the student.

Other Considerations

Each student will have unique challenges and concerns that may not be directly related to communication yet greatly impact which system is chosen. Factors such as fatigue level and student behavior should be considered. Some students are more alert and/or physically able at certain times of the day/week. Many times inappropriate behaviors are a form of communication or a response to communication frustration. Given an appropriate system, training in use, and proper vocabulary and support, inappropriate behaviors may decrease or be eliminated. In the meantime, include behavioral considerations in your decision making process.

Other considerations may include visual concerns, including both acuity and processing. Larger symbols, darker or colored borders/symbols, increased spacing between symbols, including "blanks" for more visual spacing, using the "zoom" feature on electronic devices are all options that could assist a student with visual regard. Some students may benefit from a tactile cue on paperboards or overlays. If a student is not responding to a communication system or specific symbol, consider whether visual modifications could make a difference.

Every student's communication system and needs will vary. No one system can possibly meet every communication situation the student will encounter. Students should be provided with as many different communication options as possible and taught when and where to use each one.

Environmental Concerns

As a team, discuss and write on chart paper any environmental considerations that might impact the student's communication such as auditory or visual distracters, placement in the classroom, number of different communication environments or any other environmental impacts.

Each student needs to communicate in various environments including home, school and/or community. Environmental considerations include a variety of factors such as communication partners and their skills as a communication facilitator, daily schedules, and availability of tools and technology. Other challenges that factor into the environment can include: background noise, room arrangement, glare, weather, power source or staff availability to name a few. Each environment will have its own unique set of considerations. Basics for creating a successful communication environment include:

- Expectations for the student to communicate.
- Identifying and using communication opportunities within natural routines.

- Arranging the environment to increase the opportunities for communication.

Communication Partners

Communication partners are part of every student's environment and social network (Blackstone, 2003). One of the first steps in enhancing communication in the environment is to identify the student's communication partners. There should be a healthy mix of adults, family members and peers. Partners should come from a variety of sources including school, community, family, friends, health practitioners and others. Partners' behaviors, attitudes, and expectations play a significant role in how much and what types of communication the student is motivated to demonstrate. Anyone who interacts with the student should expect him or her to communicate. Students will develop more and better communication competence as they interact with partners in their social network. The Social Networks Inventory (Blackstone, Hunt-Berg, 2003) is an assessment that recognizes that communication varies across partners and environments. It can assist teams who are struggling with providing appropriate communication strategies across contexts.

Partner Behaviors and Attitudes

Recent literature suggests that when a student is an AAC user, the relationship with their communication partner is "lopsided". Partners of AAC users tend to dominate the interaction and ask primarily yes/no questions. Light, Binger & Kelford-Smith (1994) also suggest that adult partners provide very few opportunities for the student to initiate or even make comments that pertain to the conversational topic. They tend to focus more on the AAC device than the child's communication (i.e., "Use your talker"). Also, children who use AAC typically are described as "passive communicators" who rarely initiate messages and respond infrequently with limited vocabulary (Kent-Walsh & Rosa-Lugo, 2006). It is easy to conclude that communication partner behaviors directly impact the student's communication behaviors and skills. Adult behaviors, attitudes and expectations may unwittingly create obstacles for the student's success. One resource for increasing awareness of participation in the regular curriculum is Project Participate < <http://www.projectparticipate.org/>>. The project promotes the participation of students in all environments, from young children playing in early childhood environments to adolescents grappling with high school. Teams can use their resources, curricular ideas, inclusion strategies and forms to help the team reduce barriers to the student's participation. It is imperative that we analyze our own behaviors rather than focusing only on the student. Familiar adult partners frequently anticipate the student's wants/needs, next activity, message, recreational choice, etc. Unfortunately, when we anticipate a student's communication message over time, it begins to erode the student's desire to communicate independently and promotes "learned helplessness". One way to break that cycle is for communication partners to pause and wait for the student to communicate (even when they "know" what the student is going to say). Sometimes using a "least to most" prompt hierarchy can give partners a guide for when they should provide a model for the student and when they should wait.

Prompt Hierarchy - The prompt hierarchy listed below is employed when students do not consistently initiate communication without a prompt. The prompt hierarchy progresses from least to most directive and provides a structure that encourages communication. The most difficult component of the prompt hierarchy for communication partners is remembering to pause. When

the communication partner pauses, it gives the student the necessary time to process information and to formulate a communication message (McCloskey & Fonner, 1999-2000).

1. **Environmental Cue** (e.g., snack is on the table, but student can't reach it.)

The Environmental Cue signals a communication opportunity for the student. The environmental cue is set up, the communication partner **Pauses**, looks expectantly at the student and waits for the student to initiate communication. If the student initiates, the partner provides **Descriptive Feedback** (e.g. "You asked for milk, here's some chocolate milk."). If the student does not initiate, proceed to step 2.

***A Note about Pausing:** The partner should provide the student with the necessary time to process the request/statement and then respond. The amount of "pause time" will depend on the student's ability to understand information and the time needed to physically access their response. During the pause time, it is important that the adult does not repeat or restate the request so that the student can concentrate on the original message.*

2. **Open question** (e.g., "What do you want?")

The communication partner asks an open question *one time*. The communication partner **Pauses**, looks expectantly at the student and waits for the student to initiate communication. If the student responds, provide **Descriptive Feedback** (e.g. "You asked for milk, here's your milk."). If the student does not initiate, proceed to step 3.

3. **Partial Prompt or Request for Communication** (e.g., "Do you want milk or juice?" or "Tell me what you want.")

The partial prompt or request for communication is stated by the partner *only once*. The communication partner **Pauses**, looks expectantly at the student and waits for the student to initiate communication. If the student responds, provide **Descriptive Feedback** (e.g. "You asked for milk, here's more milk."). If the student does not initiate, proceed to step 4.

4. **Full Model** (e.g. partner says "I want chocolate milk." while pointing to those symbols on the communication system)

The communication partner provides the full model. The partner should still **Pause** and wait to see if the student responds or imitates the model. If he does, provide **Descriptive Feedback**. Even if the student does not imitate the full model, provide the requested item/action as if he did.

*Repeat the prompt hierarchy from the beginning as many times during an activity as possible so that the student starts to understand the expectation for initiated communication.

Communication by the student can be as simple as gazing to a choice or selecting a picture communication symbol from a binder, or as complex as creating a novel comment or asking content related questions using a high tech speech generating device. Communication partners should respond to the exchange in a natural manner (e.g., "Oh, you want to go on the swing? Let me get you out of your chair" vs. "good asking"). Partners also have a responsibility to model appropriate language using the student's communication system. Simply providing a system

(high- or low-tech) with all of the symbols is not enough. Students need to see how one uses the symbols to respond to others, initiate topics, make comments, answer questions, and make jokes... all of the different social ways we communicate. One way to do this is to use the Aided Language stimulation technique.

Aided Language Stimulation is a technique developed by Goosens', Crain and Elder (1994) to improve a student's expressive and receptive language skills. The communication partner simultaneously points to symbols on the student's communication system while conversing with them. This provides the student with a model for using symbols to communicate. It is important for students to see how "traditional communicators" use a symbolic system to communicate. It also helps the communication partners use the system in a real and functional way to identify missing vocabulary and organizational flaws. A small flashlight, laser pointer, or even a pen can be used to point to the symbols. The advantage of using light cueing is that it can be easily faded and does not obstruct the student's view of their symbols. Light cueing can also be provided along a prompt hierarchy with a general progression as follows:

- Sweep of light in the general location of the message.
- Short flash of light directly on the message.
- Fixed light directly on the message.

Daily Communication Opportunities

Communication opportunities are present or can be created throughout the student's day within natural routines from the time the student gets up in the morning until they go to bed at night. The student can choose what to wear or eat for breakfast; say "Good morning" to a teacher or "Wassup?" to a friend; announce a message from home and communicate social, informational, and "choice" messages throughout the day. In order for the student to maximize the use of their communication system and skills, the team should generate a list of all possible communication opportunities that occur. The easiest way to do that is to list all of the activities that happen throughout a student's "typical" day. Identify those that offer communication opportunities for the student to initiate topics or comments, make requests, share information or knowledge, make social "chit-chat"; in other words, the standard communication opportunities we all have.

Prioritize your list according to the following:

- Motivating to the student.
- Frequency of occurrence.
- Potential partners.
- Vocabulary.
- Staff availability.
- Device accessibility.
- Time.
- Student specific factors (e.g., fatigue, behavior).
- Environmental factors (e.g., noise, glare, water).

After generating that list you should choose one or two communication opportunities for the team's initial focus. If possible concentrate on communication opportunities within the natural routine that occur 3-4 times a day and at least 3-5 times a week. It is easier to focus on natural communication opportunities that occur during a single activity such as snack, grooming, work

jobs, art, cooking, etc. Some students may request choices during snack or lunch (i.e., what to eat first, which utensil to use, milk in a carton or cup), request more of an item (more paint, glue, glitter, during an art activity), reject undesired items, request continuance (read the story again), indicate cessation of an activity (all done, clean-up), make comments or ask questions about the activity (Borrrring!, Why did he do that?) or any number of specific messages that relate to an activity, person or situation. After a student begins to communicate messages in one situation, expand the opportunities (and vocabulary) throughout the day. Remember to keep in mind that the messages need to be reinforcing to the student rather than messages that adults want students to communicate (i.e., request to use the bathroom).

If presenting multiple communication opportunities during the student's day does not increase the student's spontaneous messages, analyze the environment. The environment may be hindering rather than encouraging communication.

Justin is a preschooler who rarely spontaneously communicates. He is very active, independent and has many age appropriate skills. He just doesn't "talk" unless he is prompted to do so (Student Abilities). In Justin's classroom, each student has jobs that they are responsible for. One of Justin's favorite jobs is getting ready for snack. He sets the table with placemats, napkins, utensils... all of which are easily accessible to him. His team decided to limit the accessibility of the necessary snack supplies for Justin by putting them in the "teacher's cabinet" or on high shelves (Environment). Now Justin has to ask an adult for the placemats, napkins, straws, etc. Sometimes the adult sabotages the activity/environment even more by handing Justin an almost empty container of straws or an inappropriate utensil for the snack (forks for cereal). His team utilizes the prompt hierarchy mentioned previously so that every team member only prompts Justin as much as necessary. He has become much more vocal; spontaneously requests the necessary supplies, makes occasional comments about snack and is starting to become more spontaneous in other activities and environments.

Sometimes when a student is very independent, it reduces the necessity for communication with others. For those students use environmental strategies such as

- Sabotage.
- Limiting the amount of materials the student has access to.
- Materials are visible, but out of reach.
- Highly motivating materials are available, but inaccessible (piece of candy in a tightly closed clear container).
- "Accidentally" give student something he/she doesn't like (water instead of juice).
- "Misplace" necessary equipment.
- "Forget" to do something.

You are only limited by your creativity to make environmental communication opportunities.

Tools/Technology Availability in the Environment

When considering the environment, don't forget to find out which communication tools are available in each setting and if those tools are appropriate. When high-tech systems are used to access the curriculum, make sure that any additional technology (e.g., keyboard, printer,

computer) is compatible with the system and available to the student. However, there are many times during the student's day when a “low-tech” alternative or back-up system is more appropriate or easier to use than the student's high tech system. The typical AAC user requires multiple components in their communication system to meet his/her communication needs throughout the day in various environments and in differing situations. The particular device used to participate in academic activities within a regular education class may differ from the device or tool used to communicate at lunch, on the playground, or during swimming lessons. Also remember that the more advanced the system is, the more likely that repairs will require expert technicians. When a student's device is sent to the company for repairs, it may be unavailable for weeks. A low-tech “back-up” is essential during that period and can be as simple as printing paper versions of the student’s high tech overlays.

Vocabulary to Support the Environment

Just as the tools need to match the environment, so does the vocabulary. Vocabulary selection to support environments is a dynamic ever-changing process. As the student changes interests, classroom topics shift, and the student participates in different activities and environments, the vocabulary on their communication system needs to change. It should have a combination of both “core” and “fringe” vocabulary. “Core” messages are those words or phrases that are used across environments giving the student quick access to frequently used messages. Core messages include social comments, questions, continuing or stopping an activity, repair messages (“oops”) and vocabulary specific to the student. “Fringe” vocabulary messages are specific to a topic or environment (lunch room conversation), with content rich and unique. Students may use fringe vocabulary repeatedly in those specific environments, but not anywhere else. Even emerging communicators should have access to both types of vocabulary. Fringe vocabulary for beginning communicators could include songs for a preschooler or CDs for a high school student with song names, as well as messages to “play it again”, “do something else” and “stop”. Gail Tatenhove (2007) more thoroughly describes the difference between core and fringe vocabulary with suggested core language vocabulary lists, normal language development and how to apply that information with AAC users in the web article *Normal Language Development, Generative Language & AAC*. ISAAC (International Society for Augmentative and Alternative Communication) also has core vocabulary lists that can be downloaded from <http://www.aacawareness.org/Vocabulary.html>. When a student is in different environments with varying curricular vocabulary, it can be helpful to survey regular and special education teachers and the student’s peers about the words, phrases and content specific vocabulary the student needs to use.

Teacher _____ Student _____
Topic _____ Week(s) of _____

What are the core vocabulary words or phrases the student needs to use to talk about this topic or answer content questions

What are some fringe words or phrases the student needs for extended communication about this topic

Other topic vocabulary that could be useful to the student

J Cumley 6/08

It can help to leave some “blank” messages or cells on a student’s system so that specific vocabulary can be added “on the fly” for new fringe messages. The communication partner can carry a packet of “sticky notes” with them to add quick content, environmental or activity specific vocabulary. Paper boards can be easily changed when they are placed in plastic sheet protectors rather than laminated. If an emerging communicator only has a few messages on their paper board, put those messages in their final location and have blank cells on the rest of the board. You can add new vocabulary easily without changing the location or “look” of the communication board. Slide protector sheets and or baseball cardholders also work well for students with a small vocabulary set. “Scripts” such as the sample ones included in *Communication Displays for Engineered Preschool Environments* (Goossen’s, Crain, & Elder 1994) give communication partners an idea of how to communicate with a student using a topic or activity communication display. Check vocabulary and its placement on a communication board by trying to complete the activity using only the student’s vocabulary set. Can you do it? What is missing?

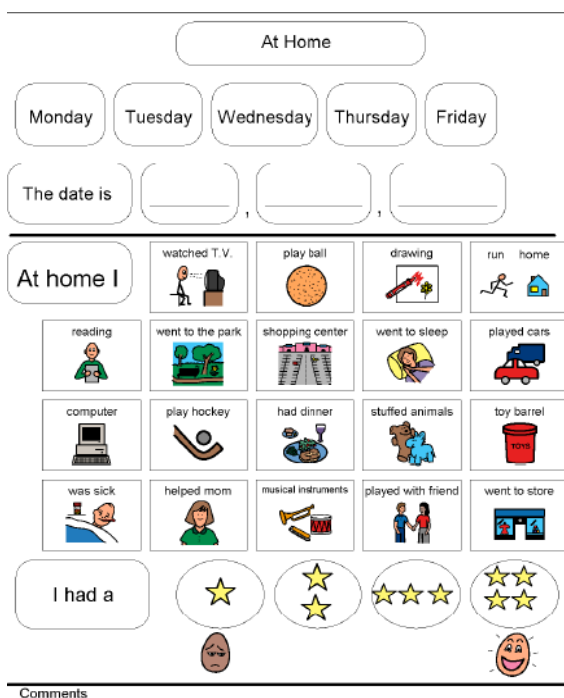
The student’s communication device does not always need to be utilized for teaching concepts and curriculum. Remember that the device is the student’s voice, not a chalkboard! Use low- to high-tech methods to teach and use curriculum-based vocabulary such as sticky notes, dry erase boards, note cards, computer programs, white boards, etc. If a communication device is used primarily for “drill and practice”, the student may view it as “work” and not for communication and may eventually abandon it.

Daily Schedule

When a student does not seem to understand or anticipate a routine schedule or the steps of an activity, try an object or picture schedule. A schedule using objects, parts of objects, pictures or symbols can be a useful tool to help a student begin to understand and anticipate the events of the day or the steps of a specific activity. The items are presented in the order in which they will occur (or need to be completed). They may be crossed out, covered up, or put away as each one is completed. Digital cameras are useful for making picture schedules of the various locations or activities of the day. *Boardmaker*, *Picture It*© and *Tobii SymbolMate* are good tools for creating schedules for a student who uses symbols. These software programs contain libraries of picture symbols to give a visual representation of each step in the student's schedule. A schedule can be just one of the many components in a student's communication system about their environment. It may be that the primary purpose for the schedule is for self-regulation or receptive language. But, the student may also use the daily schedule to ask questions about an activity, person or location. Daily schedules are useful across environments whether it is at school, home or in the community. They can serve as a way for a student to "report" happenings in different environments to different partners (e.g., tell mom what happened at school today, tell the paraprofessional what happened on the bus, etc.) in a motivating and functional way. Schedules can be presented in a paper or digital form.

These schedules are examples from Special Education Technology - British Columbia - Assistive Technology for K-12 Students ([http:// www.setbc.org/](http://www.setbc.org/))

Home to School Schedule



The form is titled "At Home" and includes a section for the day of the week (Monday through Friday) and a date field. Below this is a grid of 20 icons representing various activities and locations, such as "At home I", "watched T.V.", "play ball", "drawing", "run home", "reading", "went to the park", "shopping center", "went to sleep", "played cars", "computer", "play hockey", "had dinner", "stuffed animals", "toy barrel", "was sick", "helped mom", "musical instruments", "played with friend", and "went to store". At the bottom, there is a section for "I had a" with four star icons and a smiley face icon.

Retrieved from
<http://www.setbc.org/pictureset/resource.aspx?id=82>.
 September 19, 2007. The Picture Communication
 Symbols ©1981-2008 by Mayer-Johnson LLC. All
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Chapter 3 – Assistive Technology for Communication

Color Coded Kindergarten Schedule

My Morning at School - Kindergarten Example



Retrieved from <http://www.setbc.org/pictureset/resource.aspx?id=274>, September 19, 2007. The Picture Communication Symbols ©1981-2008 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.

Riding the Bus Schedule



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All of these examples of communication supports in the environment might fit into the general category of creating a communication rich engineered environment. Goosens', Crain and Elder first introduced the concept of engineering environments in 1994. Their concept has continued to develop with the field. An engineered environment has visual supports including symbols, words, signage for adults, students, readers, non-readers, visitors, staff, virtually anyone who enters the environment. A universally accessible environment that is communication-based is one in which:

- Everyone feels safe enough to listen, understand and express themselves.
- Enables learners to develop their social, emotional and academic potential by reducing or removing barriers to communication.
- Provides an accessible learning environment for everyone.

For examples, pictures and more about the how to create a communication friendly engineered environment, visit <http://www.symbolsinclusionproject.org/index.htm>

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not always discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Changes in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low- and high-tech AT supports.

Sensory Considerations

Different environments have varying levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment.

Other Environmental Considerations

There are many other environmental challenges and concerns that impact a student's ability to effectively communicate. Background noise may make a voice output device ineffective in the lunchroom so that staff may need to consider a low-tech paper alternative. The room arrangement in some classrooms may need to be adjusted so that the student isn't next to a window with glare. When staff is not available to support the student, peers or peer helpers may need to be assigned as communication partners.

Tasks

As a team, discuss and write on chart paper the communicative tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what does the student need to communicate? These are some questions to consider:

Communication Functions- A web search of communication functions results in a variety of definitions and lists. For our purposes, Janice Light (2005) identifies the following wide range of communication functions:

- Wants and needs.
- Social interaction.
- Joint attention leading to Sharing Information.

Additionally we want to build within those functions enough vocabulary to support a variety of topics, semantic concepts, greater complexity within messages, and for some students the phonological skills for future literacy development.

Other functional communication tasks that teams may want to consider include:

- Initiating - Asking for something, starting a communication interaction (“Can I have ...”, “Let’s do this together”)
- Continuing - Using specific vocabulary to keep the interaction going (“Uh-huh”, “more”, “No way”, “Really?”)
- Ending - “All done”, “Good bye”, “See ya”
- Repairing – Asking “What?”, repeating the message or using messages that indicate a communication breakdown (“What I want to say is not on this board.”, “Did you understand what I said?”, “I didn’t get that.”)
- Requesting – “Can I have”, “”, “want...”, “I’m really thirsty.”
- Denials/rejection – “NO”, “Don’t want”
- Communication turn taking – Answering and asking questions, sequencing messages, maintaining the topic, and waiting for communication turn.
- Social Etiquette - Brief interactions, greetings and closings, age appropriate etiquette (e.g. Please, Thank you, “Wassup”) depending on the communication partner.
- Social Closeness - smiles, head nods, eye contact, hugs or handshakes.

Kirsten is a 17 year old teenager in a CD classroom. She has had a long history of using low tech AAC devices, primarily for requesting (wants/needs) items or activities. She is very successful communicating those messages (Student Abilities), but her team wants her to do more to sustain an interaction with others (Task). They realized that when Kirsten requested and then received an item (“more juice please”), the communication interaction stopped. They needed to give her the opportunity and vocabulary (Environment) to sustain a social interaction (Task). They started by programming simple social scripts on her LITTLE step-by-step (“Guess what I did last night.” “I helped make my favorite snack.” “Can you guess what it was?” “I helped make brownies.” “What kind of brownies do you like?” “Yum!”). They also scheduled a social “talk time” within the school day in which available staff and students gathered in an informal area to socialize

(Environment and Task). Kirsten initially needed prompts to activate the next message on her device, but gradually learned to sustain an interaction, wait for her communication turn, look at her communication partners and other important functional communicative skills.

Narrowing the Focus

As a team, select student communication tasks that will have the most impact on his/her communication success.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

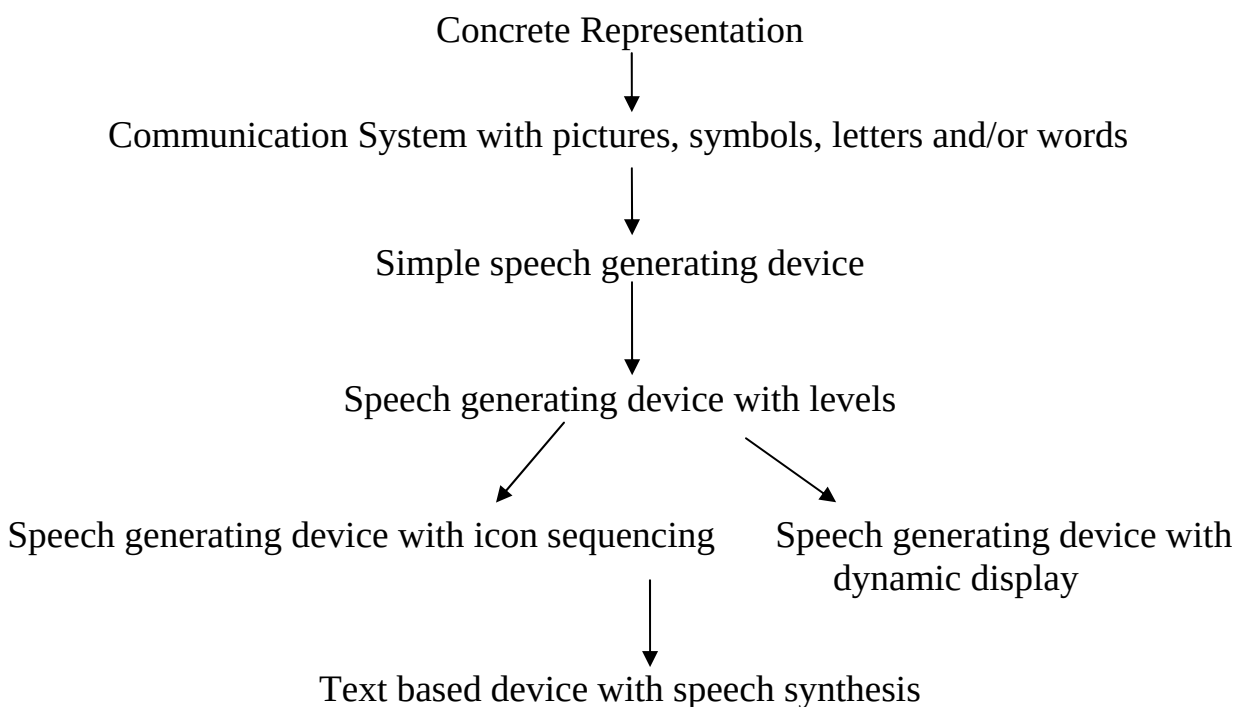
Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully communicating.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for communication. The continuum is generally organized from low to high assistive technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of assistive technology.

A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

For Communication



Assistive Technology for Continuum for Communication Concrete Representation

Concrete objects or parts of an object can be used when a student does not seem to understand photos or symbols or is visually impaired. The object represents the one that the student will actually use. A clear make-up bag might hold a variety of objects that a student enjoys during sensory activities such as lotion, a brush, powder, hand-held massager, etc. The student can select that activity after seeing the items in the clear bag and then choose which one they want to do first from an array of choices. When the student chooses lotion, use a different lotion bottle than the one in the sensory bag. As the student's skills progress, photos or symbols can be affixed to the representative objects to help the student transition to a photo or symbol representation.

Calendar box- A calendar box is a way of representing a schedule. A box is segmented so that an object can be placed in each compartment. It can be set up in an independent or dependent sequence according to the activity. Each item in the box represents an activity or step. When all sections have been emptied the task is complete. An example might be a “grooming box” using interlocking Rubbermaid® trays. Each tray could contain items such as liquid soap, washcloth & hand towel, toothpaste & toothbrush, hair brush, etc. The activity is a combination of dependent (wash your hands before you brush your teeth) and independent (can brush your hair or wash your face) activities. As the student completes each activity, the object is placed in the “all done” container. The communication partner uses the calendar box and objects in it to facilitate communication by the student: making requests, continuances, comments and other communicative functions. The student does not use the actual items in the calendar box. Each item serves as a symbolic representation which may eventually be replaced with a less concrete symbol.

Tangible symbols- Tangible symbols are concrete representations of concepts/objects/activities about which the student needs to communicate. If a student wants to request a cup to drink, the tangible symbol may be a whole cup, the plastic handle of a cup, a piece of hard plastic (an associated object that represents cup), or more standard representations. Whatever is selected as a tangible symbol must be chosen from the perspective of the student and “transparent” to him/her. The advantage of 3-D tangible symbols are that students with visual disabilities can discriminate between the symbols even if they cannot read Braille. Tangible symbols can be: whole objects, parts of objects, associated objects, textures or shapes, line drawings, or photographs. More information about tangible symbols can be found at <http://www.ohsu.edu/oidd/d21/ts/index.cfm>. Evidence based research by Rowland and Schweigert (2000) supporting the use of tangible symbols can be found at the OSEP Ideas that Work website http://www.osepideasthatwork.org/toolkit/InstPract_tan_sym.asp

Real objects and miniatures- Real objects are just that, the real object. An example of using real objects would be having sandwich material on a communication display. When the student points to the bread he/she gets a piece of bread. The real object represents the actual item (i.e., the student gets a new piece of bread, not the one displayed on the communication board). Miniatures of objects may be a replica of the object the child is requesting or commenting on. Caution must be used when using miniatures to represent an object or activity. A miniature car may not look like the student's family vehicle and even if it does, may not be easily recognized as such by a student with a cognitive impairment. If a student has poor vision, the relationship between the actual object and the miniature is poor and largely reliant on good visual perception.

Some students may need a “bridge” between three dimensional real objects and two dimensional representations. TOBIs (True Object Based Icons) may act as that bridge. TOBIs can be any picture or symbol which is cut out along the actual shape or outline. It is often mounted on a foam backing or other thick material to add dimensionality.



examples of TOBIs

Communication System with pictures, symbols, letters & or words

One does not have to start with expensive or high tech augmentative communication devices to communicate effectively with others. In fact, one of the advantages of “low tech” systems is that they require both the student and their communication partner to be actively involved in the communication interaction. Low tech communication boards are not difficult to create. Simple communication boards with pictures of the people and places in a student’s environment can be made using a digital camera. For students who may be ready to use symbols, Boardmaker is a tool for educators or parents to create communication boards about a variety of topics and activities. Paper communication boards can be made with digital pictures, symbols, words/letters or a combination.

Communication Boards

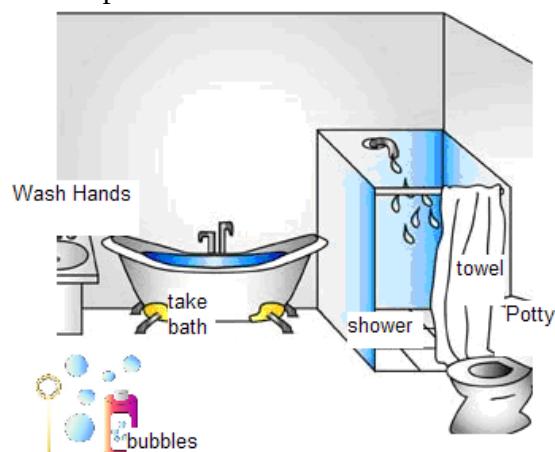
- Communication boards may consist of one, a few, or many cells containing pictures, symbols, words, phrases, letters or any combination.
- The cells may be of various sizes, even on the same board depending upon student ability, visual tracking, ability to find important messages, etc. For example a student may have limited motor control in one quadrant. Those cells may be larger than the cells on the rest of the board.
- Paper boards may be used as an AAC option for an emerging communicator or as a back-up to a more complex voice output device.
- Paper boards may also be beneficial for a student during specific activities in the community or in congested and/or noisy environments where a voice output device may not be effective or practical (i.e. swimming pool).

Various displays or arrangements may be used to increase “effectiveness” of communication interactions. Janice Light (2005) has identified three of the most common layouts:

- Traditional grid layout
 - ◆ Vocabulary is represented with symbols in “boxes”
 - ◆ Language is taken out of context and is separated

- ♦ Imposes a high degree of processing
- Visual scene layout (either a digital picture of a familiar location such as the child’s bedroom or a “generic” scene of a common location like a public restroom)
 - ♦ Vocabulary is presented in context within the scene
 - ♦ Concepts are linked visually and conceptually
- Hybrid layout
 - ♦ Visual scene display with some vocabulary presented in a grid-type layout in the scene

Sample visual scene of a bathroom. Messages are “embedded” in the scene.



Imagine Symbols®

Light indicates that traditionally practitioners have withheld vocabulary for emerging communicators when the navigational and or conceptual difficulty was too high for the student. Visual scenes, while reducing navigational demands, allows emerging communicators to have access to concepts and vocabulary in a familiar context. In fact, “Very young children are more accurate using visual scene layouts than traditional grid layouts” (Light, 2005, p. 26). Visual scene displays can be developed for low tech/paper communication displays, adapted to be used in mid-tech voice output devices and are integrated into many of the higher tech speech generating devices.

PECS (Picture Exchange Communication System) is a low-tech communication system developed by Bondy and Frost in 1985 to teach children and adults with autism and other communication deficits to initiate communication. It is a systematic program that starts with students exchanging a picture or symbol of a desired item with a communication partner. Specific prompts and reinforcement strategies are utilized in the PECS program. PECS requires specific training in order to follow the protocols in the program. More information about PECS can be found at <http://www.pecs.com/whatispecs.htm>. PECS should not be confused with PCS (Picture Communication Symbols) which are the actual picture symbols used for communicating. A device that may be considered as a “bridge” between a traditional PECS system and a communication system using voice is the Logan™ Proxtalker™. The device has five word zone buttons that attaches to a binder containing sound “tags”. The student places the tags on the buttons, then presses the button to speak the message. The sound tags use radio frequencies making it easy to record new messages or change messages.

Regardless of the type of display or system used, try to involve the student whenever possible in the design and use of it.

Mark is a student with limited verbal abilities in an Early Childhood class. The EC teacher has a number of communication boards and single symbols around the classroom to enhance communication opportunities. Every day at “closing” group, she and her paraprofessionals take time with each student using a “School to Home” communication board. The student marks on or otherwise indicates what he/she did that day, songs they sang, snacks eaten, peers played with, etc. The teacher left plenty of blank spaces on the board so that the adult could fill in specific details. While the students originally were passive participants when the adults reviewed their day, they quickly became actively involved; drawing detailed lines between friends and activities, using different colored markers to indicate “really fun” activities, etc. The parents from the classroom were thrilled because as Mark’s mom put it “For the first time, when I ask Mark what he did today, he can tell me”.

What I did at school.....

Erin 	Amanda 	Derrick 	Jess 	Justin 	Mark 	Drew 	Shawn 	Sara 	Andrew
paint 		color 		Judi 	Jill 	Shelly 	Amy's Room 	playground 	gym
cut 	draw 	glue 					game 		trike
like it 	don't like 		yummy 	yucky 	scary 	silly 	fun 	messy 	
drink 		eat 		make 		play 			
sing 							doll house 	blocks 	toy cars
	story time 		book 				play 	computer 	puzzle
	story tape 		library 				game 	Play-Doh 	play table

Special Notes:

Sample School to home board created by Judi Cumley (1993). The Picture Communication Symbols ©1981-2008 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.

Simple communication boards can also be used during “aided language stimulation” (Goosens’, 1989). Aided language stimulation is the process in which the partner points to picture symbols on a simple communication board in conjunction with ongoing verbal language stimulation. Some facilitators use a pen flashlight to highlight the symbol/cell or use a pointing device as they verbalize the message. One teacher “grabbed” a candy cane pen when she couldn’t find anything

else when trying aided language stimulation with a student. She later reported that he followed every movement with his eyes! Using a visual signal may help the student locate and track the symbol(s) being used. This can be very helpful for beginning communicators or to model for students who are starting to combine symbols/cells.

Examples of Communication Systems with pictures, symbols, letters & or words include:

- Object choice board
- Visual Scene Display
- Topic Board
- Activity Board
- Story board
- Communication wallet/book
- PODD (Pragmatically Organized Dynamic Display)
- “School to Home” board
- Eye gaze frames or boards
- PECS (Picture Exchange Communication System)

Just because a communication system is low tech does not mean that it has a low cognitive or linguistic load. Literate individuals who are AAC users may prefer a low tech alphabet or word board in addition to or instead of an SGD. In addition to the standard QWERTY configuration, low tech alphabet boards can be configured with either an alphabetic or frequency of occurrence configuration which may actually be easier for the student to find letters. Grammar based boards such as *Word Power OnBoard* include single letters and 100 of the most frequently used nouns, pronouns, verbs and adjectives in a color coded grammatical display.

Some examples (not an inclusive list) of symbol-based software include:

Boardmaker
Clicker®
GoTalk Overlay Software
Imagine Symbols (free download)
Overboard
PictureIt
Picture Master Board Designer
Tobii Symbol Mate

Simple Speech Generating Devices

Simple speech generating devices (SGDs) or voice output devices bring voice to a student’s communication system. They range from SGDs that speak a single message to devices with multiple cells or message options and those that play “looped” messages. All devices in this category use digitized or recorded speech and are usually quite simple to program or change messages. They are battery operated and have recording times from a few seconds per recording to total recording times of up to 5 minutes.

Most if not all simple SGD's can be used with a variety of symbol representations ranging from real objects to picture communication symbols and some can be used with visual scene displays. These are some of the most common characteristics of simple SGD's.

- One set of messages (represented on one overlay) are available to the student at a time.
- Pressing a key (or cell) produces one message (single word or short phrase).
- May have one, two, four, sixteen, forty, or more buttons with messages.
- Overlay must be physically changed, and device reprogrammed to change the messages.
- Devices are lightweight and portable.
- Most are accessed by a direct selection. A few have scanning capabilities.
- Some have switch ports so that they can be activated by a switch or can act as a switch to activate a battery operated device such as an adapted toy.

Patrick occasionally pointed to symbols on a communication binder display to communicate during snack, but often needed a prompt to do so. His team decided to try a speech generating device for a number of reasons. They wondered if Patrick's reluctance to use the snack symbols was because his requests might have been missed if the adult wasn't looking at him, the communication board didn't have the "power" that students with voice had and having a voice might be more motivating. They introduced a simple Cheap Talk 8[®] to Patrick during snack because it was easy to program, had up to 8 messages that were easy to access and visually defined and had the capability of recording single words or short phrases (37.5 seconds per message). At first they only programmed 4 messages ("I want...." drink & snack item, "uh oh" and "all done"). They were careful to use a boy's voice so that the device reflected Patrick's age and gender. The team used the device themselves to request snack items, make a comment when they "spilled" and were finished with snack as a model to Patrick and other students. The Cheap Talk 8 was placed close to Patrick, but he was not required to use it. When he gestured or otherwise indicated a desire for an item or to be finished, an adult would verbalize that request while pressing the appropriate message on the device. Other students liked to use the device to make snack requests even if they were verbal and were encouraged to do so. After a few weeks of daily snack, the adult paused waiting to see if Patrick would make a request using the Cheap Talk 8. With minimal prompts, Patrick started using the device on a regular basis. As Patrick's success built, other messages were added ("more", "sit here", "please", "good") and modeled by adults and peers. Patrick may soon be a candidate for a more advanced device.

Some examples (not an inclusive list) of simple speech generating devices include:

32 Message Communicator[®]
BIGmack[®] and LITTLEmack[™] Communicators
Cheap Talk[®]
HipTalk[®]
iTalk
MessageMate[™]
Step-by-Step[™] devices (Big and Little)
Tech Four[™]
VoicePal

Speech Generating Devices with Levels

As student's communication skills continue to develop, their communication opportunities need to grow with them. One way of providing more communication messages to students in different settings, activities or environments is to use a speech generating device with levels. Each level can be programmed with specific vocabulary for each activity. Overlays are created with both core and topic specific (fringe) vocabulary. Overlays are changed as the student changes activities. SGDs with levels can range from very simple to quite complex. They have many of the same features as simple SGDs, but are more powerful. They are battery operated, but some use rechargeable batteries or can be plugged into an electrical outlet. They also use digitized or recorded speech, but have a greatly increased memory (some with over an hour of recording time). Some of these devices also have the capability for both visual and auditory scanning. Many of the single level SGDs listed previously also have leveled versions. When considering the many different choices of SGDs with levels, remember to consider the student's abilities, the messages the student will need to communicate in different environments, overlay storage, student's ability to change overlays and the tasks the student needs to do. Common characteristics of SGDs with levels include:

- Capable of storing several layers of messages.
- Allows uses for multiple situations or environments, for example Level 1 can be programmed with messages appropriate for group or calendar time, Level 2 can hold messages for lunch, Level 3 could be vocabulary appropriate for social exchanges on the playground, Level 4 could be programmed to support content messages in the general education classroom, etc.
- Changing from level to level usually requires activating a button, sliding a switch, or otherwise indicating a new level and physically changing the picture overlay.

Some devices with levels have unique features that are worth mentioning. The SMART™ series from AMDI have interchangeable flash cards, which increases the memory capabilities of the device. Each flash card holds the memory for additional overlays. Commercially created sets of visual scene display overlays containing a flash card of professional voice recordings are available for purchase from AMDI. Each overlay is “recognized” by the device from a series of holes punched on the side of the overlay. When the matching flash card is installed, the device senses the hole pattern in each overlay as it is inserted.

One of the issues with leveled devices is the reliance on the communication partner to change overlays and levels when the student needs to communicate messages on a different level. The Bluebird II attempts to address that issue by attaching up to 10 overlays on the front of the device with common “binder rings”. The student flips to the desired overlays (colored tabs could be attached to make the pages more accessible) and presses the numbered button on the side keypad to select the level.

Other leveled devices with unique features are those with “window frames”/keyguards. The 7-Level Communication Builder has 7 levels and plastic window frames for 1, 2, 4, 8 or 16 messages. A student with emerging communication skills could start using the device with either the 1 or 2

message frame and move up to a frame with more messages as their skills advance. It also has the unique capability of using the 1 message frame for a visual scene display but programming more messages (8 or 16) on the display. The SuperTalker and L*E*O also have the capability to be programmed in different message formats and have similar window frames as the 7-Level Communication Builder. The L*E*O recognizes each overlay according to a bar code affixed to the back.

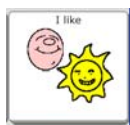
A few other examples (not an inclusive list) of SGD's with levels include:

AdVOCate
Boardmaker® Activity Pad
ChatBox
DigiCom 2000
FLASH™
Go Talk
Hummingbird
*L*E*O*
Macaw
Message Mate™
SuperHawk
Tech™ series

Speech Generating Devices with Icon Sequencing

In a category by themselves are speech generating devices that use icon sequencing as a language base for communication. SGD's from the Prentke Romich Company use semantic compaction, a language method that sequences a small number of multi-meaning icons to form words, phrases or sentences. Devices range from those that are designed for emerging communicators to word-based complex communication systems. Common characteristics of systems which use semantic compaction are:

- Icons have multiple meanings. Beginning communicators start with one meaning per icon, but more complex concepts and meanings are added to the icons as the student's linguistic competence increases. For instance the icon "elephant" may be associated with concepts of big, strong and gray.
- The core vocabulary does not change location which increases motor planning and automaticity for students with physical challenges.
- Language "rules" are built in and taught using icon sequencing and icon prediction that students use when learning new vocabulary.
- A small symbol set is used. Rather than adding new symbols, pages and navigation to the communication system, new concepts and meanings are added to the existing icons.
 - For example the yellow, smiley-faced sun icon is used for a beginning communicator for just the word "like" (everyone "likes" a nice sunny day!). Next the concepts of fun, yellow, and smile are added by combining the sun icon with other icons.



Unity® symbol

- Student may press two or three keys in sequence to produce a message.
 - Using the Unity language system, the student presses a button with a picture of a dog with a newspaper in its mouth followed by pushing a button with a picture of a question mark. The device speaks the message, “What’s new with you?”
- The student (and communication partner if supporting an early user) must be able to remember the message code sequences.

Some examples of devices that use icon sequencing are:

Vanguard™ Plus
Vantage™ series
ECO™-14
Chatbox® series
SpringBoard™ series

Speech Generating Devices using Dynamic Displays

Speech generating devices with a dynamic display have a screen that changes overlays depending on the student’s input either through direct or indirect (scanning) selection. The screens can show letters, words, phrases, symbols, photos, visual scene displays, small screens (pop-ups), even videos. Each time the student activates a message, there is potential for the screen to change. The screens can range from very simple displays to extremely complex ones depending on the student’s linguistic, cognitive, physical and visual abilities. A dynamic display device may start with displays for an emerging communicator and advance in complexity as the student’s abilities change. Some practitioners feel that dynamic display devices reduce the cognitive load for communicators because the user doesn’t have to remember symbol sequences and simply needs to recognize the message they wish to communicate. However there are features of dynamic displays that can challenge some students. Because the screen can potentially change with every “hit”, some students “get lost” trying to navigate to a message. It can be difficult for a student without literacy skills to convey a novel message. Motor planning is difficult for students with physical challenges because the symbols can change location depending on the screen. As with any speech generating device, each has features that may support one student while challenging another.

SGDs with dynamic displays can range in size and weight from very small hand-held PDA based communicators to those that are large and heavy that need to be secured to a wheel-chair mount. Many SGDs with dynamic displays have capabilities in addition to communication. Some have built in environmental controls so that the student can not only voice their request to change the channel on the TV, but also do it through their device! Some devices have a built in keyboard with word prediction capabilities. Others can be used for writing and sending emails, text messages or talking on the telephone. Many devices have advanced accessibility features including scanning capabilities with single or multiple switches, auditory scanning, head mouse access or eye gaze access. Some students with visual or attentional difficulties could benefit from

Chapter 3 – Assistive Technology for Communication

the “zoom” feature included on many SGDs and communication software in which the selected or scanned symbol enlarges on the screen to give it more prominence.

SGDs with dynamic displays may use digitized recordings, synthetic voices or both. Those that have both types of voices have the most flexibility for the student’s personalized voice. They can use a high quality synthetic voice for most messages or to speak any text the student has written. But when the student wants to sound like their peers (use slang, tell a joke, greet their peers) a digitized recording of a same age and gender peer can be used. Some dynamic display devices utilize only digitized recordings that are limited to pre-loaded or customized messages. A student would not be able to “write” a word or message and have the device speak it.

These are some of the common characteristics of dynamic display speech generating devices:

- Pictures, words or symbols are represented on a screen, which is capable of touch or switch activation. Activating a picture on the screen produces a message or advances to a new screen or window.
- The device automatically changes the picture displays and corresponding messages.
 - For example, to ask for a cheeseburger at McDonald’s...
 - the student selects the symbol for food from the main page
 - the device automatically changes to a new page of food symbols, which includes one representing fast food
 - the student selects the fast food symbol
 - the device produces a page with symbols representing several fast food restaurants
 - the student presses the symbol for McDonald’s
 - the device changes to a page that includes items on the McDonald’s menu
 - the student selects the symbol of the cheeseburger
 - It should be noted that if a student ALWAYS orders the same thing from the menu, a quicker link could be programmed which would require fewer page sets and activations
- May require significant programming to personalize.
- One icon or “hit” can be programmed to produce a single word, a phrase or a long message such as a pre-stored speech or class presentation.
- Students need to navigate to different pages to communicate about different topics.

Another option for teams who are considering a trial or assessment with a speech generating device with a dynamic display is installing software with those features on a computer. This software can be installed on desktop, laptop or tablet computers. Many teams use AAC software on a computer as a way to emulate a dedicated device. The software programs have the same capabilities such as scanning capabilities, linking to new pages or programs, student specific settings for number of display items, visual settings, etc. Computer systems can have touch-screens built into the monitor or added on as hardware. Tablet computers can have a touch-screen that rotates and lays flat on the keyboard, emulating an SGD.

A few examples (not an inclusive list) of speech generating software with dynamic displays include:

Boardmaker Plus
Boardmaker with Speaking Dynamically Pro®
Dynavox System Software
Gus! Multimedia Speech System
PTP-PC (Point to Pictures-PC)
Say-it! SAM
SpeechPRO
Talking Overboard
Talking Screen
Tobii Communicator

Some dynamic display devices (not an inclusive list) include:

Conversa™
Dynavox devices
Freedom LITE™
Optimist series
Say-it! SAM series
TANGO!
Tellus series
TuffTalker
Tobii C series

Some dynamic display devices with icon prediction:

ECO™-14
Springboard series
Vanguard
Vantage

Some Palm or handheld computer based dynamic display devices:

ChatPC series
Cyrano
Palmtop series
MV-1000
Say-it! SAM Communicator
Tellus Smart

Some dynamic display devices use eye-gaze technology for access

Tobii CEye
ERICA
Eye Max
Eye Tech TM series

Text based device with Speech Synthesis

Students who have good keyboarding and literacy skills can consider a text based speech generating device. These devices have a text window with either a membrane or physical keyboard. Text-to-speech devices allow the student to input virtually any message which the built in speech synthesizer will speak. Most of these devices have features to increase the user's keyboarding speed such as word prediction and pre-stored messages which can be retrieved by using a keyboard combination or abbreviation. Some are designed with telephone or internet features. While all of the devices are designed to speak back the text, some devices such as the Allora can also record and play back digital messages. The Allora can record a natural sounding voice to greet others, gain attention, play back MP3 files and more. Access considerations including scanning capabilities and keyguards are built into many of the devices. All of the text based devices have a text window so that the student can see the message typed. The LightWRITER™ is distinct in offering dual LCD windows so that the communication partner can also see the text window even if they are facing the student. The communication partner interacting with a text-based AAC user might support the student by using rate enhancement strategies such as predicting the user's message. That should only occur after the partner has asked the student for permission to predict messages and should always be followed up by confirming with the student that the partner's prediction is correct.

It should be noted that many of the devices using a dynamic display mentioned earlier also have text-to-speech capabilities using an on-screen keyboard.

These are some of the characteristics of text based speech generating devices using a speech synthesizer

- Anything the student types can be spoken by the device
- Requires good literacy skills including grammar, spelling and punctuation
- Most have rate enhancement capabilities such as abbreviation expansion, pre-stored messages and word &/or phrase prediction.

Some devices (not an inclusive list) that use a speech synthesizer for text-to-speech include:

Allora

DynaWrite

Dubby

Freedom Toughbook™ and Extreme™

LightWRITER

TalkingAid Wireless

Polyana and PolyTABLET

Another option for students who have the capability to key in words and phrases for communication is a portable word processor with text-to-speech capabilities. These devices are not manufactured as augmentative communication devices, yet have been successfully used with some students who don't need a dedicated device. Many have the capability of either holding pre-stored messages or having a document saved with frequently used messages for quick access. Some students won't need the text-to-speech capabilities and would be comfortable inputting or showing pre-stored text in the device to a communication partner.

Chapter 3 – Assistive Technology for Communication

Some of these alternative options include:

SmartSpeaker™ (an “add-on” speech synthesizer for AlphaSmart or Neo)
NEO2 with Text2Speech
The Fusion
Franklin Talking Dictionaries
Handheld PDAs

Innovative AAC

As general technology evolves and is made more accessible, there are those who push technology beyond its intended use. That holds true for innovative applications for AAC. “Smartphones” including the iPhone have been modeled as alternative communication options. Pre-stored messages and pictures can be activated for communication or for repair when there is a communication breakdown. Those wishing to see an iPhone being used as an AAC device can view this short movie at <http://homepage.mac.com/billziegler/iMovieTheater26.html>. Proloquo2Go™ is a new technology was designed for the iPhone/iPod touch. Features will include text, pictures and symbols.

Alexicom Tech is a web based AAC system using photos, downloaded symbols and synthesized speech. This system can be accessed any place where the internet is available and can be used on any device that is internet compatible (computer, cell phone, tablet, smartphone, etc.). For more information go to <alexicomtech.com>

Other innovative applications include (Speaking Pad) can be loaded onto T-Mobile phones that provide text-to-speech, short text messages (SMS) can be sent to other’s cell phones using a standard e-mail account, Skype™ users can type a message to an individual or group to communicate. More about these applications and more can be found at http://accessibilityportal.org/augcom_ideas.htm.

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the communication tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional staff training.

Matching Systems to the Student

Whenever selecting a communication system for a student, one must always consider its “features” in order to “match” them as much as possible to the skills/abilities of the student.

Device features may include:

- **Access-** scanning capabilities or direct selection sensitivity/pressure needed to activate the system, size of targets, spacing between targets, ease of changing overlays
- **Physical-** weight, size of the system/device, portability and mounting
- **Visual-** glare, symbol size, background color
- **Other-** compatibility/capability to interface with other technology (e.g., computers, printers, environmental controls), customer support, ease of programming and back-up, flexibility of grid set-ups, durability

There are resources that make this process easier. Many vendors provide matrices listing the features of their devices. When researching devices, visit vendor websites and/or use internet searches for comparison charts.

SET-BC (Special Education Technology-British Columbia) is a wonderful resource for AAC information, implementation. It has two grids comparing features of low tech and high tech communication devices.

http://www.setbc.org/Download/LearningCentre/Communication/AAC_Feature_Grid_HighTech_2008.pdf

http://www.setbc.org/Download/LearningCentre/Communication/AAC_Feature_Grid_LowTech_2008.pdf

AAC Tech Connect is a web site which provides pictures of speech generating devices according to category (e.g., dynamic display, simple digitized, text-to-speech, etc.). It also includes contact information for major AAC device manufacturers and their product information and brochures. Their *Device Assistant* provides a free trial for searching for AAC devices based on features with a side-by-side comparison.

Another resource is this set of protocols

http://www.mydynamicttherapy.com/tools_for_professionals.htm It correlates with the Medicare requirements for a Speech-Generating Device evaluation and is aligned with the four basic AAC competencies (linguistic, strategic, operational and social) that are identified by AAC-RERC as necessary for an individual to independently use an AAC device.

Operational Competence (operating the communication system):

Chapter 3 – Assistive Technology for Communication

- Activating device (turning on/off), speed, accuracy
- Navigating to words and phrases
- Asking for assistance when needed

Linguistic Competence (language):

- Uses a range of communication functions
- Uses different overlays for different activities/settings
- Combines words/phrases to create messages

Social Competence

- Demonstrates turn-taking
- Maintains and expands a topic
- Attends to speaker
- Uses social language

Strategic Competence

- Repairs communication breakdowns with a variety of strategies
- Uses different vocabulary with different audiences
- Uses strategies to add something new to the conversation

5. ASSESSMENT OF SPECIFIC EQUIPMENT AND TECHNIQUES- copy additional forms as needed

Fill in details, check items patient can accomplish, mark N/A for features not available on this device, and X for features not useable by this patient

DEVICE/SOFTWARE:

Length of Trial:
☐ Considered but rejected without trial due to:
☐ inability to meet required features ☐ lack of symbols to represent language
☐ lack of voice output ☐ limited ability to meet communication needs in the near future
☐ weight or size limiting portability ☐ small size not meeting physical or visual needs
☐ other: _____
☐ Trial during evaluation session ☐ Longer trial (> 1 week)
 Additional Information:

Techniques To Elicit Communication:

☐ discussion ☐ response to questions ☐ role play ☐ functional activity (play, look at magazine)
☐ other: (describe) _____

Access Methods:

☐ direct selection, with ☐ touch enter delay, with ☐ touch exit delay
☐ keypad: number of locations = ☐ 6 ☐ 8 ☐ 12 ☐ 15 ☐ 20 ☐ 30 ☐ 40 ☐ 60 ☐ 100 ☐ 150
☐ partner assisted scanning ☐ scanning ☐ joystick ☐ mouse/mouse alternative
☐ other: _____

Describe settings, scanning pattern, etc.:

RESULTS OF TRIAL

Range of Motion: Sufficient on ☐ Left ☐ Right ☐ Both Size of Display: ☐ 16x12 ☐ 9x7 ☐ 5x3
 Size of Symbols: ☐ Keyboard ☐ 1" ☐ 2" ☐ >3"
 Navigation: ☐ single page, no navigation ☐ can navigate pages – list pages: _____
 Navigation Support: ☐ independent ☐ verbal prompts ☐ taught in context ☐ repetition ☐ hand over hand
☐ visual cue-button shape, highlight ☐ taught in context ☐ partner assisted navigation
 Type of Symbol: ☐ Object ☐ Photograph ☐ Symbol ☐ Word ☐ Spelling
 Page Format: ☐ Grid ☐ Free Form ☐ Scene
 Number of Symbols on Page: ☐ 2-4 ☐ 8 ☐ 12 ☐ 20 ☐ 40 ☐ 60 ☐ >60
 Message Unit: ☐ Sentence ☐ Phrase ☐ Word ☐ Letter
 Mean Length of Utterance: ☐ 1 word ☐ 2 words ☐ 3-5 words using carrier phrases only ☐ >3 words independently combined
 Ex: I want...I see...I go...I like...
☐ on single page ☐ on single page
☐ with navigation to other pages to complete sentence ☐ with navigation to other pages to complete sentence
 Functions: ☐ request ☐ respond ☐ comment ☐ share information ☐ reject
 Vocabulary Expansion: ☐ Multiple levels ☐ Dynamic Display ☐ Encoding
 Editing Functions: ☐ close popup ☐ delete ☐ clear message
 Rate: ☐ Word prediction ☐ Abbreviation expansion ☐ Pre-stored messages
 Conclusion:
☐ Most appropriate device at this time ☐ Meets some needs, but will continue looking

Retrieved from <http://www.mydynamictherapy.com/SGD%20eval%20Step%20III%20IV.pdf>
 on November 4, 2008.

Related Assessments

In addition to standard language assessments, teams may also need to use specialized assessments to determine a student's ability to access sites on a device, understand a symbol or even how to interpret their movements as intentional communication. Much of this information is going to be gained through informal observations, interviews and trials. However there are some specialized assessments and software programs that may provide specific information needed to justify funding of a device or even to help narrow down which device is a better match for the student.

Software programs are available to help determine if the student can use direct selection and if so, what size area he might be able to activate accurately. *Compass®* and *Evaluware™* are designed to provide assessment activities for computer access which may also include AAC access. They help determine the best settings and preferences for the student based on motor/access such as range of motion, the size of button that a student can activate, the volume setting needed, switch use, and more. Both programs provide detailed reports at the completion of the assessment.

Stages assessment software is a seven-level developmental framework that assists teams in determining a learner's cognitive and language abilities. The seven Stages are developmental in

nature and are not age or grade specific. The first Stage is Cause-Effect and continues to proceed as a student's cognitive and linguistic abilities advance to language readiness, emerging language, early concepts, advanced concepts and communication, functional learning and written expression. It should be noted that Stages is not an assessment for augmentative communication, but rather an accessible instrument (single switch accessible) that assesses cognition and language skills.

If the team is not certain which symbol system is appropriate for a student, they might want to consider using the TASP (Test of Aided-Communication Symbol Performance). Subtests offer assessment of a student's knowledge of symbols including photos compared with Picture Communication Symbols, size as well as number of symbols and higher level skills such as categorization and grammatical encoding.

When students have profound or multiple sensory disabilities, it can be difficult to assess and implement an appropriate communication system. *Every Move Counts, Clicks and Chats* helps teams understand the communicative intent of a student's motor patterns. Assessment, data collection and implementation strategies are part of the program.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial equipment and materials, team member(s) responsibilities, start date, length of trial, training needed and any other student/staff specific issues. Be certain to identify communication objectives and criteria of performance to determine the effectiveness of the trials.

Data Collection

The importance of data collection cannot be over-stressed. How do you know whether a communication device was successful or not unless the team collects data during the trial(s). Decide the criteria for success to determine if the device meets the student's communication needs (i.e., the student initiates requests for desired item(s), the student makes social comments to peers during lunch, the student independently navigates to a new page set, the student answers "scripted questions", the student combines 2 symbols, the student uses simple repair strategies, etc.). The team can create their own data collection sheet or use others such as those shown below.

Chapter 3 – Assistive Technology for Communication

Student		Device		Number of messages on overlay	Number of Overlays used	
Date/Time	Observer	Environment	Activity	Vocabulary/overlay(s) used	Prompts/Cues	Notes

Prompts key: (EC) Environmental Cue, (O?) Open Question, (PP) Partial Prompt, (FP) Full Prompt
Cues Key: (Pz) Pause, (VM) Verbal Model, (ALS) Aided Language Stimulation, (DF) Descriptive Feedback

Attach copy of overlay. If helpful, indicate number of times student accessed each message.

List communication objectives for AAC device trial(s):

Device	Date: From-To	Communication Objectives:	Successful? Y/N	Why/Why not

Observational Notes:

Created by Judi Cumley, 10-08

SET-BC uses the four communication competencies (operational, linguistic, social and strategic) in their SET-BC AAC Curriculum Rubric http://setbc.org/setbc/communication/aac_curriculum_outline.html which includes rating scales and levels that track a student starting at a basic initiation and response level to communicating for learning, independence and employment. The rubric may assist a team in identifying the next level of competence a student needs to achieve.

Record of Achievement:
Unit 1: Initiating and Responding

Student name:

Date:

Source of information

O = observed

R = reported

SE = student self-evaluation

Learning outcome	Not yet meets	Minimally meets	Fully meets	Exceeds	Comments
LINGUISTIC COMPETENCIES: It is expected that the student will:					
• communicate information about preferences and interests using patterned phrases (e.g. I want..., I like..., I am...)					
• communicate requests for school or personal objects (e.g. I need my walker. I need a drink).					
• ask and answer basic questions, largely based on memorized/ pre-stored repertoire. (e.g. My name is Sarah. What is your name? I went to the movies. What did you do on the weekend?)					

May 2008

www.setbc.org/lcindexer/

Retrieved on October 30, 2008 from http://setbc.org/setbc/communication/aac_curriculum_outline.html

A resource developed by Dynavox technologies is their “Implementation Toolkit”. The Toolkit has resources for AAC users and professionals, videos, AAC frameworks, observational guides and other tools that can even be helpful for teams supporting students using devices other than Dynavox products.



**Navigation to a Particular Activity/Category
Datasheet and Teaching Hints**

Goal: (Name) will accurately navigate to (activity-based/category-based) vocabulary (criterion) in (activity).

Date	Level of Independence (circle appropriate cue)					
	Self-initiated	Natural cue	Indirect –	Pointer/Search Light	Verbal	Visual-Gestural
	Direct Verbal	Direct Pointer/Light	Physical Assistance			
	Self-initiated	Natural cue	Indirect –	Pointer/Search Light	Verbal	Visual-Gestural
	Direct Verbal	Direct Pointer/Light	Physical Assistance			
	Self-initiated	Natural cue	Indirect –	Pointer/Search Light	Verbal	Visual-Gestural
	Direct Verbal	Direct Pointer/Light	Physical Assistance			

Chapter 3 – Assistive Technology for Communication



Retrieved from Dynavox Implementation Toolkit on February 18, 2009
<http://www.dynavoxtech.com/training/toolkit/>

Training of Communication Partners

Training of communication partners in all environments (e.g. home, school, and community) is a vital step towards successful implementation of a student's communication system. Training of staff and family may include these or other skills:

- knowledge of vocabulary and its location in the system
- using a prompt hierarchy
- learning how to use and program the student's communication system
- facilitator strategies (modeling, expansion, pausing)
- competence in problem solving and completing minor repairs or contacting technical support for the device
- other student/device specific skills

Kent-Walsh and McNaughton (2005) propose an eight step instructional model for training communication partners based on a review of previous models of instruction. In summary, those steps are

1. Pretest partner's spontaneous use of communication strategies in the natural environment. Partners commit to participating in the instructional program.
2. Instructor describes the targeted strategy and provides a method for remembering the steps involved in implementing the strategy. Instructors discuss the impact of implementing the strategy with the AAC user.
3. Instructors model the targeted strategy with verbal explanations of all the steps performed.
4. Communication partners practice naming and describing all of the steps required to implement the strategy.
5. Communication partners practice implementing the strategy in a controlled environment, receiving feedback from the instructors.
6. Communication partners practice implementing the strategy in multiple situations in the natural environment. Receive reduced prompting and feedback.
7. Instructors review and document communication partner's mastery of the targeted strategy. Instructors elicit feedback on the impact of the partner's implementation of the strategy from the AAC user or their caregivers. Instructors assist communication partners in generating a maintenance plan for generalization of the strategy.
8. Communication partners practice implementing the targeted strategy across multiple environments and plan for long-term implementation.

Students can learn to "train" unfamiliar partners with messages such as "Please be patient, I use this device for communication", "If you think you know what I am going to say, you can guess" or "Please let me finish my message" each dependent on the student's communication competencies.

Funding

After the student has completed a successful trial with a specific SGD, the question of funding the device becomes an important issue. The law is clear that if assistive technology, including an AAC device is needed to accomplish the goals and objectives listed in the student's IEP, then it must be provided.

Chapter 3 – Assistive Technology for Communication

However, IDEA does not prevent school districts from seeking funding from other sources to fund a portion of the devices they may find necessary to procure for students with disabilities. It requires the school district to “provide” the assistive technology. In providing it, the school district may borrow it, rent it, or seek an outside or “third party” funding source. When seeking funding for a student’s personal SGD, the family and school team need to consider factors such as ownership, use during vacations and holidays and what happens to the device if the student moves out of district or graduates. All of those factors need to be considered when making funding decisions.

If the family agrees that the school can submit the request for funding a device to either the family’s private insurance or through the student’s Medicaid, most states have information about the funding process for “durable medical equipment”, the category under which speech generating devices fall. All of the major vendors and suppliers of SGDs have “funding” departments to assist the team in navigating “third party” funding procedures. Their staff can assist the team in writing the report, reporting data from the trial, going through the steps of the funding process, etc. Other resources of information on AAC funding include websites such as AAC funding help, AAC Institute, AAC-RERC all of which are listed on the Internet Resources page found at the end of the chapter.

As you and the student’s team venture on this remarkable journey to provide a communication system for the students you serve, remember that the device is not the goal, COMMUNICATION is!

Other Assistive Technology for Communication Disorders

Personal Voice Amplification Devices

Personal voice amplification systems are generally used for adults, especially educators because of the tendency of teachers to abuse their vocal chords with overuse. However, there are some students who are verbal, but have limited intelligibility. If speech is fatiguing, requires frequent repetition and/or excessive listener proximity because of low volume, those students may benefit from a portable personal voice amplification system. Personal voice amplification systems can be wired or wireless and consist of a small transmitter, a high quality microphone and a receiver/amplifier. The user wears the amplifier/speaker in a “fanny pack” and plugs in the microphone. Headset microphones are typically better because of their proximal location to the mouth and stability on the user’s head. Other microphones that can be considered depending on the student include a collar microphone, worn on the student’s shirt close to their mouth or pencil microphone, hand held by the mouth.

The Speech Enhancer SGD amplifies an individual’s speech, but also claims to clarify their speech. The device blends the speaker’s voice characteristics with synthesized components to reportedly create a clearer voice that sounds much like the speakers, but with more clarity. The system, a microphone, synthesizer and speaker is worn by the user. Research into the effectiveness of the device is limited and none to date has included school aged speakers. Bain, Ferguson and Mathisen (2005) reports inconclusive evidence as to the effectiveness of increasing intelligibility among adults with a variety of disorders (cerebral palsy, laryngectomy, vocal nodules, traumatic brain injury, Parkinson disease, multiple sclerosis) when judged by familiar and unfamiliar partners.

Some personal voice amplification systems (not an inclusive list)

Califone Voice Saver

Chattervox®

The Speech Enhancer SGD

Voicette

This section on stuttering was contributed by Charlie Osborne, M.A., CCC-SLP, University of Wisconsin-Stevens Point.

Assistive Technology for Stuttering

Historically, delayed auditory feedback devices have been shown to decrease the frequency and severity of stuttering in some individuals who stutter and have been used as adjuncts to therapy. The rate of speech of person who stutters tends to be slower and sounds and syllables prolonged when speaking under delayed auditory feedback (Silverman, 2004). Contemporary assistive devices may delay auditory feedback (DAF) and/or alter the frequency of the feedback (FAF) of a person’s speech. Use of DAF and FAF can often result in an immediate reduction in the frequency and severity of stuttering. There are anecdotal reports that DAF and FAF have been useful adjuncts to stuttering therapy with some adults who stutter. Unfortunately, at the present time there is limited evidence regarding the long term effectiveness of DAF and FAF with adults who stutter and almost no evidence regarding effectiveness of DAF and FAF with children who stutter. One researcher (Guitar, 2006) reported that he only dispensed devices to children over 11 years of age, believing that younger children could be better served through therapy.

Chapter 3 – Assistive Technology for Communication

There are currently several assistive devices available commercially for individuals who stutter, with prices ranging from \$1500.00 to \$5,000.00. The Stuttering Foundation lists some devices but does not endorse the use of any of them

(<http://www.stuttersfa.org/Default.aspx?tabid=88>). These devices are typically worn in one ear, much like a hearing aid. They can be worn behind the ear or, with the more expensive models, entirely in the ear canal.

In summary, use of a DAF and/or FAF device may reduce stuttering and it's severity when used as an adjunct to therapy. If considering the purchase of an assistive device for reducing stuttering, it is recommended that the child and family be counseled regarding the lack of available evidence regarding long term effects and to the fact that there remains no known cure for stuttering.

Communication board from page 5 of this chapter with text labels.



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Product	Vendor
7-Level Communication Builder	Enabling Devices
32 Message Communicator [©]	Enabling Devices
AdVOCate	Dynavox
Accessible Literacy Learning (ALL)	Dynavox
Allora	Technology and Integration
BIGmack [®]	AbleNet, Inc.
Bluebird II	Saltillo
Boardmaker [®]	Mayer-Johnson
Boardmaker [®] Activity Pad	Mayer-Johnson
Boardmaker [®] Plus	Mayer-Johnson
Boardmaker [®] with Speaking Dynamically Pro [®]	Mayer-Johnson
Califone Voice Saver	Califone
ChatBox	Saltillo
ChatPC series	Saltillo
Chattervox [®]	Asyst Communications Company
Cheap Talk 8 [©]	Enabling Devices
Clicker [®]	Crick Software
Compass Software	Koester Performance Research
Conversa [™]	Words Plus
Cyrano	Cyrano Communicator
Device Assistant	AAC TechConnect
DigiCom 2000	The Great Talking Box Company
Dubby	Zygo Industries, Inc.
DynaSyms [®]	DynaVox Systems, LLC
Dynavox series	DynaVox Systems, LLC
DynaWrite	DynaVox Systems, LLC
ECO [™] -14	Prentke Romich Company
ERICA	Eye Response Technologies
Evaluware [™]	Assistive Technology, Inc.
Every Move Counts, Clicks and Chats	Every Move Counts
Eye Max	DynaVox Systems, LLC
Eye Tech TM series	EnableMart
FL4SH [™]	AbleNet, Inc.
Franklin Talking Dictionaries	Franklin Electronic Publishers
Freedom Extreme [™]	Words Plus
Freedom LITE [™]	Words Plus
Freedom Toughbook [™]	Words Plus
The Fusion	The Writer Learning Systems
Go Talk	Attainment
GoTalk Overlay Software	Attainment
Gus! Multimedia Speech System	Gus Communication Devices, Inc.

Product	Vendor
Hip Talk [®]	Enabling Devices
Hummingbird	Saltillo
iTalk	AbleNet
Imagine Symbols [®]	Imagine Symbols
L*E*O	Tobii ATI
LightWRITER [™] series	Toby Churchill Company
LITTLEmack [™]	AbleNet, Inc.
Logan [™] Proxtalker [™]	Proxtalker
Macaw	Zygo Industries, Inc.
MessageMate	Words-Plus
Minspeak [®]	Semantic Compaction Systems
MV-1000	Digital Voice Technologies
NEO2 with Text2Speech	Renaissance Learning
Optimist series	Zygo Industries, Inc.
Overboard	Gus Communication Devices, Inc.
Palmtop series	DynaVox Systems, LLC
Peabody Picture Vocabulary Test (PPVT [™])	Pearson Assessment
Picture Communication Symbols (PCS [™])	Mayer-Johnson
Picture It [©]	Slater Software
Picture Master Board Designer	Academic Communication Associates
PixAide [™]	Slater Software
Polyana and PolyTABLET	Zygo Industries, Inc.
Proloquo2Go [™]	AssistiveWare
PTP-PC (Point to Pictures-PC)	R. J. Cooper
Say-it! SAM	Words-Plus
Say-it! SAM Communicator	Words-Plus
Social Networks DVD	Attainment Company
Social Networks: A Communication Inventory for Individuals with Complex Communication Needs and their Communication Partners	Attainment Company
SmartSpeaker [™]	Afforda Speech
The Speech Enhancer SGD	Voicewave Technology
SpeechPRO	Gus Communication Devices, Inc.
SpringBoard [™]	Pentke Romich Company
Stages	IntelliTools [®]
Step-by-Step Communicators [™]	AbleNet, Inc.
SuperHawk	Adamlab, LLC.
SuperTalker	AbleNet, Inc.
SymbolStix [®]	Tobii ATI
TalkingAid Wireless	Zygo Industries, Inc.

Product	Vendor
Talking Overboard	Gus Communication Devices, Inc.
Talking Screen	Words-Plus
TANGO!	Blink-Twice
Tango to Literacy	Blink-Twice
TASP (Test of Aided-Communication Symbol Performance)	Mayer-Johnson
Tech™ series	AMDI
Tellus series	Technology and Integration
Tobii CEye	Tobii ATI
Tobii C series	Tobii ATI
Tobii Communicator	Tobii ATI
Tobii SymbolMate	Tobii ATI
TuffTalker	Words-Plus
Vanguard™	Prentke Romich Company
Vantage™	Prentke Romich Company
VoicePal	Adaptivation
Voicette	Luminaud
Word Power OnBoard	Augmentative Communication Consultants, Inc.

Internet Resources/Links

AAC Funding Help

Attorney Lewis Golinker is primarily responsible for the site's content which includes SGD funding fast facts, SGD funding programs, AAC report coach and general resources.

http://aacfundinghelp.com/funding_programs.html

AAC Institute.org

A “not-for-profit, charitable organization dedicated to the most effective communication for people who rely on augmentative and alternative communication (AAC)”. Resources include funding, consumer and parent pages, information for “beginners”, research and more.

<http://www.aacinstitute.org>

AAC-RERC

The AAC-RERC is a collaborative research group dedicated to the development of effective AAC technology. Journal articles, book chapters, other publications and presentations are all available for download.

<http://www.aac-rerc.com/>

AAC Tech Connect is a web site which provides pictures of speech generating devices according to category and lists product and contact information for major AAC device manufacturers. Their *Device Assistant* is a tool the helps a team compare and match the features of devices to student skills. It is available on a limited trial basis or by subscription.

<http://www.aacTechConnect.com>

accessibility portal.orgSM

A source of low/no-cost, mainstream strategies and applications for accommodating the communication needs of individuals with speech disabilities.

http://accessibilityportal.org/augcom_ideas.htm

Adapted Learning.com

This free resource is a place to find and share adapted curriculum created with Boardmaker® Software. It also provides online community functions as well as feature articles and expert tips. It was developed to provide better symbol-enhanced learning tools and make it easier for special educators and parents to adapt curriculum.

<http://www.adaptedlearning.com/>

ASHA – Division 12, augmentative and alternative communication

The specific division of ASHA (American Speech-Language-Hearing Association) that promotes continuing education about AAC for professionals and pre-service individuals. Non ASHA members can access many of the resources.

http://www.asha.org/about/membership-certification/divs/div_12.htm

Askability

A UK site full of stories, jokes and news (from the UK) written all in pcs. The jokes and riddles link is universal.

<http://www.askability.org.uk/>

Baltimore City Public Schools adapted library

On this website you will find books that have been adapted using the Picture Communication Symbols (PCS) and the Mayer-Johnson program BoardMaker©.

http://www.bcps.k12.md.us/boardmaker/adapted_library.asp

CHIP Speaking™

CHIP Speaking™ is a desktop augmentative communication device that supports up to 99 messages. Students can record in their own voice (or care-givers can record the voice of someone else of the same gender and age) or take advantage of computerized voices.

<http://www.oatsoft.org/Software/chip-speaking>

Imagine Symbols®

Imagine Symbols® is a free symbol set (for non-commercial use) which can be downloaded.

<http://www.imaginesymbols.com/>

Implementation Toolkit

The Implementation Toolkit is collection of video and print-based resources created to help you facilitate successful interaction using AAC from Dynavox Technologies. Registration for the toolkit is free.

<http://www.dynavoxtech.com/training/toolkit/default.aspx>

ISAAC

International Society for Augmentative and Alternative Communication. Most of the resources are for purchase or for members. However they do have an extensive listing of AAC related websites.

<http://isaac-online.org/en/home.shtml>

Linda Burkhart

A good resource of simplified technology and strategies for working with children with severe disabilities, including resources about PODD books, 2 switch step scanning, partner assisted scanning and more.

<http://www.lburkhart.com>

Literacy Support Pictures™

These symbols are freely downloadable courtesy of Slater Software.

<http://www.slatersoftware.com/PixLibrary.html>

Meyer-Johnson

Developer of Boardmaker. Go to *downloads*, *sharing* or *tips* for ideas, pre-made communication boards, “Activity of the month” and more.

<http://www.mayer-johnson.com/>

PixAide™

A free symbol set for Mac OS 10.4 computer system of over 3,000 rebus symbols matched to over 10,000 words.

<http://slatersoftware.com/PixAideInfo.html>

Project Participate

A website filled with forms, ideas and strategies to promote student participation and success in school.

<http://www.projectparticipate.org/>

pVoice

pVoice is an application for Augmentative and Alternative Communication (AAC). Disabled people who cannot speak and have very little possibilities to operate a computer can use pVoice by selecting photo's or symbols to generate speech output.

<http://www.oatsoft.org/Software/pvoice>

Sclera's Pictos

A resource of 1041 free symbols (pictograms).

<http://www.oatsoft.org/Software/sclera-s-pictos>

SET-BC (Special Education Technology-British Columbia) is a wonderful resource for AAC information, professional development, implementation ideas and strategies.

<http://www.setbc.org/lcindexer/default.aspx>

Speaking of Speech

An interactive forum for speech/language pathologists and teachers to improve communication skills in students by sharing ideas, resources, materials and more. Be certain to look at the materials exchange page.

<http://www.speakingofspeech.com/>

Straight Street Symbol Set

Free symbol set (.wmf format images)

<http://www.oatsoft.org/Software/straight-street-symbol-set>

The Stuttering Foundation

The Stuttering Foundation, a nonprofit charitable organization, provides free online resources, services and support to those who stutter and their families, as well as support for research into the causes of stuttering.

<http://www.stuttersfa.org/Default.aspx?tabid=4>

Trainland Tripod

This site was created by a parent of a child with autism. She has information about PECS, nonverbal communication, AAC intervention, communication boards, schedules and symbols and other links.

<http://trainland.tripod.com/pecs.htm>

University of Washington at Seattle Augmentative Communication website is a good resource for AAC definitions and descriptions, resources, references and valuable information, <http://depts.washington.edu/augcomm/index.htm>

USSAAC

United States Society for Augmentative and Alternative Communication is a national branch of ISAAC (International Society for Augmentative and Alternative Communication). It is dedicated to providing information and support on AAC issues, technology, tools and advancements. There are many resources on the site available to the general public.

<http://www.ussaac.org/>

Verbalize

Verbalize is a download Macintosh for OS X.4 operating systems. Basically, you type, press enter and it speaks. Command-S saves the message into an audio file. It could potentially turn an older Mac laptop into a communication tool for someone who types.

http://www.apple.com/downloads/macosx/productivity_tools/verbalize.html

YAACK (Augmentative and Alternative Communication Connecting to Young Kids)

The website from University of Nebraska-Lincoln is a resource for individuals who are providing AAC to young children. It includes information such as “When does a young child need AAC?”, Choosing AAC systems, AAC Resources and much more.

<http://aac.unl.edu/yaack/>

Chapter 4 – Assistive Technology for Access to Computers

Introduction.....	1
SETT Process	3
Computer Access Continuum	6
Computer Access Continuum Expanded.....	7
Product Resources	22

Access to Computers for Students with Physical Disabilities

Patti Lindstrom Drescher, M. Ed, OTR, ATP

A student with a physical disability often cannot manipulate traditional classroom tools like pencils, markers, books, and paper. Access to computer-based tools may also be difficult. Fortunately, there are many hardware and software products that assist students with challenges to use computers at school and at home. These tools support individuals with physical disabilities, learning disabilities, and sensory challenges. This chapter will not address in detail computer access for students who are blind or have low vision. Please refer to Chapter 12 on Assistive Technology for Students who are Blind or have Low Vision for more information.

Computers have become an integral tool in all of our lives, making things easier, faster, and more convenient. If we didn't have our computers, we might be inconvenienced, but we would have alternatives. We'd go back to handwriting or typing, using the library, phonebook, maps, writing letters and talking on the phone, etc. But for a student with a disability, the ability to access a computer may be their only way to learn new skills, participate in classroom activities, demonstrate their knowledge, and interact with other people. Use of the computer is essential for students with disabilities, and finding a reliable access method is the key to opening many doors for learning and developing.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Access to the Computer

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to computer access? • Review Student Information Guide- Chapter 1, page 28 • Current computer access method(s) • Motor skills/ROM • Vision • Fatigue/strength • Attention • Behavior • Cognition • Computer skills • Other challenges/concerns?	What environmental considerations impact the student's use of the computer? • Number of classrooms • Ratio of students to adults • Workstation/desk • Computer operating system • Software available • Power source • Sound • Lighting • Teacher expectation • Other challenges/concerns	What computer task(s) do you want the student to do? • Access educational/special software • Complete written work (reports, worksheets) • Navigate the Internet • Take tests • Math tasks • Take notes
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts computer use? (i.e., visual, auditory, tactile)		Specific computer task(s) identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Refer to Computer Access Continuum Brainstorming Only No Decision	Use a Feature Match Process to Discuss & Select Idea(s) from Solution Generation	AT Trials/Services Needed: • Date • Length • Training • Data collection • Person(s) Responsible
		Follow-Up Plan Who & When Set specific date

Important: It is intended that you use this as a guide. Each category should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to computer access. Please complete and review Section 3 of the WATI Student Information Guide (Chapter 1, page 28).

Consider the following questions:

- Does the student have experience using a computer? If so, for what?
- How does the student currently access the computer? Is the current method acceptable in terms of speed and accuracy?
- Is the student in an optimal position for accessing the computer (chair, wheelchair, etc.)?
- Can the student keyboard with two hands?
- Can the student isolate and point with one finger?
- Does the student have uncontrolled movements that reduce their accuracy?
- Does the student need any additional supports (keyguard, wrist support, pointing tools) to access the computer?
- Does the student have the range of motion to reach all areas of a keyboard, or move a mouse?
- Does the student have low or high muscle tone that may interfere with access?
- Is the student's speech clear and consistent?
- What is the student's most consistent, voluntary movement? Be specific (press down with right index finger, lateral movement with left elbow).
- Does the student fatigue easily during an activity, or get more fatigued throughout the day?
- Does the student have any visual issues (acuity, tracking, nystagmus)? Hearing issues?
- If the student is not able to direct select, have they tried scanning? If so, where was the switch placed for activation and what types of switches were tried?
- Does the student have the necessary cognitive skills to understand the purpose of using the computer? Do they understand the scanning process?
- At what level is the student reading and writing?
- Does the student maintain their attention to the computer long enough to complete a task? Are they visually interested in what's happening on the screen?
- Does the student have any behavior issues that may interfere with computer use?
- Is the student motivated to use a computer to complete their tasks?

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as:

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space
- Other individual specific sensitivities

Chapter 4 – Assistive Technology for Access to Computers

Although these factors are not directly related to computer access, they impact the student's ability to focus on instruction and learning so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations

As a team, discuss and write on chart paper any environmental considerations that might impact the student's ability to access the computer such as auditory or visual distracters, placement in the classroom, number of different environments in which the computer is to be used, or any other environmental impacts.

Important things to consider include:

- Will the student have a specific computer dedicated to their use, or will they use several computers throughout the school and home?
- What operating system is on the computer(s)?
- Will the computer(s) be laptop or desktop?
- What software programs will the student need to access?
- If special software is to be used, will it be on a network, or only installed on specific computer(s)?
- If the access method requires set up, is someone available to assist?
- Where in the room is the computer located? Can the student see the teacher from that location?
- What position(s)/equipment will the student be in when accessing the computer?
- Will the student require an adjustable workstation to accommodate a wheelchair?
- Will anything need to be mounted?
- If a dedicated laptop is used, is there a power source? How will it be transported?
- Is there adequate lighting in the location(s) that the computer will be used in?
- If there is sound on the computer, will that impact the other students in the room? Are headphones necessary?
- Will the student need to print from the computer? Use a scanner?

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time.

Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location,

level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential on the student's learning, identify the sensory levels in each environment in which the student will be using the computer.

Tasks

As a team, discuss and write on chart paper the reading tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what activities does the student need to participate in on the computer?

These are some questions to consider:

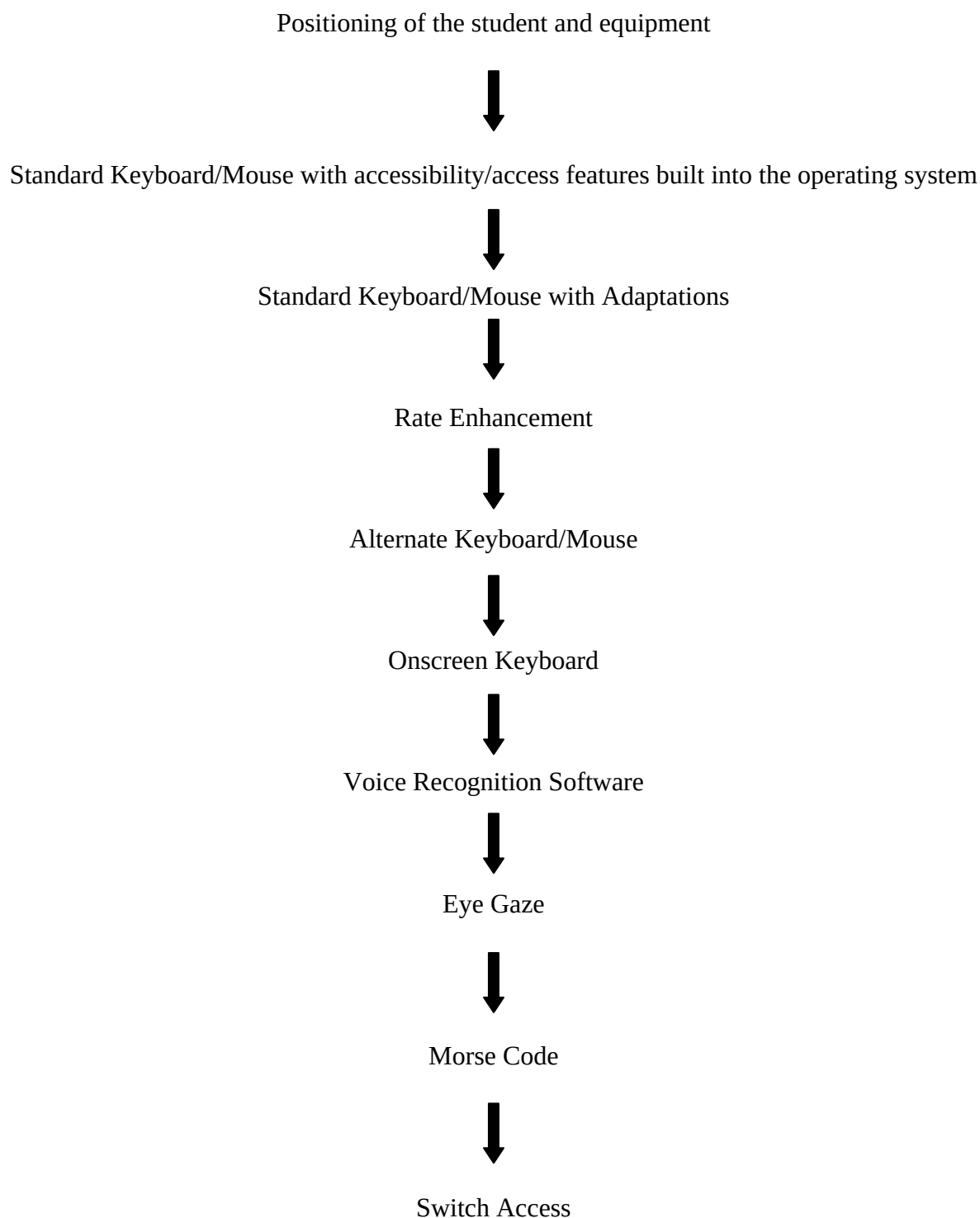
- Is the student able to access educational/special software to enhance participation in the curriculum?
- Is the student able to independently complete written work (reports, worksheets)?
- Is the student able to navigate the Internet? Use email?
- Is the student able to take notes?
- How does the student currently take tests?
- How does the student show their work in Math?

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for computer access. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A Continuum of Considerations for Assistive Technology Computer Access



Positioning of the Student and Equipment

Positioning of the student at the computer workstation is one of the first things that should be considered. Many students that have a physical disability may be able to access the computer via a keyboard and/or mouse if they are properly positioned at the computer workstation. Proper positioning and support enables the student to focus on learning. The student should sit comfortably in a well-balanced position. If they need to use their arms to support their body position or make constant position adjustments while using the computer keyboard, the seating system should be adapted.

One simple adaptation is the use of a non-slip surface on the chair to prevent slipping. While *Dycem* is the common solution for this, there are several low cost alternatives including non-skid rug material, shelf-lining material, rubber jar gripper, or non-skid vinyl safety tape. Rolled towels and pillows can also be used to make adjustments. An occupational or physical therapist should be consulted to help determine the most appropriate seating for the student.

Flexibility in the table height and positioning of keyboards and monitor is important. Students using wheelchairs usually sit higher than students in typical chairs so traditional desks and tables are usually too low to accommodate a wheelchair. Blocks or bricks can be placed under the table legs to raise the table. However, raising the table often results in raising the keyboard surface and monitor to an uncomfortable position. If this is the case, desk arms can replace standard arms on wheelchairs so that a lower table can be used. Using a wheelchair tray may also be considered.

Bi-level adjustable tables are convenient because correct working heights can be individualized quickly and easily, which is useful when several students requiring different table heights use the same computer. Other supports such as foot rests, articulating arm supports and wrist rests may improve access.

The computer monitor should be placed so the top of the screen is at or just below eye level. Keep in mind that many students with physical disabilities also have vision issues, so be sure to consider that the monitor may need to be placed to the right or left, or tilted up or down to accommodate the student's vision, as well as their position in the chair or wheelchair. A document holder may be used to place papers in the same visual plane as the monitor.

Some students find that the keyboard is easier to use when it is angled toward them, especially if they are using a pointing device (page 9). Angling the keyboard also positions it in the same visual plane as the monitor, reducing the need for the student to shift his gaze back and forth from the keyboard to the monitor. A slantboard can be used to angle a keyboard to varying degrees. An empty three-ring binder can also be used to angle the keyboard, using Velcro or non-slip materials to keep the keyboard in place.

A wrist rest or forearm support such as *Ergo Rest*® may provide needed support to increase control of movements and prevent accidental key activations. Gel supports located under the wrist or forearms provide a neutral resting position to increase stability for better fine motor control.

Operating System Built in Accessibility Features

All Macintosh and Windows operating systems have built in accessibility features that allow the user to customize features of the mouse and keyboard to better suit their individual needs. For Windows XP, Accessibility Options are found within the Control Panel. In Windows Vista they are found under “Ease of Access” within the Control Panel. On a Mac, the accessibility features are found in “Universal Access” within the System Panel.

Sticky Keys allows a user who can only push one button at a time to use the modifier keys (Shift, Control, Alt and Command) to press key combinations without having to hold down two or more keys at the same time. For example, when trying to type a capital letter, the user types [Shift] then the target letter, one after the other. The target letter will appear in uppercase and the next letter typed will automatically appear in lowercase. This is good for a student who is using one hand, or a pointing tool.

Filter Keys (Slow Keys on a Mac) ignores keystrokes that occur in rapid succession and keystrokes that are unintentionally held down for several seconds. This is good for someone who has a tremor or uncontrolled movements.

Mouse Keys allows use of the numeric keypad to move the mouse around the screen. This is good for someone who has a reliable method to access the keyboard, but has difficulty using a mouse.

Visual Display Options – Both Windows and Mac have customizable high-contrast schemes and modes to make it easier to see objects on the screen. There are options to increase the font and size of icons, cursor magnification, as well as text reading technology and screen magnification (although limited).

Standard Keyboard Adaptations

Repeat Rate – There is an option in Windows and Mac to adjust the character repeat rate to prevent multiple characters when a button is held down.

Keyguard - Keyguards are used to prevent accidental key presses. They are most often made of plastic and have finger-sized holes over each key. They are used to prevent accidental keystrokes or activation by stabilizing hand movement and preventing "drag" across dynamic screens. Keyguards are available for most standard keyboards and many augmentative communication devices.

Labels – Key labels are stickers that stick to the keys on the keyboard. They can be white letters on a black background, black letters on a white background, or color-coded. *ZoomCaps* are often used with children who have low vision or visual attention issues. Also available are large print, lowercase, color-coded labels from *Hoolean*.

Moisture Guard – A moisture guard covers the keyboard and protects it from dust, moisture, drool, etc.

Chapter 4 – Assistive Technology for Access to Computers

Pointing tools – A student with no functional use of their hands may use a head pointer or mouthstick to access the keyboard and/or mouse. A student with limited grasp might use a typing aid with a rubber tip that slips over the hand. A dowel or pencil with the eraser side down can also be used.

Keyboard Mask – For students who may only need to access a few keys on the keyboard, and are distracted by the many choices on a standard keyboard, it may be helpful to make a mask out of cardboard or foam to place over the keyboard, revealing only the necessary keys.

Standard Mouse Adaptations

Customizable Mouse Options - Students often have difficulty controlling a standard mouse, especially double clicking required for opening files and using the “drag” function. Built in features in both Windows and Mac include changing the double click speed, actions of the mouse buttons, pointer speed, cursor blink rate, and mouse pointer schemes.

Button Reassignment - The standard mouse for a Windows based computer is designed for right-handed use. You can reassign the buttons on a standard mouse in the Control Panel so that the right click makes a selection and the left click brings up the shortcut to menu items. You can also disable the right click button for students who unintentionally activate it or don’t need to use it. There is also the option to make both of the buttons make a selection.

Rate Enhancement

There are several software programs or features built into existing software that enable the user to reduce the number of keystrokes necessary to produce a word or action.

Abbreviation Expansion - Abbreviation expansion lets the user type in an abbreviation for a word or phrase, and the software spells out the full text on the screen (for example, “dc” + <Spacebar> = “Washington DC”. *Microsoft Word AutoCorrect* is a built in feature that allows you to create your own abbreviations and expansions, which work in Word only. *Typeit4me* is a popular abbreviation expansion program for the Mac.

Word Prediction/Completion - Word prediction/completion uses the first few letters typed by the student to “guess” at the desired word. After typing the first few letters, a list of words that begin with those letters is displayed. If the desired word is in the list, it can be chosen and automatically entered into the word processor. Many word prediction programs also read the list of “guesses” aloud. Some of the most popular stand alone word prediction programs are *Co:Writer* and *WordQ*. Word prediction is also available as an option in multi-feature programs like *Kurzweil 3000* and *Read & Write Gold*.

Macros - Macros are shortcuts that complete a set of commands in response to a set of keystrokes. A macro can simulate keystrokes and mouse input, activate applications, execute commands (e.g., maximize or close a window), and combinations of these. Examples of macros include: insert a name and address; launch or switch to a program; increase the volume; and copy

Chapter 4 – Assistive Technology for Access to Computers

data from one application and paste it in another. You can create Macros in Microsoft Word and Excel, as well as voice recognition software. There are many shareware programs for both Windows and Mac that will work in any application. If there are any functions or tasks that the student performs repeatedly, macros are effective in helping speed up those tasks.

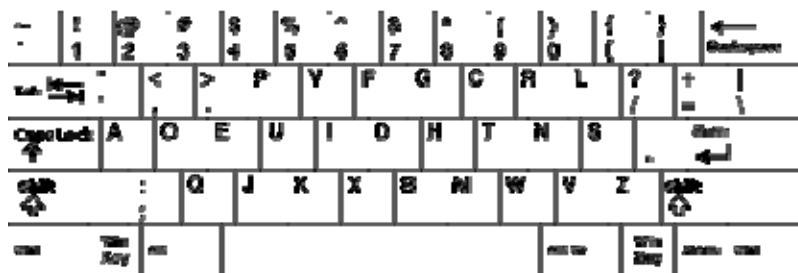
Auto Correction- The AutoCorrect feature in Microsoft Word provides the most common misspellings of words, including omissions, additions of incorrect letters, incorrect sequence of letters, misspellings due to inadvertent physical key hits, and also the user's genuine difficulty with spelling specific words. In all programs, lists of words can be modified. You can add words that you commonly misspell.

Alternative Keyboards

The standard QWERTY keyboard is modeled after the typewriter and is designed for a two-handed touch typist. This layout may not be ideal for students who will not touch type, students who will type with one hand, or students with cognitive difficulties. Although it is preferable to use the traditional keyboard since it is found in all settings, consider the many alternatives.

Alphabetical –The Alphabetical or ABC layout is often used with very young students, or those who are unfamiliar with or confused by the QWERTY layout. Students who use communication boards or devices may be familiar with the ABC layout for spelling out messages. Keyboards with an ABC Layout often have larger keys and/or brightly colored keys.

Dvorak - The Dvorak keyboard layout has the most-used consonants on the right side of the home row, and the vowels on the left side of the home row. The next most common letters are on the top row, and the least-used letters are on the bottom row. This can be a useful layout for someone who is using a pointing device such as a headpointer or a mouthstick.



The option for changing the keyboard layout is found in the Control Panel in Windows, and the System Preferences in Mac.

Ergonomic – Some ergonomic keyboards may be useful to students who need alternative positioning of the keyboard. Split keyboards, like the *FreeStyle*, enable the student to position the two keyboard halves separately in a way that is most comfortable for them.



Chapter 4 – Assistive Technology for Access to Computers

One-Handed - Many students who type with one hand do well with a standard keyboard and a modified hand placement. However, there are many different types of keyboards designed for one-handed users. A smaller-sized keyboard may be beneficial for a student using only one hand.

- There are Dvorak arrangements designed for either right or left one-handed typing. The hand rests near the center of the keyboard and the majority of the letters are centered on the home row or above.



- The Half-QWERTY Keyboard allows one-handed typing using either hand, or both, just like a standard keyboard. The student's functional hand is placed where it would normally go if they were a two-handed typist and that half of the keyboard is accessed as usual. To type the keys on the other side, the student holds down the spacebar while pressing the mirror-image key. This is most successful with students who were previously able to touch type with two hands.
- Another option is a chorded keyboard, which allows the user to enter characters or commands by pressing several keys simultaneously, like playing a chord on the piano. The *BAT keyboard* and the *FrogPad* are examples of chorded keyboards. Both are available in right or left handed versions.
- *AlphaSmart Portable Word Processor* – AlphaSmart products have built in right and left handed keyboard configurations, and can be used as a stand-alone word processor, or as an alternative keyboard to access the computer in the keyboard emulation mode.



Wireless - Wireless keyboards eliminate the need to be attached to the computer with a cord, which works well for students who use a power wheelchair with a tray or those who are distracted by cords. These utilize infrared (IR), radio frequency (RF), or Bluetooth technology. Keep in mind that Bluetooth and RF technology does not require line-of-sight between the keyboard and the receiver while IR does require line of sight between the keyboard and the receiver. Wireless keyboards can be found at many office supply or electronics stores.

Miniature/Compact – Compact keyboards have smaller keys, fewer key choices or a more "compact" layout. Some include a built-in track ball and/or wrist rest. These may be a good choice for students with a limited range of motion, or those using one hand or a pointing device to access the keyboard. There are several mini keyboards on the market, some wireless. The *Magic Wand Keyboard* has a built in mouse and requires only a light touch by the attached 'wand' to activate the keys, making it an option for students with muscular dystrophy.

Enlarged - Enlarged keyboards are larger versions of the standard keyboard, in whole or in part, usually with colored keys and a variety of layouts. Some are also programmable (see *IntelliKeys*). An enlarged keyboard is often used with students who have decreased fine motor skills, or who require color coding or an alternative layout for cueing. The Big Keys series comes in different layouts and color combinations.



Programmable - The *IntelliKeys*® keyboard is the most popular programmable keyboard. It is a flat, enlarged membrane keyboard that plugs into any Macintosh or Windows computer. It enables users with physical, visual, or cognitive disabilities to type, enter numbers, navigate on-screen displays, and execute menu commands. *IntelliKeys* comes with overlays for numbers, mouse movement, and alphabetical and QWERTY key layouts that can be slid into the *IntelliKeys* for instant use. Customized overlays can also be created and printed with Overlay Maker or existing overlays can be downloaded from the IntelliTools Activity Exchange (<http://aex.intellitools.com>). Many children's software programs now include ready-to-use custom *IntelliKeys* overlays. *IntelliKeys* can also be used as an alternative for mouse functions or as a switch.



Onscreen - An onscreen keyboard is an image of a standard or modified keyboard on the computer screen. A mouse, mouse alternative, or switch selects the keys. Some onscreen keyboards incorporate word prediction programs to increase speed and may include alternate keyboard layouts in addition to the traditional QWERTY layout. Windows and Mac operating systems have a built-in onscreen keyboard, but with limited extra features. The onscreen keyboard is an option for students who have accurate control of a mouse or mouse alternative (trackball, head controlled mouse, touchscreen), but struggle with the keyboard. The onscreen keyboard also removes the need to look back and forth from the keyboard to the computer screen. Popular onscreen keyboards include *OnScreen*, *WIVIK*, and *REACH*™.



WIVIK

Mouse Alternatives

For students who lack the ability to use a standard mouse, there are many alternatives to consider. Explore commercial types of mice at a computer store for a better individual fit. There are many different sizes, shapes, button configurations, etc.

Keyboard shortcuts - Use keyboard shortcuts as an alternative to the mouse in both Windows and Mac. Keyboard shortcuts use a combination of a modifier key plus another key to achieve a menu option (for example Control + V is the same as clicking on Edit > Paste with the mouse). For a list of keyboard shortcuts for Windows go to support.windows.com and support.apple.com for Mac.

Mouse Keys – Built-in feature of both Windows and Mac operating system, enables the student to use the arrow keys on the numeric keypad to move the pointer instead of using the mouse.

Left handed/Ergonomic – There are hundreds of different variations of computer mice, including left handed mice for Windows available on the Internet and in office supply stores. You may want to explore the options, which come in all different sizes and shapes including pen mice and vertical mice that place the hand in a vertical “handshake” position.



Wireless - There are many options for wireless mice and trackballs available at computer stores. These utilize infrared (IR), radio frequency (RF), or Bluetooth technology. Keep in mind that Bluetooth and RF technology does not require line of sight between the mouse and the receiver, while IR does require line of sight between the mouse and the receiver.

One Button – Many children are confused and/or frustrated by the right click button on the standard mouse. While it is possible to disable the right click from the operating system, many teachers and students prefer a one-button mouse. The *Chester Mouse* is a small single-button mouse with no scroll wheel.

Touchpad/Trackpad – Some students with limited range of motion and/or strength may be able to access a touchpad (commonly found on laptop computers). Sliding your finger across the pad moves the mouse. Clicking can be done with buttons or by "tapping" lightly on the surface. External trackpads are available for both PC and Mac computers.

Trackball – If a student has difficulty gripping or moving a standard mouse, a trackball may be easier to use. A trackball is basically an upside-down mouse. Rather than moving the mouse on the table, the trackball remains in one place and the ball on the top is moved with the palm, thumb, fingers, or other body part. The *BigTrack* is the largest trackball on the market. It requires less fine motor control than a standard trackball and has a left and a right mouse click button located behind the trackball to avoid unwanted mouse clicks. The *BigTrack* works well with young children, and with students who do not have



good fine motor control. Some trackballs have been adapted with switch jacks so that switches can be connected to emulate mouse buttons (*SAM Trackball*, *TRAXSYS Roller Plus*, *WAVE Wireless*).

Joystick – Many students may be familiar with a joystick as a way to access a video game. Joysticks may have four or five directional controls, and can be proportional or continuous use. Joysticks can be positioned for use with the hand, chin, foot, or head. Some joysticks have been adapted with switch jacks so that switches can be connected to emulate mouse buttons (*SAM Joystick*). The *Jouse2™* and *Quadjoy™* are joysticks controlled by the mouth.

Touchscreen - Touchscreens allow you to use your finger (or a pointer) instead of a mouse. The touchscreen is a more concrete concept than a mouse or trackball, so it may be useful for young children, or those with cognitive disabilities. A touchscreen can be an add-on (*TouchWindow*, *Magic Touch*), or an integrated monitor system (*Magic Touch*, *3M™ MicroTouch™ Displays*). Some laptops now come with touchscreens as well. Be aware that not all built-in touchscreens are touch-sensitive. Some require use of a stylus to access.

Foot-controlled Mouse – For students who do not have good hand function, but can utilize their feet, foot-controlled mice are available including the *No Hands Mouse* and *Footime™*.

Head-controlled Mouse – A head-controlled mouse translates the movement of the student's head into cursor movements on the screen. Some require only a small reflective dot be worn on the individual's forehead or eyeglasses (*Tracker Pro*, *HeadMouse® Extreme*). As with the other mouse alternatives a head controlled mouse can be combined with an on-screen keyboard to completely replace the functions of a conventional keyboard. Mouse clicks can be done with a switch or dwell selection software.

Dwell Selection – For students who can control the mouse pointer, but have difficulty clicking the mouse, dwell selection performs the operation by holding the cursor over an icon or menu option for a specified amount of time. The software can send left-clicks, right clicks or double-clicks. Dwell software is often used in conjunction with an on-screen keyboard. *MagicCursor 2000* and *SmartClick* are dwell software programs available for Windows and Mac.

Interactive Whiteboards

An interactive whiteboard is a touch-sensitive display that connects to a computer and digital projector to show the computer image. While not a practical solution for personal use, many classrooms have interactive whiteboards, which can be great for students who cannot access a keyboard or mouse. The large touch sensitive screen can be mounted or positioned so that students in wheelchairs can access it. Students can write or draw on the screen with their finger or a special “pen”. Specialized software can translate handwriting into typed text. An onscreen keyboard could be used, allowing a student to “type” using large arm movements rather than fine finger movements.

Speech Recognition

Speech recognition software converts words spoken into a microphone into text or commands. Although speech recognition may seem like the simple answer for students who have difficulty with keyboarding, many things need to be considered including:

Speech – The student should have relatively clear, consistent speech. Students with accents or mild to moderate dysarthria have been successful with speech recognition. Appropriate training of the software is essential for accuracy.

Cognitive abilities – The student should be able to understand how speech recognition works and have experience with general use of the computer. They must also have fairly intact strategic memory system.

Dictation skills – The student needs to be able to compose and dictate clear, well-structured sentences without hesitations or fillers (umm, ahhh). The student must know how to and be able to create complete sentences.

Literacy/Editing - The student must be able to review the text that has been dictated, identify errors and correct them. It is very important to correct recognition errors because this helps the speech recognition program improve its voice model. If corrections are not made, recognition accuracy is compromised.

Motivation – Speech recognition can be frustrating during the beginning stages, so the student must be very motivated and able to see the benefit of the initial work to achieve success.

Support – Speech recognition technology, especially in a school setting, requires much support. As many team members as possible should be trained to use the technology so that support can be provided in various situations.

Training the software to recognize the student's voice used to be a time consuming and frustrating process, requiring lengthy sessions of reading text aloud. However, the process of training a speech recognition program is much simpler now, and is no longer a barrier for most students. Students with severe visual or reading difficulties can be supported as they progress through the initial training.

Windows Vista has a built in speech recognition feature for dictation of text and control commands. Mac OSX has *Speakable Items* which lets you navigate menus and enter keyboard shortcuts; speak checkbox names, radio button names, list items, and buttons; and open, close, control, and switch among open applications, but not dictate text. *MacSpeech Dictate* is a software program that enables the Mac user to enter text and speak commands.

The most popular speech recognition software is *Dragon NaturallySpeaking*, which enables the user to enter text into any Windows-based software program, navigate the Internet, as well as enter commands (“close window”, “print document”) by voice. *Dragon NaturallySpeaking* uses continuous speech and can have an accuracy rate of up to 99% with appropriate training.

Chapter 4 – Assistive Technology for Access to Computers

Dragon NaturallySpeaking is a great option for students that have a physical disability and need to have “hands-free” access to the computer. *MathTalk* is an additional program that can be combined with *Dragon NaturallySpeaking* to dictate equations into *Scientific Notebook*. *Read&Write Gold* and *ClaroRead* also integrate with *Dragon NaturallySpeaking* to provide speech feedback to confirm that the dictated text is accurate.

SpeakQ is a voice recognition program that is designed for students with learning disabilities. It is used in conjunction with *WordQ*. *SpeakQ* is an option for students who can use the keyboard, but have difficulties with the processes of writing and reading. These students can benefit from a combination of word prediction, speech output and speech input to generate text. The reading demands are reduced, especially in the training where the computer uses speech output to prompt the student what to say. There are two modes. In the Speak and Select mode, spoken words are displayed as a list of choices enhanced by word predictions. The student then selects from the list of words or phrases (using the keyboard or mouse), or type letters to further refine the suggestions. In the Speak Continuously mode, spoken words are entered directly into the document. There are no verbal commands for control or correction.

Eye Gaze

Eye gaze systems are used to move the cursor on the screen to activate an onscreen keyboard or other specialized software. Dwelling or eye blink is used to make a selection. The eye-tracking piece is attached to the monitor and it reads the eye movement. To be able to functionally operate eye control systems, users must be able to look up, down, left and right and direct their gaze to all areas of a computer screen. They must be able to focus on a spot for a specified amount of time. Eye problems such as nystagmus, strabismus, visual acuity and medication that affect eye tracking can influence the accuracy the systems. Some systems track one eye and others track both. Problems can occur if users have severe involuntary head or eye movements. Students who do not have voluntary control over any body part except their eyes, and are unable to use voice recognition technology typically use these systems. Typical users may include students with a neurological disease, high-level spinal cord injuries, or cerebral palsy. Examples of eye gaze systems include *Quick Glance*, *ERICA*, and *My Tobii*.

Morse Code

Morse Code - Morse code uses two switches (see Switch Access page 17) and adaptive software to enter keyboard characters into a word processor. Morse code is not a common input method because it requires learning Morse code and it's slow, but for single switch users it can work well. Morse code input doesn't require the ability to watch the screen as visual scanning software does. If a single switch is used for entering the code, a dash is differentiated from a dot by holding the switch closed for a longer period of time. In two-switch Morse code, one switch is used for entering dots while the other is used for dashes. Mouse movement can be achieved using *MouseKeys* (accessibility feature that allows the keyboard number pad to replace the mouse), although it is tedious. The *Darci USB* is a plug and play device that replaces the keyboard and mouse for Morse code input in any Windows application. *EZ-Keys* is a software program that provides Morse code access.

Chapter 4 – Assistive Technology for Access to Computers

Switch Access

Switch access may seem like an easy alternative input method for accessing the computer. However, the student's cognitive abilities must be considered. Having the physical ability to activate a switch does not mean the student will be able to use scanning as an input method.

Switch scanning should only be considered after all other access methods have been ruled out. It is slow and tedious, but can be a successful access method for those who need to use it. Before recommending switch access for input, try it yourself. You will get a feel of the cognitive demands and patience required for this type of access.

Switch assessment

When assessing a student for switch access, a switch site will need to be determined. This involves finding a consistent, controlled movement that can be easily repeated many times without causing fatigue or pain. This usually involves a lot of trial and error. It is often helpful to observe the student while resting or during other activities. Students are usually very aware of their own bodies, so always ask the student what they think is their best movement for switch access. They are usually right. Typically, upper extremities are considered first, then the head, and then lower extremities. However, some would argue that the head is a more natural access method for students since there is a more direct connection with the eyes.

During the assessment, the switch itself should not be the activity. It should be a means to participate in something interesting and motivating on the computer. Do not say, "Hit the switch", but rather say, "make the balloons pop", or "turn the page". It may make sense to start with activating a simple switch toy or music if that is motivating for the student.

Modes of Scanning – Different modes of scanning can be used, based on the student's physical and cognitive abilities.

Automatic – The student activates the switch to begin the scan. Scanning proceeds automatically at a predetermined rate until the student activates the switch again to make a selection. This requires a high degree of motor control by the student to wait for the desired selection and then activate the switch at the required time. It also requires the ability to continually attend and visually track the movement on the screen. This is NOT an ideal method of input for many students.

Single Switch Step – In single-switch step scanning, the student must keep activating the switch until the desired selection is highlighted. To make the selection, they must wait for a certain period of time without activating the switch.

Two Switch Step – In two-switch step scanning, one switch moves the highlight from one selection item to the next and the second switch selects the desired item. The student controls all timing and movement. Two-switch scanning can be extremely efficient, allowing the student to make selections faster than with single-switch scanning. While the action of two physical

movements can require more motor planning and concentration, with practice it can become a rhythmic, kinesthetic movement which requires less active thought.

Inverse – The student must maintain the switch activation until the desired selection is highlighted. Releasing the switch makes the selection. This requires the ability to hold a motor pattern and quickly release. The student must maintain direct attention to the screen, and anticipate the need to release the switch.

Characteristics of Switches

When assessing for switch use, these are some questions to keep in mind:

- How big is the switch target surface?
- Which areas actually activate the switch? The center? The edges?
- What does the switch feel like? Is it soft or hard? Does the student prefer or dislike a particular texture?
- How much pressure is required to activate the switch?
- Can the student easily release the switch?
- What type of feedback (if any) does the switch provide when activated? Is the student distracted or startled by a “click” sound?
- Is the switch durable? Can it withstand moisture/dirt?
- Is the switch easy to mount? Can it be positioned to accommodate the student in different body positions?
- Does the switch come in a wireless version?

Types of Switches - There are two main types of switches, mechanical and electrical. Below are examples of switches that are commonly used for computer access. This list is in no way exhaustive and new switches are always under development. Check vendor websites and catalogs frequently for new products.

Mechanical – Mechanical switches require that the student actually physically touch the switch for activation. The amount of pressure needed to activate these switches can vary. Examples include:

- **Push** (sometimes called button or touch) **switches** are the most common type. The student activates the switch by pushing against its surface. These switches have a single surface area for activation. They are usually pressed with a hand, but can also be pressed by other body parts. The *JellyBean* and *BuddyButton* are common push switches.
- **Light Touch Switches** require less pressure to activate than push switches. Examples include the *ASL Micro Light Switch* and the *Plate Switch* from AbleNet.
- **Lever switches** can be activated by pushing in any direction. They are easily mounted and are typically activated by the head or gross hand movement. The *Ultimate Switch*

Chapter 4 – Assistive Technology for Access to Computers

from Enabling Devices, The *Wobble Switch* from PRC and AbleNet's *Flex Switch* are examples of lever switches.

- **Motoric-Specific Movements** activate switches such as pinch, grip, bat, pull, etc. Enabling Devices and AbleNet make several switches that require specific movements.
- **Pneumatic (sip and puff)** switches depend on a change in air pressure for activation. Sipping activates one switch, puffing activates the other.
- **Dual Switches** are two switches in one housing, each having its own action. A dual switch can be used for Morse code or for 2-Switch Step Scanning. The *Rocker* switch from AbleNet is an example of a dual switch.
- **Wireless Switches** - If cords and wires are a hindrance, consider a wireless switch that connects a receiver to the toy/device and then transmits information through radio waves. The *JellyBeamer* by AbleNet is a popular wireless switch.

Electrical – Electrical switches do not require physical contact for activation. Different types of mechanical switches include:

- **Proximity** switches simply require a motion near the surface. They are sensitivity-adjustable (*ASL Adjustable Proximity*, *AbleNet Untouchable Buddy*).
- **Fiber Optic** switches have a visible light, and breaking the beam of light activates the switch. Fiber optic switches can be set up at any reliable site such as a finger or chin (*ASL Fiber Optic*, *Fiber-Optic Eye-Blink Switch* from AMDi).
- **Infrared** - The *Self-Calibrating Auditory Tone Infrared (SCATIR) Switch* works by detecting a beam of reflected pulsed infrared light. The SCATIR Switch can be controlled with an eye-blink, eyebrow movement, finger movement, head movement, and facial muscle movement. Using the *Multi Infrared/Sound/Touch (IST) Switch* by Words+, students can access software with virtually any kind of body motion—the blink of an eye or a vocalization/breath.
- **Sensor** switches send up electrical impulses from the muscle (small movements) that activates the switch. This type of switch requires careful placement. (*Enabling Devices Sensor Switch Kit*, *Don Johnston Sensor*). The *Impulse™* from AbleNet senses tiny muscle movements and sends a signal to a receiver via wireless Bluetooth technology to activate the switch.
- **Wheelchair Integration** - It is possible to use the same switches used to drive a power wheelchair to access the computer. Adaptive Switch Labs specializes in fiber optic switches that can control both the wheelchair and the computer. A special interface box and a visual display are added to the wheelchair electronics to enable computer access. Note: Not all wheelchair electronics and/or switches have this capability.

Chapter 4 – Assistive Technology for Access to Computers

Switch Interface – Remember, a switch does not plug directly into the computer, it requires a computer interface. The computer is connected to the switch interface, which is then connected to the switch. The switch interface then determines what the computer receives when the switch is pressed. When you press a switch, the interface box makes the computer think that a key on the keyboard or a mouse button is being pressed. So if you would normally press the spacebar to turn the pages in an electronic book, you can now use a switch instead. Switch interface boxes can be wireless, too (*IntelliSwitch, Swifty, Quizworks USB Switch Interface*).

Product	Vendor	Website
USB Switch Interface	Crick	http://www.cricksoft.com/
Switch Interface Pro	Don Johnston, Inc	http://www.donjohnston.com/
IntelliSwitch	IntelliTools	http://www.intellitools.com/
SwitchHopper	RJ Cooper	http://www.rjcooper.com/
USB Switch Interface Plus	Quizworks	http://www.quizworks.com/
Wireless Switch Interface	Quizworks	http://www.quizworks.com/
Swifty	Origin Instruments	http://www.orin.com/

Mounting - Switches sometimes must be mounted in place to make them easier to use. This provides stability for the student by ensuring that the switch stays in one consistent place. Switches that are pressed with the hand can be held in place on a table or desk with Velcro. For students who access switches in other ways, a mounting system may be useful. Mounts can be rigid or flexible (gooseneck). Popular commercial mounts include the *Slim Armstrong* and the *Magic Arm*. Camera mounts may be considered as a lower cost alternative.

Switch Accessible Software - Some software programs have been developed specifically for use with a switch to develop cause & effect, choice making, early literacy skills, allow independent test taking (*Test Me Score Me*) or to give students access to curriculum specific topics (*Switching on Science/American History*). Other programs have built-in options to allow switch use (*Classroom Suite, Clicker*).

Many standard software programs can be accessed through a switch with the use of additional switch software (*Discover Envoy, SwitchXS for Mac, EZ Keys*).

Switch Accessible Software is available from the following vendors (among others):

AbleNet (SoftTouch)	http://www.ablenetinc.com/
Creative Communicating	http://www.creative-comm.com/
Crick Software	http://www.cricksoft.com/
Don Johnston, Inc	http://www.donjohnston.com/
Inclusive TLC	http://www.inclusivetlc.com/
IntelliTools	http://www.intellitools.com/
Judy Lynn Software	http://www.judylynn.com/
Laureate Learning Systems	http://www.laureatelearning.com/
RJ Cooper	http://www.rjcooper.com/
Marblesoft-Simtech	http://www.marblesoft.com/

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial equipment and materials, team member(s) responsibilities, start date, length of trial, training needed and any other student/staff specific issues. Be certain to identify objectives and criteria of performance to determine the effectiveness of the trials.

Trials – Take advantage of AT loan libraries for trial equipment when possible. Many manufactures of software provide trial CDs or downloads from their websites. Plan to use the technology for at least a month to determine effectiveness. Of course, adjustments and modifications should be done as necessary during that time.

Training - Identify at least two staff members and a family member to be trained (along with the student) by an AT professional. Training should take place in the environment where the computer will be used. Several training sessions may be necessary, depending on the complexity of the chosen technology.

Data – Collecting data will help determine the effectiveness of the assistive technology. Identify what objectives you will measure. For example, you could collect samples of written work before and after implementation to look at quality & quantity of work, or identify level of independence in computer access before and after implementation.

Documentation - Keep good records on the assistive technology (vendor, tech support, date of purchase, warranty, instructions) and its use by the student to be passed on during transition to another teacher, grade, or school.

Product Resources

The following is a list of products mentioned in this chapter. Keep in mind that there may be multiple vendors for each product. Inclusion on this list is not an endorsement.

Product	Vendor	Website
BAT Keyboard	Infogrip	www.infogrip.com
BigKeys	BigKeys Company	www.bigkeys.com
BigTrack	Infogrip	www.infogrip.com
Chester Mouse	Chester Creek	www.chestercreekttech.com
ClaroRead	Claro Software	www.clarosoftware.com
Classroom Suite	IntelliTools	www.intellitools.com
Co:Writer	Don Johnston, Inc.	www.donjohnston.com
Darci USB	WesTest Engineering	www.westest.com
MacSpeech Dictate	MacSpeech	www.macspeech.com
Discover Envoy	Madentec	www.madentec.com
Dragon NaturallySpeaking	Nuance	www.nuance.com
Dycem	Dycem	www.dycem.com
ErgoRest	Comfort Keyboard Systems	www.comfortkeyboard.com
ERICA Eyegaze	Eye Response Technologies	www.eyeresponse.com
EZ Keys	Words +	www.words-plus.com
FreeStyle	Kinesis Corporation	www.kinesis-ergo.com
FrogPad	FrogPad, Inc.	www.frogpad.com
Half QWERTY	Matias Corporation	www.half-qwerty.com
Headmouse Extreme	Origin Instruments	www.orin.com
IntelliKeys	IntelliTools	www.intellitools.com
Jouse	AbleNet	www.ablenetinc.com
Kurzweil 3000	Kurzweil Educational Systems	www.kurzweilededu.com
Magic Arm	RJ Cooper	www.rjcooper.com
Magic Cursor 2000	Madentec	www.madentec.com
Magic Touch	RJ Cooper	www.rjcooper.com
Magic Wand	In Touch Systems	www.magicwandkeyboard.com
MathTalk	Metroplex Voice Computer	www.mathtalk.com
MicroTouch	3M	www.3m.com
My Tobii	Tobii ATI	www.assistivetech.com
AlphaSmart (Dana & Neo)	Renaissance Learning	www.renlearn.com
OnScreen	RJ Cooper	www.rjcooper.com
Quadjoy	SEMCO	www.quadjoy.com
QuickGlance	EyeTech Digital Systems	www.eyetechds.com
REACH Interface Author	Applied Human Factors	www.ahf-net.com
Read & Write Gold	TextHELP Systems	www.texthelp.com
SAM Joystick	RJ Cooper	www.rjcooper.com
SAM Trackball	RJ Cooper	www.rjcooper.com
Scanbuddy	RJ Cooper	www.rjcooper.com

Chapter 4 – Assistive Technology for Access to Computers

Product	Vendor	Website
Slim Armstrong	AbleNet	www.ablenetinc.com
SmartClick	Innovation Management Group	www.imgpresents.com
SpeakQ	Quillsoft	www.wordq.com
Switching On Science	SoftTouch	www.ablenetinc.com
SwitchXS	AssistiveWare	www.assistiveware.com
Test Me Score Me	SoftTouch	www.ablenetinc.com
TouchWindow	ProEd	www.touchwindow.com
Tracker Pro	Madentec	www.madentec.com
Traxsys Roller Plus	Don Johnston, Inc.	www.donjohnston.com
Typeit4me	Ettore Software	www.typeit4me.com
WAVE Wireless Trackball	AbleNet	www.ablenetinc.com
WIVIK	Prentke Romich Company	www.prent-rom.com
WordQ	Quillsoft	www.wordq.com
ZoomCaps	Meeting the Challenge, Inc.	www.mtc-inc.com

Chapter 5 – Assistive Technology for Writing, Including Motor Aspects of Writing and Composition

Introduction.....	1
Decision Making Guide	3
SETT Process	4
Continuum for Motor Aspects.....	12
Continuum Expanded.....	13
Charts.....	23
References.....	26
Product/Vendor Guide	28

Assistive Technology for Writing, including Motor Aspects of Writing and Composing

Cindy Nankee, OTR/L, ATP, Karen Stindt MS, OTR/L, ATP, Paula Lees OTR. MS Ad Ed

Writing is a complex process that involves both the motor aspects of handwriting and the cognitive component of creating or composing written material. Due to the importance of each component this chapter has been divided into two sections; **The Motor Aspects of Writing** and **Composing Written Material**.

This chapter will address **The Motor Aspects of Writing**.

Introduction

Students are required to produce written material (e.g. tests, worksheets, and essays) to demonstrate what they have learned. Handwriting instruction begins prior to kindergarten and continues through first and second grade. Penmanship is practiced through the third and fourth grade with keyboarding instruction starting at or before the fourth grade in most curricula. Technological advances have made alternatives to handwriting available, including keyboarding, handwriting recognition and voice recognition. The majority of schools not only have computer labs, but also computers within the classroom. Some classrooms designate an area as a writing center that includes a computer with writing, visual-mapping, and outlining software along with a variety of pens, markers, crayons, stamps and papers. This section will be looking at assistive technology tools for the motor aspects of writing whether it be penmanship or technology based.

Each section of this chapter is organized in accordance with the Decision Making Guide following the SETT format (Student, Environment, Task and Tool). The *Student* section will assist you in determining skills and abilities required by the student to perform the motor aspects of writing whether it is handwriting, keyboarding, or the use of various other assistive technologies. The *Environment* section poses questions to consider concerning the impact of the student's environment, the teachers' expectations, and how these impact the choice of assistive technology. The section on *Tasks* for motor aspects of writing poses questions to help determine what is required of the student in order to appropriately choose an assistive technology solution. Following "Tasks" is a section on *Tools* which includes the continuum of assistive technology to be considered. The continuum is organized from low- to high-technology. This is followed by a more extensive listing of tools and strategies under the continuum subtitles. The chapter concludes with a discussion of a feature match process and steps for implementation. Chapter appendices include sample IEP objectives, references, resources, and product charts.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (*Student, Environment, Task, and Tool*) format with a subcategory of *Sensory Considerations* included with Student and Environment. There are three additional categories on the Decision Making Guide that further help in the selection and implementation of assistive technology. *Narrowing the Focus* helps the team identify a specific task for solution generation. The *Implementation Plan* assists the team in assigning trials, dates, responsibilities and data collection. The *Follow-Up Plan* directs the team to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (e.g. on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and try appropriate assistive technology tools and strategies for their students. Following the SETT process and the Decision Making Guide should ultimately result in the acquisition of appropriate assistive technology tools and strategies that, with maintained use, result in success for the student

WATI Assistive Technology Decision Making Guide

Area of Concern: Motor Aspects of Writing

PROBLEM IDENTIFICATION		
Student's Abilities/Difficulties	Environmental Considerations	Tasks
- Review Section 4 of Student Information Guide (Chapter 1, page 30) - Physically - Visual Perception - Social Emotional - Cognitive - Organization	- Review Chapter 1 page 42 - Environmental Observation Guide - Student to teacher position/# students to adults/aid/ - lecture/small group/number of classrooms/travel Teacher expectations - W/C accessible/lighting/clutter - Workstation/desk - Student accessible computers/OS	- Writing assignments (worksheet/sentence/paragraphs/pages) - Note taking - Projects - Tests - Reading
Sensory Considerations		Narrowing the Focus
Vision/Hearing/Tactile (hyper/hypo-sensitive)		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision Review Checklist	Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Date Length Person Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Background

This section will focus on the multiple factors involved with producing written documents. Handwriting is a complex skill involving visual perceptual, neuromuscular, and motor components. There are also cognitive and social emotional factors that influence handwriting. The student who may benefit from assistive technology in the area of writing may already be receiving occupational or physical therapy for motor challenges and the therapists should be consulted. The labor-intensive motor aspect of writing includes: holding the writing utensil; stabilizing the paper; visually guiding the hand; moving the writing utensil along the paper; visual recall of the letter; kinesthetic memory of letter formation; and word formation and writing and re-writing as part of the editing process. These all make writing one of the most difficult and complex skills acquired by students. Consider then how these mechanical challenges may affect the student's confidence, motivation, and self-esteem as they attempt to commit to paper what they actually know.

Handwriting

The following is a brief introduction to an understanding of handwriting, not meant to be all inclusive, but to give the reader a basic understanding of handwriting to better select appropriate assistive technology supports.

Handwriting is a complex process requiring *visual perception, neuromuscular abilities, motor skills, cognition and social emotional factors.*

Visual perception is the ability to understand and interpret information taken in through the eyes, which is a highly cognitive function. Visual perceptual components necessary for handwriting include:

- *Visual Discrimination* - the ability to identify like characteristics or features of visual information; and in the case of handwriting, identifying like characteristics of like letters and numbers in order to eventually replicate them.
- *Visual Memory* - the ability to demonstrate recall of visual information; and in the case of handwriting, appropriate letter formations and the sequence in which a series of letters must be placed to form words.
- *Visual Spatial-relations* - the ability to perceive the position of two or more objects in relation to each other; and in the case of handwriting, the ability to visually interpret the position of the letters/words appropriately on the lines of the paper and space appropriately between letters/words.
- *Visual Form constancy* - the ability to discriminate between similar objects; and in the case of handwriting, letters/words.
- *Visual Figure-ground* - the ability to perceive a form and find it from among an assortment of other matter found in the background; and in the case of handwriting, the proper spacing between letters and words.
- *Visual Closure* – the ability to recognize a figure when it is not complete; and in the case of handwriting, the ability to determine if a letter is correctly formed or (in)complete.

Neuromuscular refers to abilities that combine muscle strength and postural control. Neuromuscular components include:

- *Muscle tone* - the ability to maintain a posture. During handwriting, the student must have adequate muscle tone to maintain an upright position without support from the hands, freeing them up to grasp a writing instrument.

- *Strength* – the ability to maintain a grasp of a writing instrument over time both while moving it dynamically or holding it statically.
- *Postural control* - the ability to make appropriate postural adjustments while writing. It is important to develop proximal strength or position a student for trunk stability before fine motor skills can be addressed. The student's positioning must be considered for motor aspects of writing. (See Chapter 2 – Assistive Technology for Positioning, Seating and Mobility.)

Motor skills require the assimilation and interpretation of sensory information in order to accommodate with an appropriate motor response. Neuromuscular abilities lay the foundation for the development of motor skills.

Motor skills include:

- *Crossing the midline* - the ability to cross the midline of the body without disruption of body position; and in the case of handwriting the ability to move the hand across the middle of the body while writing on a horizontal surface.
- *Bilateral integration* - the ability to use the two hands in a coordinated fashion; and in the case of handwriting, grasping a writing instrument with one hand and stabilizing the paper with the other.
- *Laterality* - the ability to demonstrate a preference of one hand over the other for a task requiring coordinated movement; and in the case of handwriting' demonstrating the consistent hand preference for use of a writing tool.
- *Praxis* - the ability to plan and execute new motor movements; and in the case of handwriting, the ability to demonstrate appropriate letter formations and sequence letters by arranging letters in appropriate order to form words.
- *Fine motor coordination* - The muscle control required to make small, precise movements; and in the case of handwriting, the ability to manipulate the writing instrument to move and adjust the position of the writing instrument, turn the writing instrument over to erase, etc.
 1. Grasp is the ability to hold an item and in the case of handwriting the ability to hold a writing utensil. The tripod pencil grasp is the most frequently observed though there are other efficient grasps. The correlation between grip and handwriting success is very low and grip is generally very difficult to change.
 2. Motor accuracy is the ability to control fine motor movements and in the case of handwriting controlling the motor movements so that letters are correctly sized and on the line.
- *In-hand manipulation skills* -The ability of the small muscles of the hand to perform coordinated movements including the ability to pick up and move small items to and from the hand as well as the ability to rotate items; in the case of handwriting, the ability to move up and down the pencil when adjusting grip as well as switching from the writing end of the pencil to the erasing end.
- *Visual motor integration* – The ability of the eyes to guide hand movement and in the case of handwriting the ability to trace, and imitate or copy number/letters accurately.

Cognitive

The level of cognition required for writing is often misinterpreted. Some professionals often think that there needs to be an average level of cognitive ability in order to write. However, most students with a desire to share information, do have the ability through assistive technology to perform a writing task. Combining strategies that build upon background information and high interest topics with assistive technology can support even the most cognitively challenged students to produce written work. Students who want to share information with others may be given opportunities to write with pictures, letters, words, or other alternative media. Hanser (2006) delineates an approach to a low-tech way to foster emergent writing with students with severe disabilities. Using partner-

assisted scanning to choose letters through auditory, visual or tactile methods allows students with severe disabilities to demonstrate emergent writing skills. Students who are verbally expressive and are using AT should be able to translate their thoughts to paper, using pictures, letters, words and text.

Social-Emotional

Considering the level of difficulty involved in the motor aspects of writing, some students may experience social-emotional reactions relating to tasks requiring writing. In the case of handwriting, maladaptive behaviors ranging from minimal output to extreme avoidance behaviors may influence the production of written work. Avoidance behaviors have frequently been misinterpreted as laziness, unwillingness or general misbehavior when in fact the student is demonstrating difficulty with the motor aspect of the task. The easiest way to determine if it is a behavior problem versus a problem with the motor component of writing is to ask the student to tell you what they want to write on the paper. If the student has a desire to write and can tell you what they want to write, the behavior may be a reflection of their inability to get the information on the paper.

Handwriting Research

Complexity and multiple factors involved with handwriting

For a review of the literature related to handwriting research and articles addressing a multitude of components related to handwriting, there are several research articles that delineate the various factors involved in handwriting. Cornhill and Case (1996) address factors that relate eye-hand coordination, visuomotor integration and in-hand manipulation to good and poor handwriting. They found that visual motor integration and in-hand manipulation were significant predictors of handwriting. Tseng and Murray (1994) in their research on the perceptual motor factors involved with good and poor handwriting addressed these components of handwriting: visual perception, visual motor integration, manual dexterity, hand-eye coordination, fine motor praxis, and kinesthetic perception. They found that visual motor and hand-eye coordination were the best predictors of all handwriting. With the poor handwriters, praxis (motor planning) contributed the most to legibility and visual perceptual skills contributed the most to legibility of good handwriters.

More recently, research by Volman, van Schendel and Jongmans (2006) on the underlying mechanisms of handwriting difficulties looked at the various factors involved in the motor aspects of handwriting. They found that the poor handwriters had lower skills on visual perception, visual-motor integration, fine motor coordination and cognitive planning. Visual motor integration was again the significant predictor of handwriting. Tseng and Chow (2000) looked at the perceptual motor skills of children with slow handwriting and found a significant difference between slow and normal handwriters in upper-limb coordination, visual memory, spatial relation, form constancy, visual sequential memory, figure ground, visual-motor integration, and sustained attention. For an overview of handwriting research, Graham and Weintraub (1996) have undertaken a meta-analysis of the handwriting research from multiple disciplines. All of these journal articles help the reader understand the extreme complexity of a task that is often taken for granted—handwriting.

Grip

Grip is often the first indication of a problem or possible problem with handwriting. In their research on grip, Schneck and Henderson (1990) provide a descriptive analysis of the developmental progression of grip. It includes pictures representative of grip that can be difficult to verbally describe. Schneck (1991) looks further at grip comparisons of students that have good and poor handwriting. Their results suggest that children with handwriting difficulties may demonstrate a

lower grip score than children without handwriting problems. In addition, among children with poor handwriting, those with decreased proprioceptive-kinesthetic finger awareness may demonstrate a lower grip score than those with good proprioceptive-kinesthetic awareness. Tseng (1998) also evaluated the development of grip positions in preschool children finding that there is more than one grip that is functional. Yakimishyn and Magill-Evans (2002) looked at grip in addition to tools and surface orientation found that a short writing tool used on a vertical surface positively influenced the grasp of young children. Grip form and graphomotor control were compared in a study undertaken by Burton and Dancisak (2000). Their research supported the use of a grip assessment in documenting the grip, and at the same time finding that changing grip did not assist poor writers. Use of this research is helpful when gathering the information on how assistive technology can help students with poor or inefficient grip patterns. Despite its easily observed differences, most researchers agree that grip does not correlate with handwriting as there are many functional writers with unusual grips and many writers with good grip that have difficulty with handwriting.

Visual motor integration

Researchers Weil and Amundson (1994) confirmed to a significant degree what others have found in the correlation between handwriting and visual motor skills. The ability to copy shapes as a predictor for success with handwriting is evident. Cornhill and Case (1996), Tseng and Murray (1994) and Volman, van Schendel, and Jongmans (2006) in their research also agree regarding the influence of visual motor integration on handwriting. There is a significant correlation between visual motor skills and ability as a predictor of handwriting.

Time spent on fine motor skills

Important to handwriting and fine motor skill development is the amount of time spent on this type of activity in the elementary school years. McHale and Cermak (1992) found that 30% to 60% of the day was allocated to fine motor activities, with writing tasks predominating over other manipulative tasks. This illustrates the difficulties and frustrations that children with fine motor issues may encounter every day. Assistive technology may be a way to support students to work through writing with adaptive materials.

Handwriting instruction

Handwriting instruction also impacts the development of handwriting skills. See authors Marr and Cermak (2001) for a literature review of research on the affect of consistency on handwriting instruction.

Using AT to support students with handwriting deficits

When determining how to best meet the needs of students with handwriting difficulties through the use of assistive technology, there are several articles that can help the reader to see what others have done. Moser (2004) reviewed research on both handwriting and assistive technology and reported on the outcome measures for these interventions. This is an excellent article to use when looking for data supporting the use of assistive technology and for information on research for students with handwriting difficulties. Handley-More, Billingsley, and Coggins (2003) addressed the use of technology to facilitate written work. They found that use of word processing with word prediction improves the legibility and spelling of written assignments completed by some children. They concluded that, “It is important to evaluate each child individually and provide training and ongoing support for technology use.” Rogers and Case-Smith (2002) looked at the issue of keyboarding versus handwriting and its affects on written work. They found that keyboarding had only low to moderate correlation with handwriting performance, suggesting that they require distinctly different skills.

Most students who were slow at handwriting or had poor legibility increased the quantity and overall legibility of text they produced with a keyboard. This supports the use of keyboarding as a way to increase and improve a student's writing. Press and Banton (2007) use the SETT process to analyze technology solutions for struggling writers in the school setting and recommend using a feature match process to choose the technology, followed by an implementation plan including, trial, data collection and finally obtaining the technology for the student.

Student's Abilities and Difficulties - Motor Aspects of Writing

As a team, discuss what the student's abilities and difficulties are related to the motor aspects of writing. Please complete and review Section 4 of the WATI Student Information Guide: Motor Aspects of Writing (Chapter 1, page 30).

Indications of writing difficulties are demonstrated in many ways. The student needs adequate support and skills to perform written tasks. To help the team to better understand the abilities and difficulties there are questions that may be asked to elicit the child's current level of functioning. Some examples of questions that you might ask are:

Physical

- Does the student have a desk and chair that fit? (See Chapter 2 on Seating and positioning)
- Does the student demonstrate positioning issues such as laying on desk, frequent need for movement such as rocking, kicking, sitting on feet, excessive walking around?
- Does the student have an efficient grasp of the writing utensil?
- Is the student able to write in the appropriate space?
- Does the student fatigue when writing?

Visual perceptual

- Does the student complete written work in a timely manner?
- Is the student able to maintain their place on the paper?
- Does the student visually attend to all answer fields on a page?
- Does the student fit their answers in the allotted space?
- Is the student able to read the work they have written?
- Is the student able to correctly transfer information by copying?

Social emotional

- Does the student exhibit avoidance behaviors when asked to write?
- Does the student orally express more than they are able to physically write on paper?

Cognitive considerations

- Does the student demonstrate an interest in sharing information?
- Does the student demonstrate attention to task?
- What is the student's learning style?
- Does the student's learning style affect the writing task?
- Is the student able to see the need for producing written work?

Organization

Does the student efficiently prepare materials to initiate writing tasks?

Does the student use and follow an outline or other organizing prewriting technique?

Student Sensory Considerations

Some students are adversely affected by environmental stimulation which others can filter out or ignore. Some common factors which can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space / personal space
- Other individual specific sensitivities

Although these factors are not directly related to the motor aspects of writing, they impact the student's ability to focus on instruction and learning so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations - Motor Aspects of Writing

As a team, discuss and write on chart paper any environmental considerations that might impact the student's motor aspects of writing such as auditory or visual distracters, placement in the classroom, number of different writing environments or any other environmental impacts.

Environmental considerations pertinent to the student's success include:

- Ability to maneuver about the room/school as needed, need to travel from class to class; the number of class changes, and if there is sufficient time for these transitions.
- Lecture or small group, the ratio of adults to students, if the student has an aide.
- Teacher expectations.
- Positioning of the student in clear view of the teacher, the board, displays.
- Sufficient light, board free of glare.
- Ability to hear the teacher; is the auditory stimulation in the room conducive to the student, are students nearby talkative/distracting, is there excessive noise outside the room, does the student need background music to focus best?
- Visual stimulation both in and outside the room, the amount of distracting clutter.
- Student's organization skills; desk/workstation.
- Physical aspects including desk height.
- Positioning of the student with good trunk stability, stability of materials to keep them from falling on the floor.
- Use of a slant board to correctly position papers for visual and dexterity purposes.
- Use of software, availability in all environments needed in the correct platform.
- Accessibility of computers in the classroom.

Environmental Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the acceptable sensory levels in each environment in which the student will be writing.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make a significant difference. If the student is currently using assistive technology, note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Tasks - Motor Aspects of Writing

As a team, discuss and write on chart paper the motor aspects of writing tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? Teachers require written communication in many forms including note taking, worksheets, essays, and tests. In this instance what motor aspects are required to complete the writing task? These are some questions to consider:

- What tasks are required of the student that would influence their choice of assistive technology?
- What is required in the curriculum?
- Is the majority of writing single words, fill in the blanks, sentences, paragraphs, or multiple page term papers?
- What are the daily or weekly written assignment requirements?
- Are test questions taken from lecture notes?
- If the student has difficulty taking notes are peer or teacher notes available?
- What is the format of the test? Essay, multiple choice, true/false?
- Are there pop quizzes?
- Before considering reducing the quantity of the required writing or increasing the time element, would the task be more efficient with the use of assistive technology?
- Are there aspects of the writing assignments that are "busy work" that is not specifically beneficial to increasing the student's understanding?
- Is the student able to meet the reading requirements in order to perform the writing tasks?
- Is someone currently performing the writing tasks for the student and is the goal to make him more independent?

Consider your student's writing development with this typical progression of writing:

- Early Childhood four- and five-year-old kindergarten students are combining letters to write words and their name.
- Kindergarten students are combining letters to write words and their name.
- First graders are filling in worksheets and writing simple sentences.
- First through third graders practice penmanship and learn cursive handwriting. Computers are used, but not using structured keyboarding.
- By fourth grade, students are writing paragraphs and short stories as the writing demands at this stage become increasingly difficult. Computers are used and touch typing keyboarding is taught.
- Middle school and high school students are required to do various types of writing, including extensive papers and projects as well as demonstration of competency to show what they have learned. Handwriting and keyboarding are both used.

Narrowing the Focus - Motor Aspects of Writing -

As a team, identify by circling or highlighting those few tasks the student needs to do for writing that will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies - Motor Aspects of Writing

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for motor aspects of writing. The continuum is generally organized from low to high assistive technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of assistive technology. Subsequent to the continuum is a more in-depth description of select tools.

Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low-and high-tech AT supports.

A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

The Motor Aspects of Writing

Environmental and Seating adaptations



Variety of pencils/pens



Adapted pencil/pen



Adapted paper



Writing templates



Prewritten words/phrases



Label maker



Portable talking dictionary



Portable word processor



Computer with accessibility features



Computer with word processing software



Alternative keyboards



Computer with scanner



Computer with word prediction



Computer with voice recognition software

Low Tech Solutions to Improve Motor Aspects of Writing

♦ Environmental & Seating Adaptations

- (See Chapter 2 – Assistive Technology for Seating, Positioning and Mobility)
 - Slantboard
 - Workspace environment (desk height etc.)
 - Seating
- **Variety of pencils/pens** Office supply and even many discount stores carry a variety of different pencils/pens. They vary in diameter, shape, type of lead used, and many are constructed with a built-in gripping surface. According to research, (Carlson and Cunningham, 1990), allowing the writer to experience a variety of writing tools and allowing them to choose the one that best meets their needs is preferred to selecting the tool for the student.
- Variations of less conventional writing mediums offer students alternatives to the more traditional paper and pencil. For example, markers produce less “resistance” than writing with a pencil, allowing students who might not have the strength to apply adequate pressure to write on paper. Other students may require additional adaptations, such as a *dry erase board* in addition to a marker. Dry erase boards require even less pressure to produce a mark and errors can be easily erased. You can purchase *Memo Board™* dry erase removable paper made by Contact and create your own low cost dry erase boards.

♦ Pencil/pen with adaptive grip

- Just as there are many different pencils and pens, there are also many types of pencil grips. They vary in size, shape, and composition as well as aesthetic qualities such as color. Collect a variety and allow the writer to choose which is most beneficial. Author of *Living in the State of Stuck*, Scherer (2004), feels that the user of the assistive technology needs to have a say in what is prescribed, chosen or used. Having a variety of grips to choose from lets the student know that their opinions and desires are important when choosing a grip or any type of AT.
- You can also make a quick and inexpensive pencil grip using *Adhesive Mounting Putty*.
- *Sculpey* oven bake clay may be formed into custom made grips and baked for a permanent adapted grip.
- Crayons may be melted into various shapes/molds and a Velcro cuff may be added to secure crayons in the student’s hand.
- *3M™ Vetwrap™ Bandaging Tape* is also easily shaped around a writing utensil and comes in colors that are motivating for children.
- Grip on the writing utensil can also be adapted by using the *HandiWriter* splint available from Pocketfull of Therapy. This splint holds the writing utensil in the web space between the thumb and index finger and provides a bead to be held by the ring and little finger. It simulates an efficient grip enabling the child to use this grip until their hands have developed the strength and coordination to do it independently. It can also be fabricated with easily available materials for students using their choice of colors and beads, giving the student input to splint and helping to engage them in using the splint.

♦ Adapted paper

- There are a variety of papers available at school supply and discount stores. Some variations include line width, color, and texture for students requiring additional sensory input.
 - *Right Line Paper*; wide rule, narrow rule, stop-go red-green with raised lines.

- *Literacy Lined Paper* notebooks.
 - You can make your own raised line paper
 - Using *Elmer's glue* carefully trace the lines on paper then let it dry
 - Using *Wikki Stix*[™], place stix on lines for temporary raised line
 - You can use the software *Boardmaker* to make sheets with boxes for students to write in. The boxes provide a visual space to write in and help corral the student's writing. They can be made different sizes and help the students learn the concept of space between words as a box is left blank between words. Using different sized boxes can also help determine what the optimal space size best meets the student's needs.
- ◆ **Adapting worksheets/Writing templates**
- For fill in the blank worksheets, draw a box in the answer space to help the child corral their writing and see what space they have to write in.
 - Another way to adapt the worksheet is to use a word bank and number the words. The student can then put the number of the word in the blank and if time allows they can write the words in after all the numbers are put in the blank. This way the writing does not interfere with content of the worksheet. The writing can still be practiced, but if there is not enough time to complete the writing portion, the knowledge has still been demonstrated.
 - Enlarge the worksheet on a copy machine so that the child does not need to make as small or precise a mark as the other students may help with their ability to perform independent written work.
 - Taping the worksheet to the desk or placing it on a clipboard may also make it easier for the student to write on by stabilizing it for them. This is especially helpful for students with use of only one arm or who have difficulty with having their hands do two different movements at the same time.
 - *Magnet letters, words or phrases* may be used by students as an alternative to writing their response.
 - Using things like masking tape, *Velcro*[™], *Dycem*[®], *gripping stuff*, or non slip rubber mats from Rubbermaid is another way to hold things in place. These simple items can go a long way to help make materials more accessible.
- ◆ **Use of Prewritten Words/Phrases**
- It is extremely important to provide students with the opportunity to produce written language even though they may not have the motor skills to adequately do so in the traditional method using a pencil and paper. One way to do this is to provide words already written that can be placed in sentences and paragraphs. This requires only a swiping motion to move the words into the desired arrangement. *Magnetic Poetry*[®] is a commercial product offering preprinted words in various sizes. You can create your own pre-written words and phrases using magnetic paper or a label maker. Words can be printed on paper or card stock and stuck to magnetic material or be printed directly on magnetic paper. The student can then arrange them on a metal surface. Magnets can also be used by students to indicate choices on worksheets mounted on a cookie sheet beneath plastic.
 - Preprint numbers, letters and or words with a label maker and allow the child to choose what they need and stick it on the paper. An egg carton(s) works well for storing the letters and numbers for the child to choose from. A sticker of each letter can be put on the side of each egg cup so the child can easily see what they letters are.
 - Use rubber stamps for stamping student's name on papers or for answering one-digit answers on worksheets. The student's needs and environment need to be assessed when looking at

stamps. In particular, pay attention to the size of the stamped image, the need for an ink pad, and the grip and pressure required to use the stamp. Some stamps are self-inking. This can reduce the need and the potential mess of a stamp pad.

- Software programs that help you to create your own word banks. Any word processing program can be used to make word banks. More specialized software manufacturers include Slater Software, Mayer-Johnson, IntelliTools and Crick. These word banks can be used on the computer or printed out.
- The *IntelliShare Classroom Activity Exchange* site <http://aex.intellitools.com/> is one source that offers already created activities that allows a student to retell a story, sequence events, create their own story, etc.

◆ Writing templates

- A variety of plastic or metal *writing guides* are available from independent living aids catalogs. Writing guides are pieces of plastic with cut out areas for writing within cutout lines. They come in various sizes for writing checks, signatures, letters and envelopes. You can also make your own templates out of cardboard, manila folders or a thin plastic such as overhead transparencies.
- *Wikki Stix*™ may be used as a writing guide. *Wikki Stix*™ are colorful, flexible “sticks” made out of a wax coated string that is tacky to touch. They stick to any surface and peel off without a trace. They can be placed on the bottom or top writing line as a guide. Children can form letters with *Wikki Stix*™ or use them as letter guides when writing.
- Teacher-made templates for note taking can reduce writing demands by providing a fill in the blank format. This works well for learning note taking skills, as the teacher can leave out important words for the child to fill in as they are listening. The student is not required to write down all the extraneous information.
- Students who are unable to write even single words are often given the notes from the teacher. It is important to encourage attending to the lecture by requiring the student to circle, highlight or otherwise mark the main idea as it is being discussed. This helps discourage students from thinking they don’t have to pay attention because their notes are already done. It also gives the teacher a way to monitor a student’s attending skills and comprehension. The teacher may easily redirect the student’s attention to the copy of the notes to ensure that they are used correctly.

Mid and High Tech Solutions to Improve Motor Aspects of Writing

◆ Label maker

- The new *electronic label makers* are another way for students with difficulties forming letters to produce written work. They can be used to type a word or phrase, print it out and attach to a worksheet or other document. You may be able to check in your local school office area to borrow one. Since these devices are readily available, using a feature match will help determine the best choice for the student. There are numerous types and sources of label makers. When choosing a label maker here are some features to consider:
 - Keyboard- Size of keyboard, size of buttons, layout (QWERTY vs. ABC)
 - Features -fonts, font sizes, color of text, memory, complexity of special features,
 - Tape- size, length, color or transparent
 - Tape cutter- automatic or manual
 - Cost- machine and tape refills

◆ **Portable talking dictionary**

A student with spelling challenges may need to look up words in a dictionary. The added benefit of the *talking dictionary* is that it provides additional auditory support to students during the writing process. Some dictionaries will spell the word one letter at a time allowing the student to write the word without having to look back and forth to the dictionary.

- *Franklin Children's Speller & Dictionary*
- *Franklin Homework Wiz Speller & Dictionary*

◆ **Portable Word Processors**

If you are looking for increased computer access for students with disabilities but need to keep costs down, you may want to consider purchasing a portable word processor that will interface with a computer. Portable word processors are lightweight (2.3 lbs. or less) and extremely inexpensive (under \$400) when compared to a laptop computer. There are many portable word processors available, however below is information on some of the more popular ones that you might want to consider. They are very similar, but each has slight differences in features that you will want to consider when purchasing.

- *Dana*[™] by AlphaSmart[®] is an alternative, lightweight keyboard/computer that provides portable access to a full-featured word processor in addition to the organization tools of the Palm[™] operating system. It is an electronic notebook that you can synchronize with a computer or send files directly to a printer. The organization tools include a Data Book with calendar and alarms, an Address Book, and a To Do List for prioritizing tasks like assignments. *TextPlus*, a word prediction applet, and many other inexpensive software programs that run on the *Dana* are also available to help a student.
- *CalcuScribe* is a portable word processor that allows the student to create text files that can be used by any application once sent to a computer. It also houses an interactive calculator for arithmetic, algebra, and trigonometry that allows the student to do math problems in a word processing environment and save the calculations to send to a computer. Using the infrared pods, files can be shared with other *CalcuScribes* or sent to a printer without going through a computer first. (The printer needs IR to do this.)
- *The Fusion Keyboard* by Advanced Keyboard Technologies is a portable notetaker which features a large LCD screen with a choice of font sizes, word prediction, keyboarding and optional text to speech.
- The *Laser PC-6* by Perfect Solutions offers the additional feature of text-to-speech capabilities to the portable word processor. Text can be viewed on a changeable 4 line by 40 or 8 lines by 80 character screens. It comes with eight built-in programs including a word processor with word prediction, sticky keys, spell checker, homework calendar, typing tutor, database, spreadsheets, and a scientific calculator. It weighs 2.75 lbs with battery and has a memory of 256K which allows for 45 named files and 14 pages max of text per file with 100 pages text overall. Perfect Solutions also offers 2 add-on options. The text-to-speech cartridge provides talking word processing including talking spell checker and word prediction, and it allows text to be spoken in letters, words, sentences or paragraphs.
- *NEO* by AlphaSmart[®] is a light-weight, portable, stand-alone notebook for word processing and math. Ready to send text to any computer or printer using USB cable or infrared. Features include file management, word-processing with spell check, thesaurus, calculator, features for special needs including sticky keys, slow keys.
- *The Writer* by Advanced Keyboard Technologies is a portable word processor that allows students to organize and store their assignments, by name, in 1 of 16 password-protected work

folders. Features include wireless infrared file transfer capability or via a USB connection to a Mac or PC computer, spell check, and word prediction.

- *UBI DUO* is a device that resembles two small portable keyboards. It was designed for the deaf or hearing impaired to communicate with anyone at anytime, without a third party, personal interpreter. The communication mimics text messaging and instant messaging. It is not intended as a word processor but has features that would make it appropriate for note taking, real time modeling, or asking questions.

A chart that compares some of the features of the portable word processors is on the following page.

Portable Word Processors

Product	Ordering Info	Features	Advantages	Disadvantages
<i>NEO</i>	AlphaSmart, a division of Renaissance Learning, Inc. P.O. Box 8036 Wisconsin Rapids, WI 54495-8036	Full size keyboard Large LCD screen USB & Infrared Special Needs features (sticky keys etc.) Small to Extra large fonts	Portable & rugged 2 MB software storage for multiple applets 512KB storage for 100's of text pages Alternative keyboard layouts Under \$250.00	
<i>CalcuScribe</i>	CalcuScribe 98 Cervantes Blvd. Suite #1 San Francisco, CA 94123-1672	Word Processing Calculator 300 hours on 3 AA 50 page memory Full sized keyboard Infrared capabilities 2.75 lbs	Sticky Keys Auto-repeat option Zoom feature – 8 pt to 16 pt Unlimited files Under \$275.00	Unable to download files from PC
<i>Dana</i>	AlphaSmart, a division of Renaissance Learning, Inc. P.O. Box 8036 Wisconsin Rapids, WI 54495-8036	Runs Palm applications Date book Address book, Memo Pad, To Do List Infrared capable	Lightweight Onscreen keyboard/graffiti Easy touch keyboard Larger LCD runs over 10,000 applications Under \$430.00	Graffiti and onscreen input available only in vertical setup
<i>The Fusion</i>	The Writer Learning Systems PO Box 186 Paso Robles, CA 93447-186	portable notetaker word prediction Dictionary & Thesaurus keyboarding tuition optional text to speech.	Large LCD up to 10 lines of print Large font for vision issues lightweight Under \$415.00	
<i>Laser PC-6</i>	Perfect Solutions Software, Inc 15950 Schweizer Court West Palm Beach, FL 33414-7128	Word Processing Spell Checking Spreadsheets	Adjustable size of text Typing tutor Text-to-speech Under \$150.00	8 built in programs add to complexity
<i>The Writer</i>	Advanced Keyboard Technologies, Inc. P.O. Box 2418 Paso Robles, CA 93447-2418	Infrared capabilities Auto-Thesaurus Spell Check Password protected folders	KeyAcademy™ keyboarding program – 116 lessons WriterExpress™ -customized formatted files Word prediction in Education Package Power skin overlays available Good writing checklist Under \$200.00	
<i>UBI Duo</i>	SComm 6238 Hadley Street Raytown, MO 64133	2 keyboards in one device Wireless Allows 2-4 people to text each other Adjustable Font size 12 to 24pt Change contrast between text and background	2-4 people can communicate Could provide just-in-time note-taker Download text to computer Save text \$1995	

◆ Operating system Accessibility Features

Both Windows and Mac platforms offer accessibility settings helpful to people with visual, hearing, and mobility needs. Some examples of these are sticky keys (the ability of one key to stay depressed so that another key can be pressed at the same time-- i. e., when you press the shift key), key repeat rate (changing the key repeat rate so that students with difficulties releasing the keys do not get multiple letters printed), magnification (the ability to change the size of the information on the screen), visual or auditory alarms (to compensate for the typical alarms that may not work for the student's disability).

- To learn about Microsoft accessibility features go to: <http://www.microsoft.com/ENABLE/>
- Go to Apple Accessibility website for information about accessibility settings and pdf. files that describe in detail the settings and how to use them. <http://www.apple.com/accessibility/>

♦ **Computer with Word Processing Software**

- The computer can be an exceptionally effective tool to support students who are struggling with writing. Word processing on the computer offers the opportunity to change letters, words, sentences, and paragraphs easily and quickly while allowing a clean, attractive, and readable end product.
- Formatting options such as font styles, color and size are beneficial for the visually impaired and motivating for students who have struggled to produce legible materials.

♦ **Alternative Keyboards / Alternative Access**

Another means to provide access for a student who is experiencing difficulties with the motor aspects of writing is to use an alternative keyboard (See Chapter 4 – Assistive technology for Computer Access)

- *IntelliKeys*® USB from IntelliTools, Inc is an alternative keyboard that enables students with physical, visual, or cognitive disabilities who can press and release a part of the keyboard to type, enter numbers, navigate onscreen displays, and execute menu commands. The *IntelliKeys*® keyboard comes with six standard overlays (plus a setup overlay) that are ready to use with any word processing program or software that requires keyboard input. These overlays include an alphabetical overlay which is very useful for early writers. The *IntelliKeys*® is a programmable alternative keyboard which can be configured to almost any layout based on student need. Mac/Win compatible.
- *Big Keys* is an alternative keyboard with large keys and features which may include color coded keys or high-contrast lettering and an optional detachable Plexiglas keyguard. Features: optional ASSIST Mode (for those who cannot press 2 or more keys simultaneously or need 1-handed typing; works with and enhances the Windows "Sticky Key" Accessibility Option), and optional ability to switch between ABC and QWERTY layouts. No special software required; it is a plug 'n play device. This keyboard comes with a USB adapter making it compatible with both Win and Mac computers.
- *Logitech diNovo Mini* is a palm sized cordless mini keyboard that connects to the computer or is used for running entertainment options. This keyboard has the thumb layout of many phones which proves to be more accessible to some users.
- Another popular alternative keyboard is the *TASH USB Mini keyboard*, a small size alternative keyboard that plugs directly into a computer with no special interface needed. The membrane keys are less than one half inch square and are closely spaced for easy access. This is especially useful to someone with limited range of motion.
- *Dana/Neo*: see portable word processors above.
- *Onscreen keyboards* provide the various keyboard layouts on the computer screen. Depending on the software, selections on the keyboards may be made by mouse click, mouse dwell, or scanning. Use of the onscreen keyboard decreases the physical space between the keyboard and the monitor, thus eliminating some distracters. Onscreen keyboards are now available through the latest versions of both Windows and Mac.
- *Handwriting recognition* is a feature available through Microsoft Word. Your natural handwriting is converted to typed characters and inserted into the word document. You can write directly on a Tablet PC or on non-touchscreen computers by using a handwriting input device, such as a *Graphire pen tablet device* used with 3-D drawing programs or *Computer Aided Drafting (CAD)* software, or you can write using your mouse.

- *Handheld computers* offer a small, portable tool for written language. Handhelds allow input of text into various applications including memo pad, to do list, and word processing programs. Text can be inputted via a small onscreen keyboard and stylus or by writing on the handheld's LCD screen. The latest in handheld operating system software allow the student to write anywhere on the screen and the written words are translated into text. A variety of keyboards are available for use with the handhelds including portable wireless keyboards and snap on thumb keyboards. Some handhelds such as the Blackberry, iTouch or iPhone come with a thumb keyboard and also touch screen and onscreen keyboards.
- *Tablet PCs* also offer word processing applications with all the capabilities of a laptop or desktop. The Tablet PC incorporates a touch screen with handwriting recognition capabilities.
- *iTouch* offers an MP3 device with Internet connectivity and hundreds of downloadable applications. Using an MP3 format, this device is not only beneficial for listening to audible books, but can be used as a writing tool through applications for word prediction, instant messaging, and email. The technology for this device is evolving and becoming very usable and much less expensive.

◆ Scanning

A scanner connected to the computer may be used to assist writing by scanning worksheets or chapter questions that the student may then access digitally on the computer. Worksheets may be designed with text boxes for short answer, fill in the blank, multiple choice or true/false. A student using other software to assist writing, such as word prediction or voice recognition, would then be able to complete worksheets using these types of programs. (See Chapter 7 – Assistive Technology for Reading.)

- Many of today's light portable scanners come with a scanning program and many are compatible with various scan and read software frequently used (e.g. *Kurzweil*, *WYNN*, *Read and Write Gold*, *Premier*)
- OCR (optical character recognition) scanning software is required if you intend to have the scanned documents used with text-to-speech software. Classic scanning software simply takes a picture of a document versus recognizing characters or letters as with the OCR scanning software. A classic scanning program may be used for worksheets that a student can read independently. Text boxes may be inserted to this type of document and the student may answer the questions digitally.
- Consider a high speed scanner for scanning entire textbooks or workbooks. Keep in mind copyright laws. The student must have a purchased workbook and be identified as a student with a print disability. (See Chapter 7 – Assistive Technology for Reading-NIMAS Standards)

◆ Portable Scanners

Portable handheld scanners work like a digital highlighter to scan and read text from books, magazines, newspapers, and other printed documents. They capture the text to memory and allow the user to download the text to their PC via a cable. This tool allows a student to capture important information from textbooks, glossaries, research materials, etc. and download it directly into a word processor.

- The *QuickLink Pen* from Wizcom Technologies, Inc., LTD is a handheld scanner that scans full lines of text from 6-22 point size, store it, and then transfer it to a computer, Palm Pilot, or text enabled cellular phone.
- The *SuperPen Voice* from Wizcom Technologies, Inc., LTD is a handheld scanner and translator. The pen combines the functionalities of the *Quicktionary II* and the *QuickLink*

Pen. This pen allows the user to scan full sentences of text and receive instantaneous auditory word-by-word translation. The pen weighs 3 ounces and is capable of storing up to 3000 pages of data.

◆ Computer with Word Prediction Software

Word prediction is most frequently considered for the student with spelling difficulties but should not be overlooked for the student with mechanical difficulties. The use of word prediction software may decrease keystrokes and increase quantity and efficiency; for the student with physical limitations, using fewer keystrokes to complete words and phrases will increase the quantity and quality of writing, while reducing fatigue. Word prediction software is fairly easy to use, and requires minimal instruction. Many programs include phonetic spelling prediction, auditory text to speech feedback and customized topic dictionaries to assist students in many curriculum areas.

- Most scan and read programs now include word prediction (e.g. *Kurzweil*, *WYNN*, *Read and Write Gold*, *SOLO*)
- Other word prediction programs: *WordQ* by Quillsoft, *Premier Accessibility Suite* including *Predictor Pro* by Premier Literacy, *Clicker 5*, *Pen Friend* and *Wordbar* by Crick, *Co:Writer* by Don Johnston, *IntelliTalk* by IntelliTools, *ClaroRead* by Claro Software.

◆ Voice Recognition Software

Voice recognition is a computer application that lets people control a computer by using speech. Students can write using voice recognition in conjunction with a standard word processing program. When users speak into the microphone their words appear on a computer screen in a word processing format, ready for revision and editing. Not only can voice recognition software benefit students with learning disabilities but also the student with physical access challenges. While many such students benefit from standard word processing, the visual-motor demands of keyboarding can be a major stumbling block that compounds the writing process. Similarly, students who are the poorest spellers are frequently unable to effectively use standard spell checkers. For whatever reason, if a student's oral language skills far exceed their ability to generate text with pencil and paper or standard word processing, voice recognition may enable them to become successful writers.

There are two kinds of voice recognition software: discrete speech and continuous speech. Discrete speech recognition requires the user to speak one - word - at - a - time. Continuous speech recognition allows the user to dictate by speaking at a more or less normal rate; both have their advantages and disadvantages.

Dragon NaturallySpeaking is one of the most comprehensive voice recognition programs for the Windows OS, enabling hands-free navigation and dictation in Microsoft® Word, Excel®, Corel® WordPerfect®, and virtually all Windows®-based applications. *Dragon NaturallySpeaking* may be used to create documents, reports, send e-mails, instant messages, surf the web, and even operate many of the computer functions.

Microsoft Office has incorporated voice recognition within *Microsoft Word 2003 and XP*. The voice recognition engine within Word is not designed specifically for individuals with disabilities; however, it provides an excellent diagnostic tool to use to determine if voice recognition may indeed be a useful tool for the student. The voice recognition component requires custom installation.

Microsoft Windows Vista operating system now has voice recognition built into the operating system.

SpeakQ by Quillsoft plugs into *WordQ* and adds simple speech recognition. Users can benefit from a combination of word prediction, speech output and speech input to generate text when stuck with spelling and word forms, identifying errors, proofreading and editing. Designed with special students needs in mind, it works in both discrete and continuous modes.

IBM ViaVoice for Mac OS X is a continuous speech voice dictation for Apple's Mac OS X. Users can dictate, correct, edit, and format text with their natural voice. Mac OS X Edition also provides voice command and control of the Internet, so users can move back and forth between Web sites. An enhanced Speech Recognition Engine takes advantage of Mac OS X audio features and provides for a fast enrollment.

Writing AT into the IEP

There are many correct ways to write AT into the IEP. It must be considered on the special factors form of the IEP and a listing of AT may be included there. It may be included as a related service and maybe also be included as a supplemental aid or service. If in an exploratory phase, do not write AT as a goal, put it in the special factors until the technology has been determined to work for the student.. (Purcell, Grant, 2002, 2004, 2007) and (Bateman, Herr 2003) state many examples of writing present level of performance, objectives and goals.

The following is a four step formula for writing an IEP goal.

(e.g. #1)

Time Frame: In 36 weeks

Conditions: Given a computer with adapted keyboarding

Behavior: Eric will use an onscreen keyboard to complete writing assignments

Criterion: in 10th grade English and civics class

(e.g. #2)

Given access to a computer with voice recognition (condition), the student will dictate sentences (behavior) averaging 15 words per minute in a 10 min. practice session (criterion) one of two opportunities (time frame).

Solution Selection: Tools & Strategies - Motor Aspects of Writing

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the motor aspects of writing tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan - Motor Aspects of Writing

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training

needed and any other student/staff specific issues. Be certain to identify motor aspects of writing objectives and criteria of performance to determine the effectiveness of the trials.

Feature Match

The following charts are examples of ways to involve the student in the feature match process. The student can choose the template that appeals to them visually. Then the student can highlight or otherwise mark their thought process when choosing the tool for the specific task they need to accomplish. It can also be used to remind the student of the choices they may have. Additionally, the student can have copies of it available to them to use independently to further increase their ability to perform written tasks.

Motor Aspects of Writing Continuum: Matching the tool to the task
A worksheet for users of multiple writing tools

Variables:

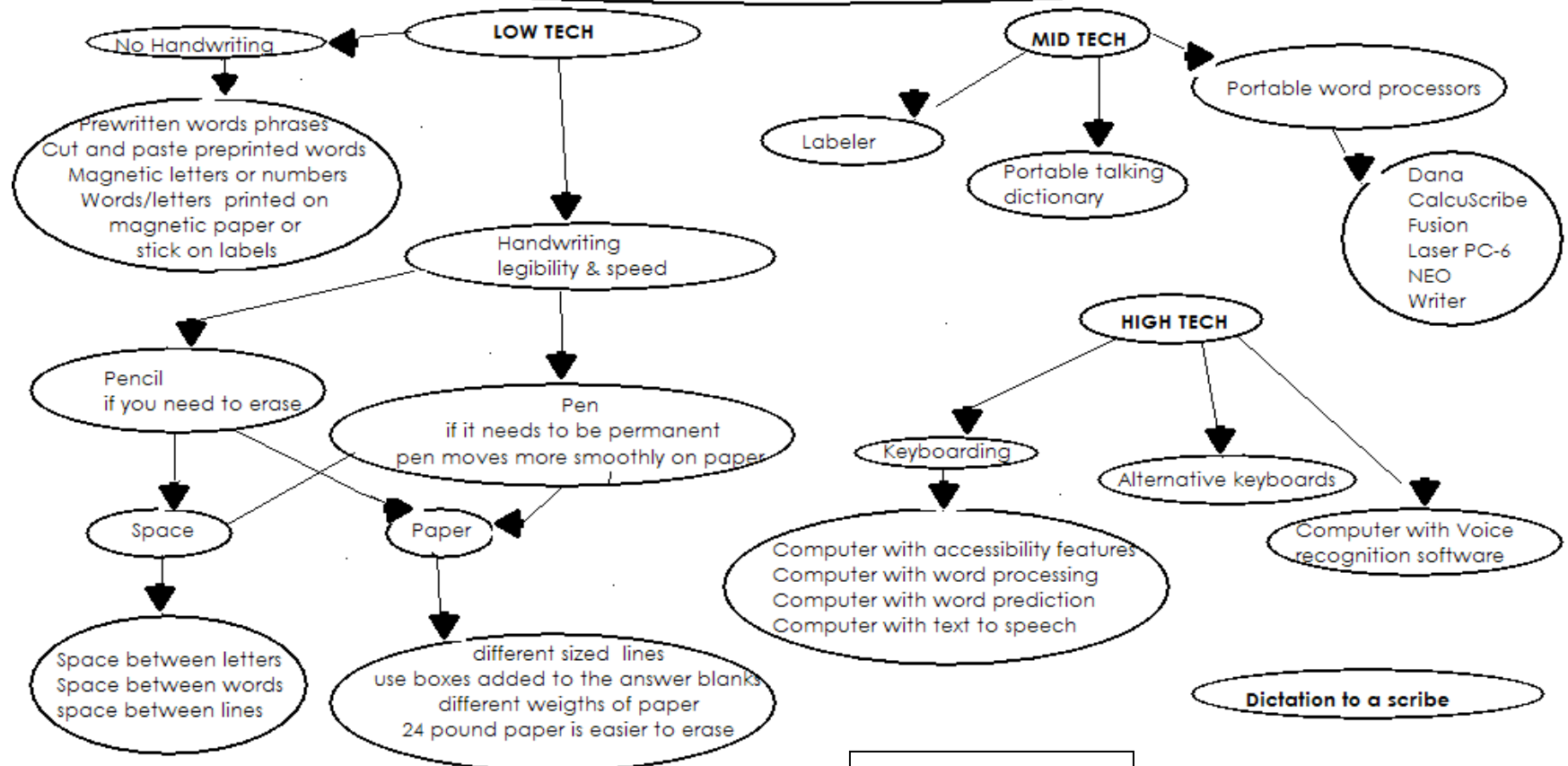
Purpose of the task (Are there other ways to do the work besides writing? circle, number, dictate)

Copying information.....review information.....demonstrate knowledge.....create new information

Amount of writing single words.....sentences.....paragraphs.....essays.....papers

Revisions or editing none.....pencil editing.....one draft.....multiple drafts

Due date immediately.....next day.....next week.....next month



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Text alternative for Motor Aspects of Writing Continuum: Matching the tool to the task. A worksheet for users of multipole writing tools.

Variables:

Purpose of the task (Are there other ways to do the work besides writing? Circle, number, dictate).

- Copying information
 - Review information
 - Demonstrate knowledge
 - Create new information
- Amount of writing
 - Single words
 - Sentences
 - Paragraphs
 - Essays
 - Papers
- Revisions or editing
 - None
 - Pencil editing
 - One draft
 - Multiple drafts
- Due date
 - Immediately
 - Next day
 - Next week
 - Next month

Low-Tech

No handwriting

- Prewritten words phrases
- Cut and paste preprinted words
- Magnetic letters or numbers
- Words/letters printed on magnetic paper or stick on labels

Handwriting

- Legibility and speed
- Pencil if you need to erase
 - Space
 - Space between letters
 - Space between words
 - Space between lines
 - Paper
 - Different sized lines
 - Use boxes added to the answer blanks
 - Different weights of paper

- 24-pound paper is easier to erase
- Pen if it needs to be permanent.
 - Pen moves more smoothly on paper
 - Space
 - Space between letters
 - Space between words
 - Space between lines
 - Paper
 - Different sized lines
 - Use boxes added to the answer blanks
 - Different weights of paper
 - 24-pound paper is easier to erase

Mid-Tech

- Labeler
- Portable talking dictionary
- Portable word processors
 - Dana
 - CalcuScribe
 - Fusion
 - Laser PC-6
 - NEO
 - Writer

High-Tech

- Keyboarding
 - Computer with accessibility features
 - Computer with word processing
 - Computer with word prediction
 - Computer with text-to-speech
- Alternative keyboards
- Computer with voice recognition software

Dictation to a scribe

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Motor Aspects of Writing Feature Match- Matching the tool to the task

Factors to Consider

1. **Amount of writing** Very little.....to.....Lots of writing
 Single words.....Sentences.....Paragraphs.....Essays.....Papers
2. **Due date** right away.....to.....much later date
 Immediately.....Next day Next week.....Next month
3. **Purpose of task** Are there other ways to do the work besides writing?
 Copying information.....Review information.....Demonstrate knowledge.....Create new information
4. **Revisions or editing required**
 None.....Editing done with pencil.....One draft.....Multiple drafts

Low tech

- *Utensils*- Variety of sizes and types
- *Utensils* -Modified with pencil grip or splint
- *Paper*-different sized lines, boxes *heavier paper (24 pound) is easier to write on and erase*
- Templates- eliminate excess writing
- Prewritten words phrases
- Cut and paste preprinted words
- Magnetic letters or numbers
- Words printed on magnetic paper
- *Handwriting*
- Writing tools pencils, mechanical pencils, markers, pens
- Increasing handwriting legibility
- Space between words, between lines
- Margins -keep uncrowded
- Note taking- make copies, use carbon paper or get from teacher

Mid Tech

- Labeler
- Portable word processor

High tech

- Computer with accessibility features
- Computer with word processing
- Alternative keyboard
- Computer with word prediction
- Computer with Voice recognition software

No Tech

- Dictation to another person
- Although not assistive technology, dictation can solve some of the issues with written language assignments

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Product/Vendor Guide

Product	Vendor
3M TM Vetwrap TM Bandaging Tape	Available locally
Adhesive Mounting Putty	Available locally
BigKeys	Graystone Digital, Inc.
CalcuScribe	CalcuScribe
Dana TM	AlphaSmart, Inc.
Dragon Naturally Speaking	Nuance
Dycem [®]	Dycem Technologies
Franklin Children's Speller & Dictionary	Franklin Electronic Publishers
Franklin Homework Wiz Speller & Dictionary	Franklin Electronic Publishers
Handheld computers	Palm, Compaq, Handspring etc.
IBM Viavoice	Nuance
IntelliKeys [®]	IntelliTools, Inc.
Laser PC-6	Perfect Solutions
Magnetic Poetry [®]	Magnetic Poetry
Memo Board TM Contact Paper	Available locally
Microsoft Office	Microsoft
Microsoft Windows	Microsoft
NEO	AlphaSmart, Inc.
QuickLink Pen	Wizcom Technologies, Inc.
Quicktionary II	Wizcom Technologies, Inc.
Research Assistant for Students (and Teachers) with Bibliography Generator	ESSDACK
Sculpey modeling clay	Available locally
SmartApplets	AlphaSmart, Inc.
SpeakQ	Quillsoft
Product	Vendor
SuperPen Voice	Wizcom Technologies, Inc.
TASH USB Mini keyboard	TASH Inc.
The Writer	
Velcro TM	Available locally
ViaVoice [®]	IBM North America
Wikki Stix TM	Wikki Stix

Chapter 6 – Assistive Technology for the Composition of Written Material

Introduction.....	1
Using the SETT Process	2
Decision Making Guide	3
Decision Making Guide Expanded.....	4
Continuum.....	7
Continuum Expanded.....	8
Web Resources	12
Product Resources	13

Assistive Technology for the Composition of Written Material

Kim Swenson, Mary Wirkus, Marcia Obukowitz

Introduction

Writing is a complex process that involves both the physical mechanics of handwriting and the cognitive component of organizing, creating or composing written material. This chapter focuses on tools that may assist students who struggle with writing composition.

“Composition is the plan, placement, or arrangements of the elements.” (www.wikipedia.org) Composition of writing involves the ability of the student to express ideas in a way that is meaningful to others. Standards for the development of literacy suggest that good writing necessitates a linear path to the end product. A student is required to learn a concept or series of concepts, to organize that information into a linear form, and then compose the ideas in a meaningful way which creates a presentation that express ideas surrounding a specific topic.

A common concern expressed by teachers, parents, and in some cases, the students themselves is “They have good ideas but just can’t get them down on paper.” Understanding the writing sequence and adding supports as needed may help students. For others there may be alternate ways to share or present what they know. The following tools may assist students in overcoming or adapting to the writing obstacles they face.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student’s progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Composing Written Materials

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to the area of concern? - Struggles getting thoughts on paper - Problems organizing thoughts - Doesn't know how to get started with the writing process	What environmental considerations impact the area of concern? - Teacher's expectations concerning tool use - Rigor of assignments - No one trained in operation of tools - Limited access to tool - Current/past AT used	What task(s) do you want the student to do? - Generate ideas - Organize writing - Getting ideas on paper - Connecting ideas - Appropriate citations and formats - Using correct grammar, spelling and/or punctuation
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts this area of concern? (i.e., visual, auditory, tactile) Visual clutter, background noise, tactile stimulation, awareness of physical space, fluorescent lighting versus full spectrum lighting		i.e. Identify specific task(s) for solution generation After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team will focus on. The tasks that remain can become your new focus at a later date.
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decisions yet Review the area continuum	Use a Feature Match Process to discuss and select idea(s) from Solution Generation	AT Trials/Services Needed: - Date - Length - Person Responsible - Formulate objectives/criteria to determine success of trial/AT
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

Students may struggle getting thoughts on paper, organizing thoughts, getting started with the process of writing, and/or making a mental picture of what to write about.

As a team, discuss what the student's abilities and difficulties are related to composing writing. Please complete and review Section 5 of the WATI Student Information Guide: Composing Written Material (Chapter 1, page 32).

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as:

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space
- Other individual specific sensitivities

Although these factors are not directly related to writing, they impact the student's ability to focus on instruction and learning so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Concerns

As a team, discuss and write on chart paper any environmental considerations that might impact the student's writing such as auditory or visual distracters, placement in the classroom, number of different writing environments or any other environmental impacts.

An area to consider may include teacher expectations such as: rigor of the assignment, goal of the composition process, comfort level with alternative media as an expression of knowledge (i.e., *PowerPoint*, Venn Diagrams, *Inspiration* outlines, etc.), rubrics for evaluation of the project or facilitation of tool use.

What are the tools already available in the student's classroom or in the school? Are they pre-loaded and ready? Have all the student's teachers and the student themselves been trained in how to use the tool? Are the number and location of tools appropriate to allow access to the student in all environments? What supports are in place for the teacher to facilitate tool use?

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Some students are adversely affected by environmental stimulation which others can filter out or ignore. Some common factors which can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as: visual clutter, fluorescent lighting versus full spectrum lighting, classroom and background noise, tactile stimulation, awareness of physical space or other student specific sensitivities.

Although these factors are not directly related to writing, they impact the student's ability to focus on instruction and learning and should always be considered.

Tasks

As a team, discuss and write on chart paper the reading tasks that the student needs to do. One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what does the student need to write and then what does the student need to do with the information written? Some examples may include: generating ideas, organizing writing, getting ideas on paper, using appropriate grammar/spelling/punctuation, connecting ideas to make sense to the reader or using appropriate citations and formats.

Narrowing the Focus

As a team identify, by circling or other means, those few tasks the student needs to do for writing that will have the most impact.

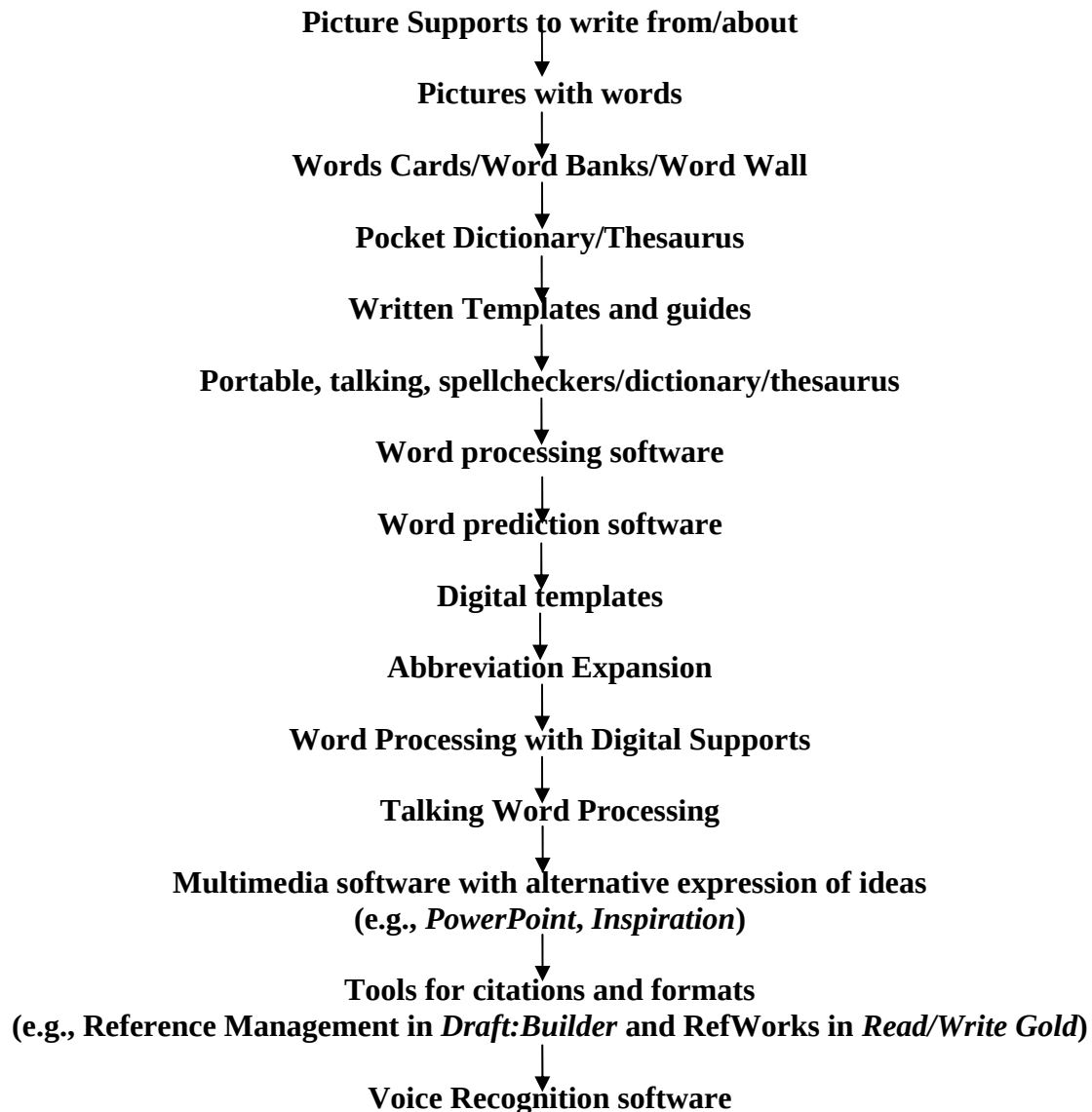
After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed earlier follow the general continuum for writing. The continuum is generally organized from low to high assistive technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A Continuum of Considerations for Assistive Technology For Composing Written Materials



Chapter 6 - Assistive Technology for the Composition of Written Material

Picture Supports to write from or about

Some students have difficulty determining a topic or image about which to write. Students on the autism spectrum may not be able to readily form a visual picture of what they are to be writing about. Utilizing a picture from a magazine, a digital photograph, or a textbook picture may help to provide the visual support necessary for the student to be able to complete a written activity.

Pictures with words

Some students may need pictures or photos with word labels attached. For students who seem to have difficulty finding the correct word, having the picture label may help them identify the words they are looking for. Thus the student is able to spend his/her time and energy on writing about the topic, instead wasting valuable time searching for the correct word. Specific software: *Boardmaker*, *Picture It*, *Writing with Symbols*, *Pix Writer*.

Word Cards/Word Banks/Word Wall

These tools are commonly used in many elementary school classrooms, and help to provide students who struggle with writing by having frequently used words displayed on the classroom walls, study carrels, dividers, or on charts. These visual tools provide examples of words the student might need to use in the given activity. These words can also be added to word prediction programs that have topic dictionaries for easy retrieval while they are writing. Writing with Pictures: using a picture-based writing program such as *PixWriter* will allow students to write even if they are unable to spell. The student can begin to put together simple picture sentences.

Pocket Dictionary/Thesaurus

If a student is able to look up words in a dictionary or thesaurus, these pocket models can be useful. Because they are portable and unobtrusive, the student is able to utilize the tool whenever needed.

Written Templates and Guides

These may include “story starters” and other sentence builders that can help students by allowing them to fill in words or phrases to make complete sentences. Various templates can be created for the main idea, supporting characters, developing plots, etc. Templates can be created of varying complexity depending upon the needs of the student. Specific software such as *Kidspiration* or *Inspiration* work very well for making templates.

Portable Talking Spell Checkers, Dictionaries and Thesaurus

Stand-alone desktop and pocket sized spell checkers are available. Some are based on exact spelling while others use phonics to help a student find the word they are trying to write. Most stand alone spell checkers have a small keyboard to enter the word the way a student thinks it's spelled. Homonyms can be particularly difficult. When words sound alike but have different meanings (there/their/they're), some spell checkers will not show the other options. Using the wrong spelling changes the meaning and can increase the frustration of the writer, having a dictionary component as part of the spell checker can help decrease that frustration. When a word is spelled phonetically, it may not be recognized with all spell checkers. The spell checker suggests words that begin with the same two or three letters typed in. Spelling that's not phonetic may not be recognized, so no suggestions for the correct word are given. Chances of success are greater if the first two or three letters are typed correctly.

Chapter 6 - Assistive Technology for the Composition of Written Material

Talking spell checkers and electronic dictionaries such as Franklin etc. can help a poor speller select or identify appropriate words and correct spelling errors during the process of writing and proofreading. Talking devices “read aloud” and display the selected words onscreen, so the user can see and hear the words. Match the student’s needs with the features - speech, thesaurus, help with words that sound alike but are spelled differently, and capabilities of the device.

Check the keyboard of the electronic, handheld spell checker for asterisk and question mark keys. Depending on the design of the device, those two keys may be used to help you find the correct spelling. The asterisk often is used as a marker for an indefinite number of missing letters. For instance, typing in "neu*" yields a list of words beginning with those two letters and, hopefully, phonetic alternatives as well - "neutral," "new," "newt," "pneumonia." The question mark sometimes can be used in place of unknown letters. Typing in "p?t" brings a listing of all words in the spell checker's word base with that letter pattern - "pact," "pant," "past," "peat," "pelt," "plot." A stand-alone, electronic spell checker with asterisk and question mark keys and speech capability can be a helpful tool for students who struggle with spelling.

If the student is using a computer, websites like www.dictionary.com can help with definitions and homonyms and www.visuwords.com can give a visual representation to the words through color coding groups of meanings when a word has several uses. *Read and Write Gold* is one example of a software program that not only gives text to speech but also clarifies homophones.

Word Processing Software

Computers change the writing process by making it easier to access, develop, record and edit ideas, and to publish and share with others. Different computer supports are useful during different phases of the writing process. Students may need to change the size, color or shape of the font they write with. The background color can be formatted if needed and pictures added to cue up what they are writing about. These can be converted back to the “print standard” of an assignment—a student may prefer to type in 24 point font but the assignment needs to be converted back to 12 point font before it is turned in.

Word processing software (i.e., *Microsoft Word*, *Open Office*, *Claris Works*, *Word Perfect*) lets you see typed text on a computer screen before printing on paper. In this way, you can easily remove or add words, move sentences or paragraphs around, and correct spelling errors without having to rewrite the paper.

Grammar checkers, often included in word processing programs, check for errors in grammar, punctuation, capitalization, and word usage. Possible errors are shown on the computer screen and cue the student to check their writing, giving them a chance to correct problems before printing a document. Grammar check may be a part of the word processing program or purchased separately. Digital text also allows for easy formatting—it's easy to underline, boldface, change spacing between lines, center text or add visual elements.

The writing and editing process can be a laborious time-consuming task. Errors are easily corrected and information can be reorganized and edited before printing the final product. Other tool "add-ons" such as word prediction programs and/or abbreviation expansion, which are described below, can work along with word processing software for added support.

Word Prediction Software

Word prediction programs reduce the time, effort and frustration for individuals with spelling difficulties to produce written work by providing an on-screen list of possible words to use in a piece of writing. The student types a letter or two and the program provides a list of words (based on word frequency and context) beginning with that letter(s). If one of the choices is a word the student wishes to use, they select it. If not, the student enters another letter that produces a new set of choices.

Word Prediction software (i.e., *Co:Writer*, *WordQ*, *Read and Write Gold*, *Premier*, and *SOLO*) also include features such as spell checking as you type, multiple word prediction, text to speech, grammatical rules, phonetic spelling and hotkeys for frequently used words. Text-to-speech can provide auditory feedback to students to assist them in word choices and selection to monitor the structure and meaning of their work.

Digital Templates

Digital templates are interactive prompted writing guides that assist writers through the correct writing sequence. Some software (*SOLO*) uses prompt statements that guide students through each step of the writing process, from creating an introductory paragraph to completing the conclusion statement. Many allow you to modify any of the templates or create your own templates for any subject or assignment.

Abbreviation Expansion

Abbreviation Expansion software can be used to create abbreviated forms for frequently used words or phrases for slower writers and poor spellers. For example, if a student consistently misspells "conscious" they could type "c-o-n" and space bar in its place and the word "conscious" will automatically appear on the screen. This feature is often included in word prediction programs such as *Co:Writer* as well as word processing programs like *MS Word*.

Word Processing with digital supports

Students can be provided with access features to support their digital writing. Digital highlighters can be used to extract text from source documents, decreasing the copying time this would normally take. Digitally based graphic organizers can be used to group chunks of information that will be needed and to organize the circular thinking patterns students may have on a topic into an outline with a push of a button. This outline can then be exported to a word processing document or PowerPoint with the "organizational" elements intact. Some students benefit from hearing the words they are writing, text readers or read back elements can help them catch poor word choices or the correct spelling/wrong word used. Programs mentioned before such as word prediction and abbreviation/expansion help get the right words on paper, and built in tools such as the thesaurus, word count and grammar check can provide valuable editing feedback. Some new writing tools are emerging at the time of this writing that can assess not only writing conventions like punctuation and capitalization, but these tools can provide more in-depth feedback such as sentence length, sentences leading to a cohesive paragraph, or sentences that lead to a key point, all helping a student to evaluate their writing before it is turned in.

Chapter 6 - Assistive Technology for the Composition of Written Material

Talking Word Processing

This software is used to provide verbal feedback to a student while they write. The verbal feedback can be provided at a letter, word, sentence, or paragraph level. The entire document could also be read back. Some students are better able to hear mistakes than read for mistakes. Some examples of software that do this are *Write Out Loud*, *WordQ*, *Read and Write Gold*, *Premier*, etc. (See Chapter 7 – Assistive Technology for Reading for additional resources.)

Multimedia Software for Alternative Expression of Ideas

Improving access to digital media is changing the type of assignments students can use to express their understanding of content. Early multimedia such as *PowerPoint* or *HyperStudio* allowed a student to add pictures, videos, movement and sound to their projects. SMART® Notebook software is an example of a new generation of multimedia software. Alternative formats of expression may help some students get their “ideas out”.

PowerPoint, a program that is available in almost every school allows a student to add graphics, movement, charts and graphs, video, and voice to a project. Text to speech software can be used to read the text in the PowerPoint. Internet access allows a student to find the right pictures and videos to express an idea. Sound and video editing software such as *GarageBand* or *Audacity* are also available to edit media materials a student may want to use. Through picture editing and the slideshow feature, projects like *Claymation* and cartoons can be made. Personal publishing software, such as *Comic Book Creator*, allows students to use visuals to help make their point. Choosing the features that match a student’s motivation and/or abilities will help them create a project that can truly share what they know.

Graphic organizers like *Inspiration*, *C-map* or *Spark-Space* can help a student visually and kinesthetically organize the bits of information gathered for a project prior to beginning the writing process. This information can then be organized into a coordinated whole.

Video and pod casting software can help a student express visually and verbally what they are struggling to get down on paper. Through the editing process they can organize those thoughts into a cohesive whole.

Some of the new online tools such as *Google Docs* or protected group spaces such as those found in *Moodle* can help students work together on writing projects. The group members are at their own workstation and see a group document at the same time. This may work well as an instructional strategy but can also be used by the students to create a better group document.

Tools for Citation Formats

Citations are important for students to use, helping them recognize the authors and creators whose ideas, words and media contributed to the current project. Websites, documents and other citable works are easy to lose in the rush of internet searching. Website tracking software and reference managers such as the ones built into *Draft:Builder* or *Read/Write Gold’s RefWorks* can help a student format not only written work but the varying media a student may draw upon for their projects.

Chapter 6 - Assistive Technology for the Composition of Written Material

Voice Recognition (VR) Software

Voice recognition software is improving as fast as the new versions are released. Training time has been significantly decreased, ease of use increased, and student accuracy significantly improved. In addition to stand-alone VR software, VR is also built into other software such as *Office XP*, *Vista OS*, *WordQ*, *SpeakQ*, *Read and Write Gold* and *Premier*.

For all of the positives VR software may still fall short of getting the student's thoughts and ideas down on paper. VR can not organize thoughts or improve sentence delivery on its own. A student's jumbled thoughts or poor speech patterns will show up on the computer screen. Good training with voice recognition is important. Students need to master navigating the software and controlling the writing process by voice. They will still need to edit, catch the program's misunderstood but correctly spelled words, and check their work. VR software can be used with an organizational software such as *Inspiration* to help enhance the organization of writing.

Students will need time to learn and master the VR program before they are expected to use it functionally in classroom assignments. Microphones may also be an issue. Many schools report they are using a lot of them. The tender wires take a beating in the school environment. Despite these challenges (needed training, proper computer equipment, still needing an organizational tool, etc.), students may benefit greatly by using their voice to write. (For more information, see Chapter 5, Assistive Technology for Motor aspects of Writing.)

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify writing objectives and criteria of performance to determine the effectiveness of the trials.

Follow Up Plan

Before the meeting ends set a mutually agreed upon time and place to give progress on the implementation plan. Be sure to include all those people who have assigned tasks and an interest in the outcome. This will give team members a chance to revisit concerns, keep members on track and solve problems before they become a roadblock to implementation.

Chapter 6 - Assistive Technology for the Composition of Written Material

Web Resources

Dictionary.com

An online dictionary, thesaurus, reference and translation guide

<http://dictionary.com>

Visuwords.com

Online graphical dictionary — Look up words to find their meanings and associations with other words and concepts. Produce diagrams reminiscent of a neural net. Learn how words associate.

<http://visuwords.com>

Wikipedia

A multilingual, web-based, free content encyclopedia project.

<http://www.wikipedia.org>

Product Resources

Audacity

<http://audacity.sourceforge.net/>

Claymation

Registered Trademark – Will Vinton 1978

Claymation Station

<http://library.thinkquest.org/22316/home.html>

C-Map

Institute for Human and Machine Cognition

<http://cmap.ihmc.us>

Comic Book Creator

Planetwide Media a division of Planetwide Games, Inc.

Personal publishing software

<http://mycomicbookcreator.com/>

Draft:Builder

Don Johnston Incorporated

26799 West Commerce Drive

Volo, IL 60073

<http://donjohnston.com>

GarageBand

<http://www.apple.com/ilife/garageband/>

Google Docs

International Business Machines Corporation

<http://www.google.com>

HyperStudio

<http://hyperstudio.com>

Inspiration

Inspiration Software, Inc.

<http://www.inspiration.com>

Moodle

<http://moodle.org>

Chapter 6 - Assistive Technology for the Composition of Written Material

Power Point

Microsoft Office

<http://office.microsoft.com>

Read/Write Gold

TextHelp Systems Inc.

http://www.texthelp.com/page.asp?pg_id=10059

Spark-Space Limited

UK Company

www.spark-space.com/education.htm

Chapter 7 – Assistive Technology for Reading

- Introduction.....1
- Using the SETT Process 7
- Decision Making Guide 8
- SETT Process 9
- Reading Continuum.....14
- Reading Continuum Expanded 15
- Student-specific Reading Solutions 35
 - Nonverbal Reading Approach 37
 - Adapted Phonemic Assessment 39
 - Other Alternative Assessments.....39
 - Response to Intervention (RtI) 40
- References and Resources 41

Assistive Technology for Reading

Judi Cumley

Introduction

There are students who struggle with reading every day. They may be students who have an identified disability in reading or are “unidentified” struggling readers. We also know that students who have language learning disabilities often struggle with making meaningful connections with printed text, as do students who are English Language Learners (ELLs) and students with cognitive disabilities. Some students with physical impairments, visual and hearing impairments, and AAC (Augmentative and Alternative Communication) users often have difficulty accessing the text. This chapter will outline some of the research that impacts students who struggle with the reading process, National Instructional Materials Accessibility Standards (NIMAS) definitions, requirements, definitions and restrictions will be addressed. Factors about the student, environment and tasks that should be considered when contemplating assistive technologies and strategies will be explored. Finally, we will examine some of the tools from low- to high-tech that can support struggling readers.

This chapter is not intended to educate professional staff in appropriate reading instruction. If you are interested in knowing more about how children learn to read, McGee and Richgels book, *Literacy's beginnings: Supporting young readers and writers* and *Put reading first: The research building blocks for teaching children to read* by Adler provide a good analysis of reading development. Free copies of the Adler publication are available from their website <http://www.nifl.gov/partnershipforreading/publications/PFRbooklet.pdf> . A good resource for teaching reading to students with disabilities is *Children with Disabilities: Reading and Writing the Four-blocks® Way* by Karen Erickson and David Koppenhaver.

Students with Print Disabilities

For many students with disabilities, the limitations of print raises barriers to access, and therefore to learning. Following the passage of the IDEA in 1997 and more recent reauthorizations, it has become essential that all students have access to the general curriculum, and thus to print materials. Some students cannot see the words or images on a page, cannot hold a book or turn its pages, cannot decode the text or comprehend the sentence structure. Students may experience different challenges, and may require different supports to obtain meaning from books. For each of them however, there is a common barrier - the centuries-old fixed format of the printed book. Many students with disabilities presently do not have access to the printed material they need. There are several reasons for that. In some cases, the problem is technical - schools may not have the technology they need to properly provide accessible versions to students, even if they had such versions. In other cases, the problem is lack of knowledge - many teachers and schools do not understand the issue of access or the potential solutions that are available (“NIMAS at CAST: About NIMAS”, 2006).

Educators usually select technology for two reasons. They select programs that remediate specific skills through individualized and/or repetitive practice or they select programs that compensate for a student’s disability. Deciding when to provide remedial supports and when to provide assistive technology accommodations is critical when designing a student’s instructional plan. As many reading researchers have suggested, the focus in the early grades is on learning to read, and the focus in the intermediate and upper grades becomes reading to learn. Some of the research shows that using technology for compensatory intervention actually also provides remedial benefits (Silver-Pacuilla, H., Ruedel K. & Mistrett, S. p. 8). While assistive technology by definition is not instructional, sometimes the support that assistive technology provides enables the student to further develop his or her skills.

Research

There is an abundance of books and research about how children learn to read and the typical progression of most students. McGee and Richgels (2000) say that children’s literacy learning is developmental, but not in the sense of proceeding in an irreversible, step-by-step progress. No child’s literacy development exactly matches those of another child. Furthermore, an individual child’s literacy behaviors vary in sophistication depending on the task and situation. Although the age may vary with each student as they acquire literacy skills, research tells us that students with cognitive disabilities follow the same developmental progression as “typical readers”. Additionally adolescent aged or older students with cognitive disabilities continue to develop literacy skills long after “traditional reading instruction” usually stops (Katims, 2001; Erickson, 2007). When Katims looked at reading instruction for students with mild to moderate cognitive disabilities, he discovered that although many students engaged meaningfully with print, the special education reading instruction they received focused primarily on word identification with

little instruction on engagement with connected text (Katims, 2001). Karen Erickson says that in order to build comprehension when reading, instruction must have emphasis on both automatic word identification and phonics or decoding skills. The combination of the two is required for reading success. Successful readers must be able to effortlessly recognize most words they encounter and have the skills to figure out unfamiliar words. Comprehension is adversely affected when instruction emphasizes only one skill. When readers do not have the skills to figure out unfamiliar words, they are forced to skip or guess words (often based on the initial letter with no regard for sentence context). When readers are taught to stop and sound out or consciously think about every word they encounter, they are expending cognitive resources that would otherwise be devoted to comprehension (Erickson, K. 2003).

Teachers who use the Four-Blocks[®] method of literacy instruction by Pat Cunningham (1991) can modify the activities for students with disabilities. The original Four-Blocks framework was developed to adjust to individual differences in the classroom and teaches students not only how to decode unfamiliar words but also builds comprehension, writing skills and independent reading. The basic premise is that each day is devoted to four different approaches to teaching all students to read. Incorporating Guided Reading, Self Selected Reading, Writing and Working with Words on a daily basis enables students to interact with print meaningfully. Karen Erickson and David Koppenhaver further addressed the specific accommodations of the Four-Blocks framework for students with disabilities, using assistive technology when appropriate (2007).

Although teachers have been using technology to support students' reading for a relatively short time period, research is reporting that it improves student's reading fluency, comprehension, speed and vocabulary. When students use text-to-speech technology, their writing quality and length of writing projects increase. Older students report better editing when using text-to-speech than when reading for editing purposes on their own. Ann Orr and Lorena Parks summarize this research in *Educator's Ezine* (2007).

NIMAS

What is NIMAS?

NIMAS is the **N**ational **I**nstructional **M**aterials **A**ccessibility **S**tandard that is part of IDEA- 2004 20 U.S.C. 1474 (e)(3)(A). NIMAS files are text files from publishers that can be converted to a standard or specialized format. Files and documents we traditionally see and use (word processing doc, pdf, html, etc.) are not accessible to all users. But those files can be changed into an accessible document or format depending on the student's needs. NIMAS is a file format that is accessible and flexible and can be converted to:

- RTF (Rich Text Format) for text-to-speech and large print alternatives
- HTML (Hyper-Text Markup Language) for large print and text-to-speech that can include audio, text and video
- BRF (Digital Braille) for common Braille devices or Braille printers
- DSY (Digital Audio-based Information System) digital talking book standard.

Goal of NIMAS

The goal of NIMAS is to ensure the development of high quality and consistent text source files in order to create specialized formats for students with print disabilities. State and Local Education Agencies (SEAs and LEAs) must ensure that students who are blind, visually impaired or those with other print disabilities receive instructional materials in a timely manner. Each state is required to adopt NIMAS or provide an assurance that students will have appropriate instructional materials in a timely fashion. The state of Wisconsin has adopted NIMAS. NIMAS files will be "housed" in a national repository, the NIMAC - National Instructional Materials Accessibility Center - 20 U.S.C. 1474 (e).

School District Responsibilities

School districts must send their Department of Public Instruction (DPI) an assurance form stating that district students who are blind, visually impaired or those with other print disabilities, will receive their materials in the appropriate format and in a timely manner. Wisconsin DPI strongly recommends school districts coordinate with NIMAC (a national repository for NIMAS source files).

How will it work?

How will this work? When schools districts who coordinate with NIMAC, purchase core materials or textbooks for elementary or secondary schools, they *must* request that the publisher send a NIMAS source file to the NIMAC. It should be noted that the mandate is not to the publisher, but rather to the SEAs and LEAs. It also only relates to those printed core materials published after July 19, 2006. When the school district requires an alternate form of the text for a specific student with a documented print disability, they must contact one of the state authorized entities that can download files from the NIMAC database. The authorized entity will convert the source file into a useable format as requested by the school. Some of the authorized entities are already sources of alternative text such as Recordings for the Blind and Dyslexic (RBFD), American Printing House for the Blind (APH), Bookshare.org or state schools that support students with visual impairments. Anyone can search the NIMAC <http://www.nimac.us/> for files, but only authorized agencies can download files from the NIMAC.

Alternate files from publishers

School districts may be able to purchase a CD version of textbooks directly from the publisher in an attempt to provide accessible versions for students with print disabilities. While this is encouraged, care must be taken to make sure these versions will actually work for the students. CDs can be "locked" so that it is difficult or impossible for a screen or text reader to "read" them, or an audio file created from them. Some may not contain full text versions or only outline key points in a text. Requesting NIMAS-compliant digital copies in the original PO can help. Don't assume that just because a publisher provides a CD, it will be accessible. Remember that NIMAS is not retroactive and will not apply to core materials purchased prior to July 19, 2006. School districts can also purchase NIMAS files directly from the publisher.

In Wisconsin, Stanford Taylor (December, 2007) from the Department of Public Instruction recommends the following language be included on purchase orders of new text:

By agreeing to deliver the materials marked with “NIMAS” on this contract or purchase order, on or before ___/___/___, the publisher agrees to prepare and submit files meeting NIMAS requirements to the NIMAC at the American Printing House for the Blind (APH) located in Louisville, Kentucky. Should the vendor be a distributor of the materials and not the publisher, the distributor agrees to immediately notify the publisher of its obligation to submit NIMAS file sets of the purchased products to the NIMAC. The files will be used for the production of accessible formats as permitted under the law for students who are blind or have other print disabilities (Section 1). (Retrieved 6/2/08 from <http://dpi.wi.gov/sped/bul07-03.html>)

Copyright Issues

Whenever a school uses an alternative version of copyrighted text with a student, we need to be certain that it is a legal copy of the text. The Chaffee Amendment is the law most frequently referenced when providing alternate versions of text to be used with students with print disabilities.

The Chaffee Amendment:

- Allows authorized entities to reproduce or distribute copies of phonorecords of previously published non-dramatic works in specialized formats for use with individuals who are blind or other persons with disabilities.
- ...*specialized formats* refers to Braille, audio
- or digital text which is exclusively for use with individuals who are blind or other persons with disabilities.

There is no new language or clarification regarding which students qualify as having print disabilities. Current language states that students whose reading disability is physically based are eligible to receive NIMAS files. By definition of the Copyright Act of 1931 as Amended, student with “print disabilities” are those who have been certified by a competent authority as unable to read printed materials because of:

- Blindness
- Visual Impairment
- Physical Limitations
- An Organic Dysfunction
- Students who qualify as a student with a disability under IDEA 2004

In all instances, the student who will be using the NIMAS files must be one who qualifies under IDEA 2004 and have an IEP that reflects the student’s print impairment. For more information on NIMAS, NIMAC or copyright, please go to the CAST (Center for Applied Special Technology) website at <http://www.cast.org>. Wisconsin schools can go to <http://dpi.wi.gov/sped/vision.html> and view the information listed under National Instructional Materials Access Center (NIMAC) and Accessibility Standard (NIMAS).

While it is legal and ethical to provide adapted text for those students who meet the eligibility under current definitions, it is illegal to make copies of those same materials for other students even if a student could benefit from the alternative format. Those materials are the copyright

Chapter 7 – Assistive Technology for Reading

holder's property and should be paid for when used. It behooves all of us to request accessible digital files from the publishers when purchasing their textbooks. Those publisher-produced files can be used legally with any student.

When a team is deciding whether accessible instructional materials are necessary for a student, they should consider these key questions

- Does the **STUDENT** need instructional materials in specialized formats to access the curriculum and receive a free, appropriate, public education?
- In which **ENVIRONMENTS** will specialized materials be used?
- For which **TASKS** will the student require materials in which specialized format?
- What **TOOLS** will the student and others need?

(Marfilus, S. 2008)

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies
- Implementation Plan to assign trials, dates, responsibilities and data collection
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Reading

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to reading? - Review Section 6 WATI Student Information Guide (Chapter 1, page33) - Physical considerations - Communication considerations - Visual considerations - Background knowledge and/or receptive language - Comprehension of text-read or listened to - Phonemic awareness - Sight vocabulary - Other concerns	What environmental considerations impact the student's reading? - Reading requirements for different settings - Student's distance from text - Reading group size - Visual clutter on page - Lighting - Computer operating system - Current or past AT used - Other concerns	What reading task(s) do you want the student to do? Read: - Standard Curriculum - Modified Curriculum - Community print - Worksheets - Tests - Recreational - Computer
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts Reading? (i.e., visual, auditory, tactile)		Identify specific reading task(s) for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming only- no decisions yet Review the Reading Continuum	Use a Feature Match Process to discuss and select idea(s) from Solution Generation	AT Trials/Services Needed: - Formulate reading objectives to determine effectiveness of trial - Training needed - Date - Length - Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them (i.e. on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to reading. Please complete and review Section XX of the WATI Student Information Guide: Reading (pp. ****)

Physical Considerations

Students who have difficulty physically manipulating books, text, or other print based materials may benefit from assistive technology solutions to increase their accessibility to the text. Once those accommodations have been made, the student may need no further accommodations. Some examples of physical access questions are:

- Does the student have difficulty turning pages in a book, magazine, or other paper-based material?
- Can the student support or hold the printed materials in a comfortable and accessible fashion without compromising his/her posture?
- How well does the student see the print?
- Have you noticed a difference in the student's reading ability when the font size is smaller, larger, with or without a serif?
- Does the spacing between the words or lines of text impact the student's vision?
- Can the student track the words across the page/line without losing his/her place?
- What happens when there are more or fewer words on a line such as when text is bulleted or indented?
- Is the student affected by the amount of visual "clutter" on a page?
- Has anyone assessed the impact of color on the student's reading skills?
- Is visual or physical fatigue an issue for this student?
- What other physical considerations/questions are specific to this student?

Communication Considerations

Does the student have the ability to express their knowledge in all of the areas below? If not, please see Chapter 3 Assistive Technology for Communication.

Reading Comprehension

Erickson & Koppenhaver say that without instruction aimed at making meaning from text, children are left with an impression that "reading is merely decoding words and successfully saying them aloud....addressing only word reading will not promote successful silent reading comprehension." (Erickson & Koppenhaver, p.64)

If a student has an identified language learning disability, is an English Language Learner (ELL), has a cognitive disability or otherwise lacks sufficient background knowledge, reading comprehension can be limited. Some questions to consider for this child include:

- Does the use of pictures supporting the text increase the student's background knowledge and comprehension?
- Does the student benefit from "brainstorming" sessions using words or graphic maps?
- How do you know the student understands the vocabulary used in the text?
- What other pre-reading strategies have been used, and with what success?

Chapter 7 – Assistive Technology for Reading

- Is there a difference in the student’s comprehension when the text is read aloud by an adult compared to the student’s independent silent reading?
- Does the student comprehend equally well when the text is read aloud by an adult compared to computer read text?
- Would the student benefit from seeing text highlighted as the computer reads it?
- Does the student have auditory processing difficulties?
- Is the student’s listening comprehension sufficient for auditory text only?
- Is the student’s comprehension different for different types of text such as fiction, nonfiction, directions, and assessments?
- Has the student’s working memory and/or short-term memory been assessed?

Word Attack Skills

It used to be assumed that students with cognitive limitations could only learn to read using a “sight-word approach”. That assumption has proven to be erroneous. Regardless of disability, successful readers need to build their skills to read and decipher unfamiliar words.

- Does the student have the phonemic awareness to identify similar and dissimilar patterns in words?
- Has the student established sound/symbol relationships?
- Does the student recognize familiar words and patterns?
- Can the student isolate individual sounds (i.e., initial, final, medial)?
- Does the student use resources such as a word wall to decode unfamiliar words?

Sight Vocabulary

Word attack skills are important when encountering unfamiliar words, but if students need to decode every word they read in a sentence, their comprehension of the text will suffer. Good readers have automatic sight word vocabularies that they can read without stopping to decode.

- Does the student have a sight word vocabulary?
- Does the student remember previously taught words?
- Can the student recognize and remember the visual pattern that words or letter combinations make (i.e. “ing”)?

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student’s learning and focus include hypersensitivity or hyposensitivity to stimuli such as

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space

- Other individual specific sensitivities

Although these factors are not directly related to reading, they impact the student's ability to learn and focus on instruction so should always be considered.

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Environmental Considerations

As a team, discuss and write on chart paper any environmental considerations that might impact the student's reading such as auditory or visual distracters, placement in the classroom, number of different reading environments or any other environmental impacts.

Students may encounter different reading requirements, expectations, tasks, stimuli, and other differences that can affect their reading performance in each setting. Some questions to ask and consider for each reading environment include:

- What is the student's position and distance from the text to be read (i.e., the board, computer or other surface which cannot be manipulated by the student)?
- Do the student's reading skills change according to environmental influences such as group reading versus independent reading?
- Do individual teachers have different reading expectations for the student?
- Does the student have different reading requirements in each classroom/subject?
- What kind of support does the student receive in the regular education classroom with standard curriculum?
- If the student uses or will potentially use computer based programs for reading or reading assistance, where are the computers located; what is the computer's age, operating system and system capabilities?
- Does the student have ready access to computers with supports (reading support, access support, adult support)?
- If text needs to be scanned into the computer, are the scanning stations easily accessible to the student/staff?
- Can text be quickly scanned when necessary?
- Is the school Technology Coordinator involved in decision-making when discussing options for electronic text?

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time.

Chapter 7 – Assistive Technology for Reading

Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment in which the student will be reading.

Tasks

As a team, discuss and write on chart paper the reading tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what does the student need to read and then what does the student need to do with the information read? These are some questions to consider:

- Is this student currently reading standard curriculum?
- Is the student currently reading modified curriculum? If so, what modifications have been made?
- Does the student need assistance in reading worksheets, assessments, directions, information from the board or overhead, study guides or other typical requirements in the classroom?
- When the student uses the Internet, can he/she read web sites, wikis, blogs?
- Does the student have a need to read electronic text?
- Does the student have access to appropriate reading materials for recreation or personal purposes?
- How does the student read text they encounter in the community such as menus, signage, product labels?

Skilled readers use multiple cues when reading, such as contextual clues in the sentence, initial letters of an unfamiliar word, word shape, automatic word recognition, prior knowledge, concepts about the type of text they are reading and more. Struggling readers often only employ one or two strategies and will skip unfamiliar words/text if they are not successful (McGee & Richgels).

- Does the student employ reading strategies when encountering unfamiliar words? Which strategies?
- Does the student automatically use effective strategies or need prompting to do so?
- What strategies and cues does the student use to enhance comprehension?

We generally read prior to completing a process, whether it is to take a test, write a report, discuss the material with others, follow directions, pursue an interest, or many other reasons.

- What does the student need to do after they have read the material?

Reading is often the first step in eventually using the material. We always need to keep in mind, what will the student do with the material read?

Narrowing the Focus

As a team, identify by circling or other means those few tasks the student needs to do for reading that will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

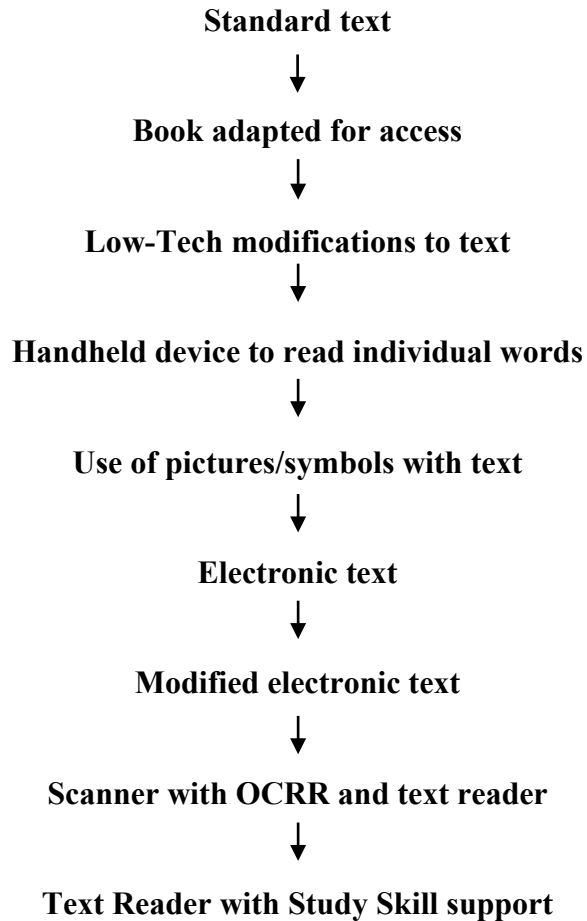
Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for reading. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

For Reading



Standard Text

Using Reading Strategies

Some students are successful reading standard text with the assistance of low-tech strategies and systems. Students may need regular reminders in order to use successful reading strategies. Harvey and Goudvis describe strategies that students can use to enhance their understanding of the text such as:

Think how the book is like me.

Think how the book is like another book.

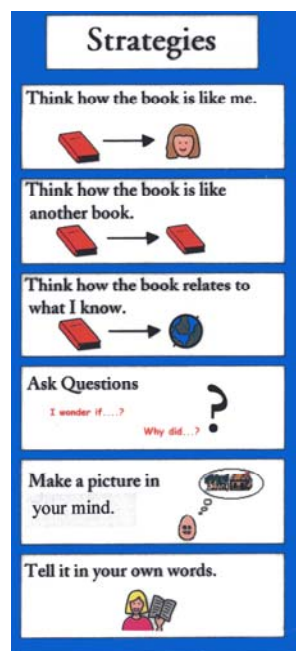
Think how the book relates to what I know.

Ask questions.

Make a picture in your mind.

Tell it in your own words. (Harvey & Goudvis, 2000).

These strategies and others can be written on a bookmark and laminated. Some students do better with a visual or picture clue of strategies to use. You can find symbols to represent the strategies from the Internet or programs with graphic libraries such as *Boardmaker*® or *Inspiration*®. The student can then easily refer to the strategies while reading.



(Based on Harvey & Goudvis, 2000. The Picture Communication Symbols ©1981-2008 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission.)

Using Color

Highlighters can be used to make specific letters or words stand out. Highlighters come in many colors and sizes. Students should be taught strategies for highlighting. Students can highlight new vocabulary, key words, dates, important people or facts, definitions, a sequence of steps or events, or concepts pointed out by the teacher as being important for a test. Use a consistent color for each category; vocabulary-orange, main ideas-pink, important people/dates-blue, etc. Students can later transfer that information to study guides or outlines. Some *Crayola*® highlighters are even erasable so that a student's highlighting can be later removed.

Highlighting Tape can be used in lieu of standard highlighters. *Highlighting Tape* comes in six colors (orange, yellow, pink, blue, purple and green) and has a large number of uses. It is especially useful in library books or other books that should not be permanently marked. The tape is easily removable and can be written on.

Transparent colored *Post-it*® notes can be used similarly to *Highlighting tape* and standard *Post-its*. *Post-its* can be used to remind the student of important text, facts, charts, or can be used by teachers to write pre-reading or summary questions (i.e., “What were the main reasons for the start of the Civil War?”). “Hefty” *Post-it* tabs can be used to mark important pages such as glossaries, table of contents or as a bookmark for students who have difficulty organizing themselves or their materials.

Another low-tech strategy for students reading standard text is using *transparent color overlays*. Some students experience a significant improvement in their reading when the standard white background is changed to a contrasting color. Experts in the field recommend trying different colors to see what the impact is on reading. If you have two copies of the same page of text and place a different colored overlay on each, you can ask the student to tell you which is better, clearer, and easier to read. Continue trying different colors to see if the student can find one that makes a difference. The student will often describe the effect as, “the letters don’t move”, “the words are bigger,” “the words are brighter,” “I can see the spaces,” etc. Different students are helped by different colors. Blue, pink, red, green, purple and other combinations have all been known to work. Some students benefit from two or more overlays overlapped on top of each other. Once the student finds a filter, have the student read 10 or more lines first without the filter and then with the selected filter. If this is going to work, it will work immediately (Sweeney, 2000).

Colored reading strips sometimes called *Reading Helpers* or *EZC Readers*® are widely available and can be used in lieu of colored overlays. They come in a variety of widths and colors. Another simple idea is to place a strip of *Highlighting Tape* on a two-inch strip of clear plastic transparency (the kind used for overhead projectors). The child can then use it to move down the page, highlighting the line being read.

Book Adapted for Access

Physical Access

If a student has a physical disability that makes it difficult to handle books, pages can be made

easier to manipulate. Putting something in between pages to separate them makes it possible to slip a finger between the pages. These “page fluffers” can be anything that works well for the student. An easy way to make “page fluffers” is by adhering pieces of lightweight foam or sponge to a piece of tag board. These can be cut into one inch squares and then paper clipped to each page. A small piece of the soft side of sticky-back Velcro[™] can be stuck to the corner of each page as another “page fluffer”. Any lightweight item that will sufficiently separate the pages will work. Some students simply need a way to “grab” pages. You can use large paper clips or Hefty *Post-it*[®] tabs, or the student can try wearing an office “rubber finger” to grip individual pages. It is also important to consider the physical placement of the reading material. Often an easel is used to hold the reading material in an upright position so the student can easily view it.

Automatic page-turners such as *Flip* by AbleNet[®] can turn the pages of a book or magazine when the student presses a switch. Reading materials are inserted in the page-turner, adjusted and activated by one or more switches depending on the student’s needs. They can be programmed for automatic dwell times that can be adjusted depending on the user and reading material.

The *BookWorm*[™] Literacy Tool from AbleNet is a device that makes almost any children’s book a “talking book.” Record the text of each page of a children’s book into the *BookWorm* literacy tool and affix the matching stickers. Students press the keypad or use an external switch to listen to the recorded pages of the book as they read.

AAC Users

Students with Severe Speech and Physical Impairments (SSPI) who use communication devices generally need special accommodations for their reading instruction. As students with SSPI develop reading skills, teachers can program building words activities, phonetic exercises, word banks/walls, vocabulary pages, and more into the student’s communication system. As the student’s reading skills progress so will the overlays/pages the student uses to support their reading. They may have overlays to ask and answer comprehension questions, word definition pages, vocabulary to express prior knowledge before reading text or even have replicas of books, pages or repeated lines on their device so that they can read independently or as part of a group reading activity. These students require the support of Speech and Language Pathologists in addition to their special and regular education staff in order to meaningfully interact with print. One literacy program, *MEville to WEville* by AbleNet uses standard children’s books with specific adaptations for students with limited communication skills. The program suggests possible communication devices and activities for those students. For more information about students with SSPI, please see Chapter 3 – Assistive Technology for Communication.

Visual Modifications

Special adaptations of text need to be made for students with visual impairments; books can be converted to Braille or large print, text can be copied and enlarged on a copier or low-tech tactile cues can be placed in the book. All are adaptations that could be appropriate for students with visual impairments. Students who need Braille copies of text or large print books can receive those from vision support services-local, state or national.

Some students without an identified visual impairment might also benefit from large print because of visual processing deficits, problems with tracking words in a sentence, identifying word borders/boundaries or other impairments. A low-tech solution might be enlarging the page on a copy machine. While you can only enlarge to a certain point before cutting off text, it might be enough to relieve the visual fatigue that some students experience without even knowing it. Some students with sensory impairments benefit from tactile cues such as pieces of textured material glued on the page to illustrate a concept (soft, scratchy, smooth), or glue or puffy paint to outline a shape in the book.

Others may benefit from using hand-held magnifiers. Although you can find low level magnifiers at retail discount stores, be aware that their clarity and magnification are less accurate than those developed specifically for individuals with visual impairments. Some students may improve their ability to track the words in a line using a bar magnifier. Vision specialists should be consulted about high quality magnifiers for students with identified visual impairments. Please see Chapter 12 - Assistive Technology for Students who are Blind or have Low Vision, for more adaptations for students with visual impairments.

Low-Tech Modifications to Text

Changing the Readability of Text

When students need standard text or curriculum slightly modified, there are some low-tech solutions. Using *Wite-Out*® on challenging vocabulary and replacing the words with easier synonyms can change the readability of the text. Another solution is to summarize the text on the computer with easier vocabulary and less details. Paste the summary over the existing text so that the student's book "looks" like their peers. Enlarging the font, increasing the line or word spacing, or increasing the margins on the document so that fewer words are on a line can increase readability. Once again, that modified text can be glued over the existing page.

Marking Text

Color coding, either with highlighters, *Highlighting Tape*, colored text printed from the computer or any other means can give students a visual clue to identify important vocabulary, facts, main ideas, recurring "trouble" words, where to start/stop reading, repeated lines or whatever the skill the student needs support for.

Independent Reading

If students need individual vocabulary words or short phrases/sentences read to them, the text can be printed on *Language Master* cards and recorded by the teacher. Students can then run the card through the *Language Master* or similar card reader to hear the text read aloud as many times as needed. Other reading supports such as spelling the words, giving definitions or synonyms to unfamiliar vocabulary, and syllabication cues can also be recorded on the cards.

Handheld Device to Read Individual Words

Talking Dictionaries

The various talking products such as those from Franklin Electronic Publishers are especially helpful for students who stumble over new words or larger words as they are reading. The

student types in the trouble word and the talking spell checker/dictionary/thesaurus will pronounce it. There are a number of these products. Some of the devices let you enter a word list so that the student can scroll through the list; looking for the word they are unsure of and select the word to hear it spoken. It clarifies homophones such as *too*, *two*, and *to*. The phonetic spelling correction lets the student look up a word even if he doesn't know how to spell it.

Reading Pens

A single word scanner can be of great help to an advanced reader who struggles with large, multi-syllabic or unfamiliar words. A device such as a *Readingpen*® from WizCom Technologies LTD. can be an excellent tool. It can be moved across the unknown word or line of text either from left to right or right to left. It scans the word or line of text and uses built in optical character recognition (OCR), to pronounce the word or read the line of text. It provides the definition if needed, speaking it on some models. A thesaurus is also included on some versions. This is not a tool for a young reader, one who struggles with many words in a passage, or has visual/motor difficulties. However, it can be a good match for the right student. A similar device, the *QuickLink Pen*® *Elite* from WizCom Technologies LTD also speaks entire lines of text. Unlike the Reading Pens, it stores the scanned text into the pen to be transferred later to a Windows® based computer. The *IRISPen*™ series are pen scanners that transfer scanned text into Windows or Mac® applications. They are small and lightweight and connect to a computer using a USB cable. Some versions have text to speech technology.

Use of Pictures/Symbols with Text

Adding pictures to text can be very helpful for students who struggle with reading text. Using pictures together with words not only strengthens the association of text with vocabulary but also allows struggling readers to more easily comprehend what is written. Seeing words illustrated makes the text more meaningful and easier to remember. This is a strategy that has been reported as being effective for emerging readers (Silver-Pascuilla, H., Ruedel, K. & Mistrett, S.).

Software

One example of software that easily adds rebus symbols to text is *Picture It*. *Picture It* from Slater Software allows the teacher or therapist to enter text and quickly add rebus symbols. Rebus symbols are added to the entire passage with just the click of one button. One way to adapt books is to paste with adhesive picture-supplemented text over the traditional text. *Picture It* software consists of a library of over 6000 pictures/symbols linked to words, including the 100 most commonly used words. Customized pictures can be imported into the library. Pictures can be placed above or below the text and reduced in size so that as the student increases his or her reading ability, the text is more prominent than the picture. If necessary, the picture-supported text can also be read to the student by the computer and is accessible by switch, touch screen, keyboard or mouse.

Chapter 7 – Assistive Technology for Reading

A typical line might look like the following text from *Monkey Business at the Market*© (1994) by Jean Slater.



When a student no longer needs the support of pictures, he will tend to stop looking at it and naturally fade its use. The teacher can also reduce the size of the graphic while enlarging the size of the text so that it has increased prominence on the page. *Clicker5*, *Writing with Symbols 2000*TM, *IntelliTools® Classroom Suite*, *PixWriter*TM and *Boardmaker* are software programs that can be used to supplement text with pictures. Slater Software, the developers of *Picture It* have a free online service, *Literacy Support Pictures*TM which supplies symbols for words entered into their search window.

Newspapers



News-2-You[®] is a weekly online newsletter with picture supports for beginning readers. This weekly downloadable newsletter consists of an 18-20 page edition of current events, jokes, a recipe and activity pages. The simplified version of the same newsletter includes communication boards that support the newsletter. The “higher edition” has fewer picture supports and higher-level activities. The subscriber does not need to have specialized software to download and view the pictures. A speaking edition of the *News-2-You* newsletter is available if you have the free software *Flash* installed on your computer.

If a student could benefit from just a few pictures to support general concepts or key words, you might consider using a standard word processor for the text and add images to the document. You can use digital pictures, clipart or download images from the internet using a search engine set for images or other software programs that have a graphic library to illustrate key points or vocabulary.

Electronic Text

Electronic text allows you or the students to manipulate or access the text in ways that would not be possible using standard printed text. Words can be seen and heard when used with a text reader. Electronic text is abundant and comes from a variety of sources:

- Commercial
- Free downloadable
- Subscription-based downloadable
- CD included from some publishers when a hard copy of the text is purchased
- Scanned from a paper copy
- NIMAS text from an authorized entity

These are just a few of the many available resources. A more comprehensive listing of electronic resources for reading follows at the end of the chapter.

Commercial e-books

The following commercial products are highlighted because of the accessibility features that are built in. Electronic books or e-books are another way to allow students with physical disabilities to interact with text. When they are well designed with accessibility features, they offer a way for students to interact with the text. They are especially useful for students with physical disabilities who may not be able to hold or turn the pages of the regular text version. But they can also be a good choice for other students with other disabilities. Generally these programs read stories aloud to students in digitized (recorded) speech. Many have colorful graphics, music and sound effects. The students can interact with both the text and graphics. Here are just a few of those available.

IntelliTools Reading: Balanced Literacy program incorporates guided reading, phonics and writing through theme based stories including song, rime, and patterned language activities. The *Balanced Literacy* program includes nine full-color original storybooks, 142 lessons, 117 letter, pattern and decodable minibooks, 212 phonics activities, and 27 writing exercises. It also includes 46 colorful *IntelliKeys*® overlays that support *IntelliKeys* users and customizable options including one for low vision.

LeapFrog® products are commercially available at discount stores or over the Internet. They have a variety of learning systems, books, pads, and other digital devices that can read text, spell and interact with the student in a variety of ways. They have products suitable for students from infancy through secondary. While not developed to be assistive, they provide reading supports for many students by reading and spelling words, adding meaning to a term or concept, asking comprehension questions and more.

Planet Wobble from Crick Software is another series that provides hard copy and on-screen books. Activities included in the series are based on specific literacy objectives such as repeated text for the first series, word study, comprehension activities and writing activities. These activities are differentiated, enabling children of all abilities to use them and are switch accessible. The series of books and activities provides progression through three levels. *Planet Wobble* books must be used with *Clicker* software.

Start-to-Finish® Books from Don Johnston Incorporated are high quality literature based stories. The stories come with a CD, a hard copy of the book that looks age-appropriate and an audiotape. The CD includes the text in exactly the same arrangement as in the book. Some of the stories in the series are classics that have been rewritten with high interest, controlled vocabulary (e.g., *Treasure Island*, *The Red Badge of Courage*). Others are new stories that have been written specifically for the series. The Gold Library includes titles with grade 2-3 readability, syntax and vocabulary of conversational speech, easily decodable words and a limited number of ideas per sentence. The Blue Library includes titles with grade 4-5 readability, syntax and vocabulary of more formal English; more ideas introduced into longer sentences with varied sentence structures. All *Start-to-Finish Books* include built-in scanning for single switch users. Each *Start-to-Finish* title includes teacher support materials, guided reading levels, lexile levels, PDF files of activities that include vocabulary and word study, plot and character development activities, cloze passages, multiple-choice quizzes and open ended questions for each chapter. Titles cover history, literature, science and nature, mystery and sports.

Start-to-Finish Literacy Starters are written and edited to match the interests and issues of older beginning readers. The content and graphics are more mature but take into account the barriers of language, syntax, and vocabulary that would make text difficult to read or comprehend for a beginning reader. *Start-to-Finish Literacy Starters* uses a proprietary combination of three text types—Enrichment, Transitional and Conventional—to provide the support for different skill areas: print conventions, oral language development, alphabetic principle and phonological awareness. All *Start-to-Finish* books and materials are read to the student using recorded speech from an actor rather than synthesized computer speech. The student or teacher can set the books to highlight word-by-word, by line or sentence as the text is read.

Thinking Reader from Tom Snyder Productions is a software series of electronic books developed to provide support for struggling readers. The program trains students to read strategically in order to increase their comprehension. Specifically designed for Grades 5-8, the *Thinking Reader* series presents unabridged, grade-level literature via the computer screen combined with human voice narration.

UKanDu Little Books® are switch accessible simple books for emerging readers. Students can choose words to complete the sentences on each page and create their own stories. When finished, the story is read back to the student and can be printed for a hard copy.

WiggleWorks® by Scholastic is a complete instructional program that features electronic versions of several excellent children's books. Students can click on unfamiliar words to hear them read aloud, record themselves as they read the book, and write or dictate their own books, which the computer can read aloud. Customizable features allow teachers to choose how text is read and

highlighted and customize text size, background color, recorded sound, and graphics. It has an on-screen keyboard and is single-switch accessible.

There are many other sources of e-books available. If you would like to know names of more electronic books you can visit the website of *Project LITT: Literacy Instruction through Technology* which conducted a three year study of the effectiveness of hypermedia based children's literature in improving reading skills of students with learning disabilities.

Free e-books (downloadable)

There are several excellent websites that provide access to electronic books. *Starfall Learn to Read* is a free website featuring a multitude of stories appropriate for Early Childhood through second grade. Stories are categorized according to early emergent readers through advanced emergent readers. The website allows the user to highlight words and have the words sounded out for the reader.

International Children's Digital Library (ICDL) is a five-year project funded by the National Science Foundation (NSF) and the *Institute for Museum and Library Services (IMLS)* to create a digital library of international children's books. One goal of this project is to create a collection of more than 10,000 books in at least 100 languages that is freely available to children, teachers, librarians, parents, and scholars throughout the world via the Internet. This website provides scanned images of the books but does not read the book aloud for the student.

Text and books that were written more than 50 years ago are now in the public domain and can be downloaded from the Internet by going to the *Project Gutenberg* site. These wonderful stories and novels can be adapted for use with older students who are still struggling with reading but would enjoy a more complex story line.

Bookshare.org is a web-based system supplying current accessible books in digital formats designed for people with print disabilities. These digital formats are in NISO/DAISY format for talking books, and BRF format for Braille devices and printers. Access to copyrighted books from Bookshare.org is limited to people in the United States with bona fide print disabilities and the non-profit organizations serving them. Bookshare requires an affidavit of print disability. Bookshare has partnered with Don Johnston, Inc. to offer a free Bookshare.org edition of *Read:OutLoud*®. Eligible members will have full access to the NIMAS compliant reader complete with study skills tools.

Teacher Tap is professional resource for educators that lists electronic text with and without pictures, audio texts, interactive stories and more. The site is organized according to reading level, content, lists and collections, etc.

UDL Editions by CAST take advantage of the flexibility of digital text and power it with a text reader, highlighters and other study tools using the *Texthelp*® *Toolbar* and animated reading “coaches” that provide leveled supportive reading strategies.

Fee based e-books

Some organizations offer electronic books to schools or individuals with disabilities for a modest fee. Most require a written proof of disability.

Accessible Book Collection

Books are listed by reading level, grade level and word count. They have specific high interest/low vocabulary books listed. Many of their books include illustrations and are switch accessible. The annual membership for schools requires a certification that the books will be used with students with disabilities.

One More Story

E-text subscription service that uses recorded voice with e-text. Offers books in a library format. Booklist mirrors frequently used elementary reading books.

Reading A-Z

Provides access to leveled readers, lessons, Benchmark books with running records, phonemic, phonetic and alphabet activities, vocabulary, assessments and more.

Tumblebooks

Tumblebooks for early readers are adapted by taking existing picture books and adding animation, sound, music and narration to produce an electronic picture book that either the child can read or have read to them. Older readers have a separate library of chapter books, high interest/low level, literature and more that have been adapted with narration, highlighting options and adjustable online text.

Publishing houses, including those that provide curriculum for schools and commercial sites (www.amazon.com) are also resources for digital books that can be purchased.

Handheld ebook readers and applications

Many of the handheld devices, PDAs and ebook readers can be used as an assistive tool for reading text. Ebook readers hold hundreds of pages, can enlarge the text and may be physically easier for students to turn pages. Many come with MP3 converters, so a student may be able to listen to the text while reading it.

The *Amazon Kindle* and *Cybook* are examples of portable reading devices that can hold hundreds of titles including books, magazines, newspapers, documents, and pictures. They use “electronic paper”, with the readability of paper and adjustable font size. Students can add bookmarks and annotations, copy and paste passages and then export them. Some of the devices are wireless, others use USB connectivity. Portable reading devices read text using a proprietary format, thus most text is not interchangeable between devices.

TouchBook™ uses Touch User Interface (TUI) technology. By pressing the surface of a printed page that is TUI-enabled the reader is able to retrieve digital content such as definitions, links or bookmarks that are stored on the computer, websites, DVDs, and CDs.

Children's Illustrated eTales is a Palm application of four short stories with colorful illustrations for students Kindergarten through Grade 2. On Palm OS handhelds, *Palm eBook Studio* allows ebooks to be created, formatted, and converted for reading on a handheld.

Digital audio book readers such as the *EZDaisy Talking Book Player* and *Scholar Talking Book Player* by Telex Communications, Inc. or *VictorReader® Stream* by Humanware are designed for students with a vision or learning disability. These hand-held book players read DAISY files and can convert digital text into audio files, and feature navigation controls, audio formats including MP3 and variable speed control. Because they are digital, students don't have to worry about tapes or CDs. The *Scholar* and *VictorReader Stream* includes additional features such as bookmarking and "Go To" options. In addition to playing audio files in an MP3 format, the digital book reader, *ClassMate Reader* by Humanware also visually displays text with a highlighting feature so that students can see and hear the text read using the portable device. It also includes study skills features, the ability to create voice and text notes, bookmarking options, a dictionary and the ability to listen to audio only files. Some of the readers use "human-like" voices while others use high quality synthesized voices. They can all hold literally thousands of books on flash memory cards. Humanware reported a study in which 29 "college-bound" students were instructed in the use of and had access to a ClassMate Reader over a 24-week period. At the conclusion, the study reported that students read electronic text for significantly longer time periods than printed text (4.7 hours compared to 1.46) and self-reported an increase in comprehension of the electronic text when they could see and hear the text being read (<http://www.humanware.ca/web/en/Newsletter/15.html> Retrieved 11/20/08)

Audio Texts

Audio-only texts are a resource that should be considered for some students given the technology available and used within the mainstream. Students can listen to audio books on CD players, playaways, MP3 players, cell phones, *iPods* and other handheld devices and/or the computer. Because audio formats are familiar to so many students, they may be more accepting of audio books as an alternative format than other options. One study showed that secondary level students with mild disabilities performed higher in content assessments when they used audio texts compared to standard print based text (Boyle, Rosenberg, Connelly, Gallin, Washburn, Brinckerhoff, & Banerjee). Text files can be converted to MP3 files, WAV files, AAC files (for *iPods*), or a number of other audio formats. The software for MP3 and AAC (*iTunes*) playback is available for download at no cost, and many text-reading programs have MP3 players built in. Another option for audio text is to create your own podcast of short books, chapters, tests or other traditional text. A podcast is simply an audio file that is recorded to be downloaded at a later time. Students can download the podcast and listen either on the computer or a portable media player. Podcasts can be created using a telephone (*gcast*) or using free or commercial programs. Audio files come in many different formats, each geared to be played by specific media players. Not all are interchangeable.

Audio files of text are also available from different sources. Audio books are available from commercial web sites such as Amazon and iTunes. Audio books are also available from *Recording for the Blind and Dyslexic®*. This organization provides audio books for students with a verified print disability for a fee. They provide a list of compatible portable media players for RFB&D audio files at <http://support.rfbd.org/index.aspx?page=playing>.

Playaway® self-playing digital audio books from Follett Library Resources come ready to play. They are self-contained single audio books complete with a battery, earbuds and a lanyard. The device has a simple interface with 8 buttons to play, increase or decrease the narrator speed, navigate throughout the book and bookmark pages. These may be available at the local public library.

A slightly different format from a standard MP3 player is the *FP™3 Player* from Fisher-Price. This is a child friendly player with large navigation buttons, volume control and a graphic representation of books and songs that are listed on the player. Books can be downloaded from the Fisher-Price website (fee) or converted from existing CDs using the software from the player. Media must be converted into the specific format for the *FP3 Player* and is not compatible with MP3.

Text-to-Audio® by Premier Assistive Technology, Inc. is a tool that converts text documents to sound files. *Text-to-Audio* can create 10 different types of audio output files including MP3 and WAV files. It compresses files as it creates them. *Text-to-Audio* uses *AT & T's Natural Voices*™ to produce high quality digital-speech audio. The WAV or MP3 files that are created can be played back using an MP3 player or on the computer. They could even be burned to a CD to be played later by the student.

There are many resources available for teachers to convert text into some type of audio format. While this is a format that many students are familiar with on a recreational basis, they may need support in comprehending the text, navigating through multiple pages and building good listening skills. Teachers who need support in teaching those skills may want to use websites such as *Learning through Listening* from *Recordings for the Blind and Dyslexic*. Lesson plans, research articles and other downloadable materials are available regarding teaching listening skills even if your school doesn't subscribe to the service.

Modified Electronic Text

When reading materials are electronic, the text becomes flexible and can be reformatted or transformed into accessible alternative formats. Text can be enlarged, format can be adjusted with more spacing between words or lines, or presented in high contrasting colors to make it easier to see. Once text is in a digital format, it can be read on the computer, word definitions can be spoken or students can click embedded links for a multimedia presentation of the content to increase understanding.

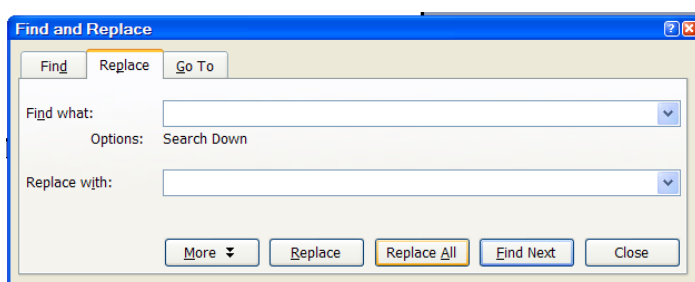
Using digital text makes format changes easy to do which may actually increase the readability of the text for a student.

In this example, you or the student can “Select All” of the text from the Edit menu of the word processor application and select a larger font size (Times New Roman 16pt).

Some fonts (such as Verdana 14pt) may be easier for students to read than others, so the student may use the same procedure (“Select All”) to change the font type to one that is easier for them to read. There is no research to support the claims of readability of typeface. However personal preference does make a difference.

Other students may have difficulty tracking words and need increased space between lines.

“Select All” and increase the line spacing to 1.5 or double line spacing. These sentences use the same font and size as the rest of the text, but are double-spaced.

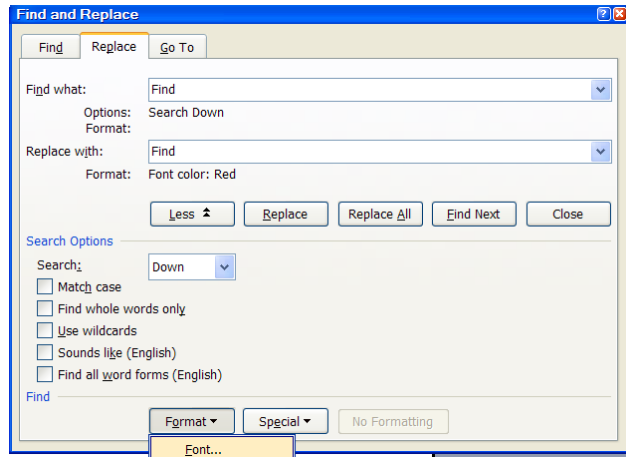


It is also possible to change the spacing between words. In this example the “Select All” feature is used to change the spacing between words. Type one space in the “Find” window and two spaces in the “Replace” window. Having more spacing between words may assist those students with “word boundary” problems who have difficulty seeing where one word stops and the other begins. This sample inserted two spaces between words.

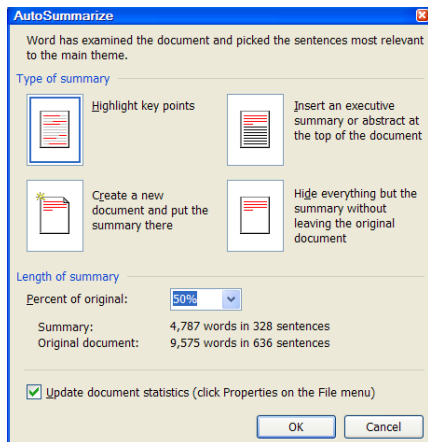
Another formatting change may be to increase the margins so that fewer words appear on the line. Students with difficulty tracking the words across a page may be more successful when there are fewer words per line such as in this example.

If the student is more successful using a colored overlay (see Using Color with Standard Text), change the background color on the computer by going to the “Format” menu, then “Background” to replicate the colored overlay on the computer. Use color to bring key words to a student’s attention by using the “Find/Replace” options again. This time insert the key word in

the “Find” window and “Replace” it with the same word, except change the format font to a colored one or highlight selected words and change the text color.



Some students need the text simplified for them. If the document is in *Microsoft Word® 2003*, you can “cognitively reformat” the text by using the AutoSummarize function in the “Tools” menu. Select the type of summary (highlight key points, executive summary, new document or hide everything but the summary) and the percentage of the original document included in the summary. As with any curricular modifications, you or the content teacher may need to adjust the summary to insure that it matches curricular objectives and benchmarks.



The AutoSummarize feature is still present in *Microsoft® Office 2007*, but is in a different menu location.

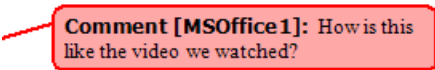
The AutoSummarize tool now appears on the Quick Access toolbar which may need to be installed. Directions to do so can be found in the Help menu. To create a summary of the document:

1. Open the document you want to summarize.
2. Click the AutoSummary tool on the Quick Access toolbar.
3. Choose Auto Summarize from the submenu that appears.

4. In the Type of Summary area, specify which of the four summary types you want to create.
5. In the Length of Summary area, indicate by using the Percent of Original drop-down list exactly how long you want the summary to be.
6. Click on the OK button.

Remember to show students other helpful features of *Microsoft Word* such as inserting bookmarks for easy navigation (to glossary, chapter questions, table of contents) or returning to the last page read, using different “Views” like the “reading layout” and using the Thesaurus and Dictionary (right click on *Windows*, Control + click on *Mac*) as they encounter unfamiliar words.

Instructional staff can insert comments as pre-reading or summary questions or definitions in the text to assist a student’s comprehension by using the “Review” Toolbar. Click on “New



Comment [MSOffice1]: How is this
like the video we watched?

Comment” and insert a question, definition, definition or statement to encourage student reflection of the text.

One software program that can create most of the above-mentioned modifications for e-text is *CueLine ED* from Onion Mountain Technology. It allows you to control the presentation of electronic text on the computer screen. You can change font, background and margin (cue line) colors, adjust the font size and alignment, decide the number of lines per screen, the distance between those lines, and the number of words on each line. A left click takes the student to the next page, and a right click reads the text on that page to the student. Color cues can be attached to the left side of the screen to visually cue the student to sweep back to the left side.

Visual Thesaurus[®] is an online interactive dictionary and thesaurus with a display much like a semantic map. The graphical map displays the connections between a word and its definitions and synonyms in a unique display that can increase understanding and comprehension.

Modified text can come in a variety of types, formats, genres, and ability levels. *Route 66* is a website that contains modified high-interest low-vocabulary text for beginning adolescent and adult readers with significant disabilities. An “e-tutor” assists the reading partner in supporting the student in reading, writing and word study.

Classic Book Shelf allows students to adapt literature “classics” to a more readable format and presentation. Students can adjust font size and type, colors, margins and more. Students can even bookmark pages and later return to read.

Symbol World has modified newsletters, stories and more with pictures and rebus symbols for students who need picture supports.

Please review the Internet Reading Resources pages at the end of this chapter for more listings of online resources.

Create your own modified electronic books

You can create your own electronic books and text by using many software programs. Creating personalized books that students can relate to can be motivating to reluctant readers or students with emerging literacy skills. *Kid Pix*®, *HyperStudio*®, *IntelliTools Classroom Suite*, *My Own Bookshelf*, *CAST UDL Book Builder* (a free online program), *PowerPoint*®, *Buildability*, *SwitchIt Maker 2* and *Clicker* are examples of software that can be used to create electronic books for beginning readers or advanced readers who need accessibility features built in. *Clicker* and *IntelliTools Classroom Suite* also have online resources such as books and activities that other educators have created and are available to download. *KidBook*, a free download for Macintosh is available from *Switch in Time*'s website. The program is appropriate for all ages and literacy levels. It enables users to convert all standard books into electronic documents that can be highlighted, magnified, colored, and speech-synthesized. Another simple way to create digital books is to literally take a picture of each page of the book using a digital camera, the built in camera available on some computers or an inexpensive "web cam". After the digital picture has been transferred to the computer, it can be imported or copied into any of the programs listed above. Add text and recordings to create your own electronic book. Many of the software programs have switch accessibility built in or the program can be modified so that it will work with a switch.

Modified text for the Hearing Impaired

Many students with hearing impairments have a difficult time learning to read English. In fact, at the time of high school graduation, the average Deaf/HH student reads at or below the 4th grade level even though they understand and use sign language at a much higher level. (There are many reasons for this occurrence that can be found in Chapter 13 – Assistive Technology for Students who are Deaf or Hard of Hearing). For these students, written English is a second language that they don't have the luxury of hearing or practicing. Students who are deaf or hearing impaired can benefit from specialized software that uses 3-dimensional signing "avatars". These realistic animations provide students with sign language translations of vocabulary and assist with comprehension and fluency. *Sign Smith*™ products from Vcom3D provide signing translations within a dictionary, a studio program and signing animations, all of which can help students learn word meanings and make the connections between English text and American Sign Language (ASL).

Modified text for the Visually Impaired

Computer operating systems have accessibility features built into them. Accessibility features are generally found in the Control Panel and/or the Accessories and Settings menus. The display can be set with a higher contrast so that text stands out more clearly against the background. Magnification options enlarge the entire display or portions of it. Resolution and display settings make icons on the desktop bigger. If students need enlarged text on their web browser pages, go to <http://www.saltmeadow.com/large.html> where you can find instructions for enlarging the text on any web browser. Please read Chapter 12 – Assistive Technology for Students who are Blind or have Low Vision about other modifications for students with visual impairments.

Text Reader

Research Supporting Text Readers

Using a simple text reader has been an accepted accommodation for students with reading disabilities. Educators have been using text-to-speech (TTS) software and TTS functions of computer operating systems for a number of years. But what does the research say? It's been assumed that converting text-to-speech will improve the reading abilities and comprehension of students with reading disabilities. Silver-Pascuilla, et al. reviewed the research about the effectiveness of TTS with students with disabilities. They report that

- TTS helps special education students improve comprehension, fluency, and accuracy and enhances concentration (Leong, 1992; Lundberg & Olofsson, 1993).
- Word recognition skills also improve with this technology (Olson & Wise, 1992).
- Being able to immediately decode a word by hearing it spoken within the context of a passage helps students build word recognition and vocabulary without disturbing the flow of comprehension (Califee, Chambliss, & Beretz, 1991).
- Comprehension is augmented by supporting decoding, thereby freeing the listener to focus on the meaning of the text (Wise, Ring, & Olsen, 2000).
- These technologies provide a supportive reading environment and increase a student's ability to read interesting and appropriate grade-level materials by minimizing the need for decoding skills and maximizing the student's ability to comprehend (Silver-Pascuilla, H., Ruedel, K. & Mistrett, S., p 24).

Elkind and Elkind (2007) interviewed secondary and college-aged students about their use of text readers. They found that

- 93% of the students with learning disabilities reported that reading was easier, less stressful, and less tiring.
- 91% of students with learning disabilities said that they were able to increase the time that they could sustain attention to reading before their attention wandered or they needed a break.
- The average duration of sustained reading reported by students with attention disorders increased about 60%, from 30-40 minutes to 50-60 minutes.
- The combined effect of faster reading speed and longer reading durations can result in a dramatic increase in the amount of material that a slow reader can read in an extended reading session of several hours. Some slow readers saw improvements in the number of pages read by factors of 2 or 3.

Research about using Text Readers

The Iowa Assistive Technology Text Reader Project (Maurer, Dimmitt, Hodapp, Judas, Munn & Rachow, 2006) was a statewide project that studied the impact of using a text reader on student achievement and attitudes. The Iowa Study specifically used Kurzweil 3000 as their text reader; however the effects of using text-reading software could be generalized to any of the previously mentioned programs. The study documented improved reading fluency and comprehension as well as very positive subjective responses from the students and teachers implementing the text

reader project. Data indicated that there might have been an initial adverse effect on student's performance while they were learning to navigate within the software. However, as they became more familiar with the program, their performance improved. Week 13 was the tipping point when students move from the acquisition process to the implementation process and their comprehension scores improved. The final results of the three-year study indicates that students accessed twice the amount of material (160 words per minute using the computer vs. 79 words per minute using paper probes) using text reader software rather than conventional means (2008). Additionally, while the student's comprehension of the paper text declined as the text difficulty increased, they were able to maintain and even improve comprehension levels using the text reader with the more difficult text. It should be noted that rates of satisfaction and greater gains were observed over the second year for both students and teachers.

Text Readers as part of the computer operating system

Prior to purchasing or downloading a free text reader, look at your own computer operating system. *Macintosh OS*® has long had text-to-speech (TTS) built into their operating system. *TextEdit* is a simple text-editing program with built in speech or the speech settings in the system preferences can be set to speak highlighted text when you use a keyboard command (i.e., control + T). *Windows XP* and *Vista*™ OS for *Windows* has the equivalent TTS with "Narrator" built into the system. Systems running *Windows XP* with *Office 2003* can use built in TTS in *MS Word*®.

Free Text Readers on the Internet

Another free program that includes TTS is one that works with the Internet browser *Firefox*®. *Click, Speak* adds text to speech capability to the browser so that students can hear text spoken while they are on the web. *Adobe Reader* is a free download that reads many pdf documents. A pdf document is often the type of document downloaded from web sites. Many standard text readers cannot read them, however *Adobe Reader*, v. 7 or higher can read, although it has navigational and other limitations. *Zamzar* is a free online document converter. You can convert a pdf document into a document your text reader can read and highlight. *PowerTalk* is a free program that speaks the text in any presentation in *Microsoft PowerPoint* for *Windows*. Another free resource for anyone that uses *MS Word 2003* on a *Windows* machine is *WordTalk*. It highlights each word as it is read, and it has a talking spellchecker and talking thesaurus.

Simply entering a keyword search for "free text readers" in your Internet browser should create a listing of available resources for you including *ReadPlease*, *Natural Reader*, *Microsoft*® *Reader*, *iSpeak* and more. Many of these programs offer versions with more options for a minimal fee.

WebAnywhere is a web-based free screen reader that can read whatever appears on the computer screen. *WebAnywhere* is a web-based, self-voicing web browser that enables web users to hear the text that is on web sites from almost any computer that can produce sound. It works in the browser and speech is generated remotely, then delivered to the computer, all without installing any software. This service resides on the University of Washington server.

Commercial Text Readers

There are many text readers that are available for purchase with pricing generally dependent on number of functions, capabilities and voice quality. Some of the lower cost programs that still

offer good options include *TextAloud* and *TextAssist*® for Windows and *AbleReader* for Macintosh. A program by Premier Assistive Technology, *PDF Equalizer* reads PDF files, including text in graphs, fancy lettering, etc. without converting. It also includes a “notes” function and the ability to convert to MP3 format. Do consider the “lower cost” programs as many of them are very capable and may offer the supports your students need. They are oftentimes a good option for families.

Many school districts already have talking word processing programs such as *Write:OutLoud*® or *IntelliTalk*® for supporting struggling writers. While these programs are designed primarily for writing, any digital text can be copied and pasted into talking word processing programs and set to read sentences, paragraphs or the entire document.

When downloading e-text, you may see the term DAISY (Digital Accessible Information SYstem) as an option to select. DAISY is an international standard for formatting ebooks. There are six different types of DAISY books. Four of the types offer improved access and human voice delivery. They are navigable which enable readers to move from heading to heading, page to page, paragraph to paragraph, phrase to phrase and/or word to word. Pages can be bookmarked so that students can easily return to the last page read, search for words, go to a selected page and have the ability to speed up and slow down the audio playback without distorting the sound. DAISY books have both audio and text files but not all text readers are compatible with them. DAISY books can only be read with a DAISY reader or DAISY software which is embedded into many text or screen reading programs such as *JAWS*®, *ReadPlease*®, *Kurzweil 3000*™, *WYNN*™, *TextHelp Read & Write Gold*, *AspireREADER*™ and others. As DAISY books become the standard, expect to see most text reading software to be DAISY compatible.

Scanner with OCR and Text Reader

In order to use a text reader or even talking word processing software such as those listed above, the text must be in a digital format that text readers recognize as print. It can be from a CD, downloaded, scanned into the computer using a flat bed scanner or a copy machine with scanning capabilities or entered into a document by “traditional” methods. If the text is scanned into the computer, it must be converted by Optical Character Recognition (OCR) software before it can be “read” by any type of text or screen reader. OCR software recognizes print as text and inserts it into word processing programs or other text formats. Most scanners come with “light” versions of OCR software which will convert the text and allow you to manipulate it, copy it into a word processing or text document and use it with other programs. The full versions of OCR software such as *OmniPage Pro*, *FineReader Pro* or *TextBridge Pro* generally retain the format of the document that was scanned in, including graphs, tables, graphics/pictures and the specific formats found on worksheets or tests. It must be stated that the quality of the scanned text is largely dependent on the quality of the printed material. If you are scanning a print document that is a second-generation copy of the original, on low-grade paper, has faded ink or is of marginal quality, the scanned text will likely have numerous OCR errors. Whenever possible, scan documents from high quality, original sources.

Chapter 7 – Assistive Technology for Reading

“Scan and Read” programs are a different class of OCR software. These are sophisticated software programs that allow the student to create “user profiles” which adjusts the digital text to personalized reading settings. These programs easily allow the student to change the spacing between words and lines, add voice notes, typed notes and much more. Two examples of these are WYNN (What You Need Now) and *Kurzweil 3000*. Both of these programs include their own OCR software that converts scanned images into their own formatted text. Students can view the image on the computer as it looks on the page and have the text read to them. They can also add text, hear definitions, use powerful study tools, change the format of the text, select reading speeds, styles, voices and other customized settings. Additionally these programs will read the text on web sites.

Some slightly different programs, but within the same class are *Read&Write GOLD* and *Premier Assistive Technology’s Accessibility Suite*. These programs work with standard applications on your computer such as word processing, email, web browsers, and spreadsheet and media presentation software. *Read&Write GOLD* adds an additional toolbar to your programs with its own reading supports. The *Accessibility Suite* has a variety of programs that can provide reading supports for different documents. Both of these programs and *Kurzweil 3000* also have mobile versions installed on flash drives. The *Key to Access* is a flash drive with the accessibility programs from Premier Assistive Technology Suite while *Read&Write GOLD MOBILE* includes is a portable version of *Read&Write GOLD*. Students who have a flash drive containing this software are able to access digital text and all of the other reading supports regardless of the school, home or community computer that they are using.

The last scan and read program to consider which is slightly different than those previously mentioned is the more economical *Colligo Scan N Talk*. The scanner is included as part of the program. It combines full OCR scanning options with accessibility features such as scanning to Braille, DAISY, Large Print, Audio, accessible pdf in addition to scanning to a word processing document. *Scan N Talk* uses *AT&T Natural Voices™* and has some limited study supports.

All of these programs are worth considering if you need to scan large amounts of text for students. As with all assistive technology software, each program has unique strengths. It is well worth the time to explore each program with students to identify which one is the best match for students and district technology requirements. All of these programs have the ability to be trialed before purchase using vendor-provided demo CDs, trial downloads or through vendor grants (Premier Assistive Technology). Readers can also refer to product comparison matrices such as those developed by NCTI and CITED’s *Tech Matrix* <http://www.techmatrix.org/index.aspx>.

Test Talker™ is a program from Freedom Scientific designed to assist with test taking, worksheet completion, and study of written materials by highlighting and reading the text. *TestTalker* maintains the integrity of the written test by not modifying the test, but providing the accommodation of a bimodal presentation of the written information. *TestTalker* supports true/false, multiple choice, fill-in, and extended answer tests. It includes a PDF converter so teachers can simply open an existing PDF file in *TestTalker* without needing to scan it to the computer.

It should be noted that all of the “scan and read” programs listed previously also have the capability of reading tests or worksheets and most can have text added to them by using specific features or scanning/conversion methods. However the OCR software may compromise the format of the printed page.

Text Reader with Study Skill Support

Research supporting the use of electronic study tools

Studies have found that proficient readers automatically use comprehension strategies to help them bring meaning to the text as they read. Struggling readers, on the other hand rarely use common comprehension strategies as they are reading, even though their understanding of the text is poor. “There is good evidence that struggling readers can improve reading comprehension skills by learning the strategies of proficient readers and putting them into practice” (Don Johnston, Inc., 2005). A study reported in the *Journal of Special Education Technology* by Lange, Phillips, Mulhern, & Wylie found that the following study tools—the speech synthesizer, spellchecker, electronic dictionary, and the homophone tool in *Read & Write GOLD*—all made a significant difference in reading comprehension for secondary students with literacy difficulties (Lange, Phillips, Mulhern & Wylie, 2006).

Many assistive reading programs have built in study skill support tools. Highlighting tools of different colors are available in supportive text readers, *Read:OutLoud* and *Microsoft Reader* and all of the scan and read programs (*WYNN*, *Kurzweil 3000*, *Read&Write GOLD*, *Premier Assistive Technology Accessibility Suite* and the mobile versions of both). Students or their support staff can highlight key vocabulary, main ideas, supporting details, important dates/places, organizational structure of the text, etc. with different colors from the toolbar. Those highlighted details can then be extracted into separate or combined study guides. Important passages a student needs to return to for clarification can be bookmarked so that the student can easily navigate to the desired page. Text notes can be added by teachers with explanatory information, to prompt a “think aloud”, ask a pre-reading question, or provide a summary of the passage. Students can use text notes or voice notes to record questions about text as they read or as the computer reads to them. Talking dictionaries provide explanations of key vocabulary often in the context of a sentence. Most of the programs offer either graphic organizers or outlining supports so that students can extract highlighted or bookmarked information. The extracted information can provide study guides, an outline for further research, vocabulary lists and other supportive information.

Hearing and seeing text read as it is by the computer may help the comprehension of many struggling readers, but providing and using study support tools increases student engagement with the text. Furthermore, the Don Johnston Inc. (2005) study showed when at-risk students learned and used effective strategies, those students generalized the strategies to other reading tasks and continued to use them after the instruction ended.

Student Specific Solutions

Using the Nonverbal Reading Approach to Teach Reading to Students with Severe Speech and Physical Impairments (SSPI)

Teaching reading to students who are unable to speak is possibly the most challenging of all instructional tasks. Reading is essentially a process where students decode letters and words or recognize familiar words by sight. They demonstrate those processes by speaking the words aloud. When the student cannot speak due to a severe physical disability it is very difficult both to identify current level of performance and to monitor progress. Consequently students with severe speech and physical impairments (SSPI) often experience significant reading and writing difficulties.

Many factors may contribute to the literacy difficulties of students with SSPI, including:

- Lack of experience with literacy activities.
- Difficulty holding or manipulating books and other materials.
- Limited language experiences due to the lack of speech.
- Reduced expectations for the development of literacy skills by both teachers and parents.
- Restricted participation in “typical” literacy activities in school and home.
- High levels of absenteeism from school due to health issues.

Research

AAC-RERC is dedicated to the development of effective AAC, including a project researching effective literacy instruction for students using AAC. Summaries of their progress thus far, webcasts, *Maximizing Literacy Skills of Individuals who Require AAC* (Light), and publications are available on the website <http://www.aac-rerc.com>. Heller, Fredrick, and Diggs (1999) demonstrated the effectiveness of the Nonverbal Reading Approach to teach reading to three students with severe speech and physical impairments (SSPI). The Nonverbal Reading Approach uses internal speech, diagnostic distractor arrays, and error analysis in conjunction with individualized adaptations including assistive technology. Part of that study will be summarized here.

Internal Speech—When students are unable to verbalize phonemes when sounding out a word, they can be taught to use internal speech (Bigge, 2001). Internal speech is the process of silently speaking to oneself.

Distractor Arrays—Because these students are not able to verbalize an answer, they must be provided with an array of choices from which to indicate an answer. Heller et al. (1999) describe the importance of the distractor array.

“A distractor array is a list of alternative choices provided to the student, either orally, or in writing (on paper, computer or AAC device). Distractor arrays are diagnostic when the alternative choices are carefully selected to include the correct answer and two or more additional items that can indicate a student’s misunderstanding. For example, if the student is learning the word, “ball” and

the choices are “bill,” “ball,” “doll,” and “bat” and the student chooses “bill,” the error indicates that the student knows the first and last consonant, but not the vowel. If the student chooses the word “bat,” it indicates that the student knows the initial sound and/or consonant, but not the ending. If the student chooses “doll” it indicates that the student does not know the beginning sound or vowel (p. 7).

Error Analysis—The ability to analyze the student’s responses in order to determine the need for specific instruction is dependent upon a well-constructed distractor array.

A well-constructed diagnostic distractor array will target the errors the student has been found to make. These diagnostic distractor arrays will help determine if the student is really reading the word. Analysis of the errors will enable the teacher to determine the student’s specific problems and provide appropriate remediation. Poorly constructed distractor arrays provide little information and can give the impression that the student knows the word, when, in fact, the student does not. For example, if the student is learning the word, “ball” and the choices are “cat,” “ball,” “dog,” and “tree,” the selection of the word “ball” only tells us that the student can accurately select the correct first letter (b) of the word, but may not know the word “ball” from the word “big” (Heller, et al., 1999, p. 7).

Assistive Technology—A variety of assistive technologies may be needed to present the content and to allow the student to respond. Students with SSPI who already use voice output AAC devices may be able to utilize these devices to indicate their responses if the vocabulary is appropriate and the student’s level of competency with the device does not interfere. Some students may be able to respond when the material is presented on a computer. Others may need to have letters and words displayed on cards so that they use eye gaze to look at their choice. Some students with SSPI will be able to direct-select an answer by gazing at it, pointing to it or activating a computer or AAC device. Others will need to utilize scanning techniques. Scanning may be done with low-tech materials by having the teacher point to each item in the array and wait for the student to indicate his choice. It may also be accomplished with a single switch to select a choice on a computer or AAC device. It can be as simple as writing words, phrases, word endings, etc. on a small “wipe-off” board, note cards or even “sticky notes” so that the student can indicate their choice in their preferred manner. Low-tech options allow for the teacher to quickly monitor the student’s understanding and provide content “on the fly”. However there are times when it is necessary to program a student’s communication system with content vocabulary for increased participation, checking for understanding, book study or any other instructional reasons. To read more about using an alternative communication system, please refer to Chapter 3 – Assistive Technology for Communication in the manual.

Using the Nonverbal Reading approach

When teaching a word, the instructor first showed the word, then pointed to each letter or moved a card across the word revealing each letter as it is sounded out. The student was instructed to say the sound “in your head” while the teacher said the sound aloud. The student was then asked

to “say the sound aloud” no matter what approximation of the sound the student was able to make. This helped ensure active participation on the part of the student.

Next, the student was instructed to “sound out the word in your head without stopping between sounds” as the instructor verbally blended the sounds aloud. Finally, the student was told to “say the word fast in your head.”

When the student was initially assessed on a word, the instructor showed the word and pointed to each letter (or used a card) as before. The same steps were followed when a word was first introduced, except that the instructor did not say the sounds or word aloud. Three or four choices were then provided, either written or oral, from which to choose the correct response. The diagnostic distractor array was carefully selected to provide possible alternatives that were close in pronunciation or visual appearance to the correct word to determine if the student really knew the word.

Student errors were documented and later analyzed to determine any patterns or types of errors being made. Identified errors led to additional instruction and practice or adaptations, depending upon the type of error. Diagnostic distractor arrays were specifically designed to include the words with letters that the student had previously confused so that it was possible to assess whether or not the student had learned the correct response.

This study indicated that the combination of internal speech, diagnostic distractor arrays, error analysis and assistive technology are an effective approach for teaching reading to students with SSPI. One of the keys to using this technique effectively is to attend carefully to the words and pictures used as distractors. They must be carefully selected to test the student’s ability to discriminate between very similar letters, sounds, letter combinations, or meanings. Highly dissimilar words or pictures would not be effective in assessing specific knowledge.

Silent reading using an augmentative or alternative communication system

The ability to read, specifically to read silently with comprehension, has a positive impact on school success, employability, independence, and autonomy, as well as providing a means for lifelong learning, entertainment, and introspection. For people who use augmentative and alternative communication (AAC), this ability carries each of these benefits, as well as enhanced face-to-face communication and the added ability to participate in asynchronous communication...Although many (AAC users) successfully learn to read words in isolation and understand text when someone reads it to them, estimates are that no more than 10% can read with comprehension above a second-grade level (Erickson, 2003).

Students who use AAC need to integrate and use all of the skills “typical readers” employ, but for the most part do so internally or silently. They must use their inner voice to “hold words” in their working memory long enough to process and understand the text. They must understand the structure of written language and have background knowledge about vocabulary and the topic. This is in addition to the physical aspects of reading such as coordinating eye movements involved in reading. Erickson (2003) says that it is especially important to build background knowledge with this group since so many of these students have limited experiences. Set a purpose for reading the passage so that the student understands clearly the reason for reading and

the expectation of the task after the passage is read. She also stresses the importance of teaching AAC users to build meaning using the existing vocabulary already in their communication system rather than teach text specific vocabulary in isolation.

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify reading objectives and criteria of performance to determine the effectiveness of the trials.

Assessment

As the team completes the SETT process, questions may arise about the student's ability to perform certain reading tasks. Standardized reading assessments or teacher observations may answer those questions; however, adapted, specialized or alternative assessments are occasionally in order.

Adapted Phonemic Assessment

Phonemic Awareness is the ability to hear, think about, and work with the individual sounds in words. It is an auditory skill and does not involve words in print or sound symbol relationships. However, it is one of the building blocks of beginning reading skills because it involves the isolation and manipulation of sounds. Because it is auditory and oral in nature, phonemic awareness is difficult to assess in students with complex communication needs. Standard phonemic assessments such as *The Phonological Awareness Test* can be adapted using *Boardmaker* picture communication symbols. Students are presented with symbols (with no text label) representing words/phonemes that demonstrate a student's phonemic awareness of segmentation, isolation, deletion, substitution and blending. Students could select the symbol using a preferred selection method (e.g., pointing, picture exchange, eye gaze) instead of vocalizing the sound or word.

Commercial Alternative Assessments

Some skills are more accurately assessed using a commercial product designed for a specific population of students. *Stages* is a seven-level developmental framework that assesses a student's cognitive and language abilities. Stages 4, 5 and 7 assess early reading and

Chapter 7 – Assistive Technology for Reading

reading/writing skills. Additionally the program has built in access features such as single switch accessibility. A promising program still under development is the *ABC-Link*. It asserts that it will be a reliable and valid reading assessment tool for use with students who have complex communication needs (CCN). Students will have to be able to respond yes-no, select from a field of four, and have access to the alphabet. In its final form, *ABC-Link* will yield individualized instructional plans. The goal is to guide instructional decision-making for students who experience CCN. Standard, percentile, and other types of scores will not be generated as a result of completing the assessment because *ABC-Link* is intended for use as a guide to good instruction rather than as a tool for accountability, program placement, and/or eligibility. Other reading based programs such as *Simon S.I.O.*™ and *WordMaker*® track student progress and identify areas for further work.

Response to Intervention (RtI)

Response to Intervention (RtI) is a general and special education initiative that combines best practices in both fields. As staff work together to analyze those students who continue to struggle to develop reading skills despite skilled differentiated instruction, we should see Universal Design for Learning (UDL) and AT mesh together so that all staff and students use multiple means of expression and representation. That may mean that a school district has a text reader installed on all school computers so that any student can hear digital text read back to them by the computer. It may mean that teachers regularly represent textual facts, characters, timelines, etc. using a graphic organizer and encourage their students to do the same. It may mean that all staff and students know how to manipulate digital text to increase readability by increasing font size, word, line and margin spacing or change background and text color. Talking and standard handheld dictionaries might be available in all classes and media centers. There will still be those students who need more intense and individualized intervention and resources including very specific assistive technology, but our hope is that those distinct lines between students who are using AT and those who are not will start to blur.

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Chapter 7 – Assistive Technology for Reading



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Products Mentioned in Chapter 5

Product	Vendor
AbleReader	NextUp Technologies, LLC.
Amazon Kindle	Amazon.com [®]
AspireREADER 4.0 [™]	CAST
AT&T Natural Voices [™]	AT&T
Boardmaker [®]	Mayer-Johnson
BookWorm [™]	AbleNet, Inc.
BuildAbility	Don Johnston Incorporated
CAST UDL Book Builder	CAST
ClassMate Reader	Humanware
Clicker	Crick Software
Crayola [®] Erasable Markers	Crayola
Cybook	Bookeen
CueLine [®] ED	Onion Mountain Technology
EZC Readers [®]	Available online
EZDaisy Talking Book Player	Telex
FineReader Pro	ABBYY
Firefox [®]	Mozilla
Flip	AbleNet, Inc.
FP [™] 3 Player	Fisher-Price
Franklin Talking Dictionaries	Franklin Electronic Publishers
Hefty Tabs	Lee Products Company
Highlighting Tape	Lee Products Company
HyperStudio [®]	Sunburst Technology
IntelliTalk [®]	Cambium Learning
IntelliTools Classroom Suite	Cambium Learning
IntelliTools Reading: Balanced Literacy	Cambium Learning
iPod	Apple
IRIS Pen [™] series	I.R.I.S. Inc.
iTunes	Apple
JAWS [®]	Freedom Scientific
Key to Access [©]	Premier Assistive Technology
Kid Pix [®]	The Learning Company
Kidspiration [®]	Inspiration Software, Inc.
Kurzweil 3000 [™]	Cambium Learning
Language Master	2000 Drake Educational Associates Ltd
LeapFrog [®]	LeapFrog Enterprises
Literacy Support Pictures [™]	Slater Software
Little Step-by-Step Communicator	AbleNet, Inc.
MEville to WEville	AbleNet, Inc.
Microsoft Word [®]	Microsoft [®]
Monkey Business at the Market	Slater Software
My Own Bookshelf	SoftTouch

Chapter 7 – Assistive Technology for Reading



Product	Vendor
News-2-You [®]	News-2-You.com
OmniPage Pro	Nuance
PDF Equalizer	Premier Assistive Technology
PictureIt	Slater Software
Planet Wobble	Crick Software
Playaway [®] audio books	Follett Library Resources
Post-it Notes	Office supply stores
PowerPoint [®]	Microsoft [®]
QuickLink Pen [®] Elite	WizCom Technologies LTD
Reading Pens	WizCom Technologies LTD
Read & Write for Mac	TextHelp
Read & Write GOLD	TextHelp
Read&Write GOLD MOBILE	TextHelp
ReadPlease [®]	ReadPlease Corporation
Scan 'n Read	Switch in Time
Scan N Talk	Colligo Corporation
Scholar Digital Talking Book Player	Telex
Simon S.I.O. [™]	Don Johnston Incorporated
Sign Smith [™]	Vcom3D
Stages	Assistive Technology, Incorporated
Start to Finish Books [®]	Don Johnston Incorporated
SwitchIt Maker 2	Inclusive TLC
Talking Word Processor [©]	Premier Assistive Technology
TestTalker [™]	Freedom Scientific
TextAloud	NextUp Technologies, LLC
TextAssist [®]	Mindmaker
TextBridge	Nuance
The Phonological Awareness Test	Lingui Systems
Thinking Reader	Tom Snyder Productions
TouchBook [™]	Somatic Digital Technology
Transparent Post It Notes	Available locally
UKanDu Little Books [®]	Don Johnston Incorporated
Velcro [™]	Available locally
VictorReader [®] Stream	Humanware
Visual Thesaurus [®]	Thinkmap, Inc.
WiggleWorks [®]	Scholastic
WordMaker [®]	Don Johnston Incorporated
Write:OutLoud [®]	Don Johnston Incorporated
Writing with Symbols 2000 [™]	Mayer-Johnson
WYNN [™]	Freedom Scientific

Internet Reading Resources (based on the Reading Continuum)

Standard Text

Reading A-Z

An excellent source of literacy materials that can be printed or adapted. A free 30 day trial is available. Colored online reading materials from RAZ-Kids.

<http://www.readinga-z.com>

<http://www.raz-kids.com/>

Starfall Learn to Read

A free website featuring a multitude of stories appropriate for Early Childhood through second grade.

<http://www.starfall.com/>

Seussville Story Maker

Users can create a three-scene story selecting from "Dr. Seuss" backgrounds, characters, and music. You add your own text. When the story is played, the text appears in "conversation bubbles" but is not spoken.

http://www.seussville.com/games/storymaker/story_maker.html

Tumblebooks

An online collection of books for young readers up to middle and high school aged. Picture books have been adapted with sound, music, narration and animation. Those for older students have adjustable text, highlighting options and audio narration. They include chapter books, high interest, classics and English and American literature. Free trials available.

<http://www.tumblebooks.com/>

Books Adapted for Access

Accessible Book Collection Wiki

This Wiki has templates from Clicker 5 and IntelliTools Classroom suite that are designed to meet the needs of as many students as possible. Download the templates and books that others have created and share books that you have done.

<http://accessiblebookcollection.wikispaces.com/>

Books2burn

A Macintosh program. You copy and paste text to makes audio books with chapters and everything! Can be transferred to MP3 files, etc.

<http://books2burn.sourceforge.net/>

Tar Heel Reader

Tar Heel Reader is a collection of free, easy-to-read, and accessible books on a wide range of topics. Each book can be speech enabled and accessed using multiple interfaces (i.e. switches, alternative keyboards, touch screens, and dedicated AAC devices). The books may be

downloaded as slide shows in PowerPoint, Impress, or Flash format. You may also write your own books using their tools.

<http://tarheelreader.org/>

Handheld Device for Reading

Children's Illustrated e Tales

Handheld application of children's books

<http://handheld.softpedia.com/get/Documents-E-Books/Childrens-Illustrated-eTales-21102.shtml>

iPod eBook creator

Convert text files to iPod Notes, download existing eBooks from the eBook library. Conversion of web pages and copy & pasted texts is available. Conversion of RSS feeds to iPod Notes is available for registered users.

<http://ebookhood.com/ipod-ebook-creator>

Many Books

Free eBooks for your PDA, iPhone, or eBook reader.

<http://manybooks.net/>

Memoware

Free ebook titles for Palm

<http://www.memoware.com>

Palm ebook Studio

Creates eBooks that can be read by the eReader and eReader Pro software on Palm OS ® or PocketPC handhelds.

http://www.ereader.com/ereader/software/product/15001_eBookstudio_win.htm

University of Virginia eText Library

Free ebook library for the Microsoft ® Reader and Palm.

<http://etext.virginia.edu/ebooks/>

Use of Pictures/Symbols with Text

Boardmaker ® Books

A list of many books that have Boardmaker symbols already made for them from the Baltimore City Public School System.

<http://www.bcps.k12.md.us/boardmaker/Results.asp>

bubbl.us

A free online graphic organizer for students to create a visual representation of text to assist in comprehension.

<http://bubbl.us>

Gliffy.com

Free online graphic organizer can help students create a visual representation of text to assist in comprehension.

<http://gliffy.com>

Literacy Support Pictures™

A free resource of pictures from Slater Software. Simply enter the word into the search window. Copy the picture and insert it into the document for picture supported text.

<http://www.slatersoftware.com/PixLibrary.html>

News-2-You ®

A weekly online newsletter with picture supports. Subscribers can download newsletters with differing degrees of difficulty and pictorial support.

<http://www.news-2-you.com>

Symbol World

Everything has symbols attached to it. Newsletters, stories (for older students also), Nursery Rhymes, personal care and more.

<http://www.symbolworld.org/>

Visuwords™

A free online visual dictionary. Diagrams demonstrate word meanings and associations with other words and concepts.

<http://www.visuwords.com/>

Visual Thesaurus ®

A dictionary and thesaurus with an intuitive interface that encourages exploration and learning.

<http://www.visualthesaurus.com/>

Electronic Text

Accessible Book Collection

A non-profit corporation that provides high interest/low vocabulary and other digital books to qualified individuals and schools for a modest fee.

<http://www.accessiblebookcollection.org>

Assistive Technology Training Online

This module identifies software features and programs that enhance independent reading opportunities. Includes descriptions, resources, links to programs, e-text and more.

<http://atto.buffalo.edu/registered/ATBasics/Curriculum/Reading/index.php>

AudibleKids

Actors read stories which can be loaded to MP3/Ipod. There is a fee for the books

<http://kids.audible.com/>

Chapter 7 – Assistive Technology for Reading

AudioBooks for Free

MP3 and DVD audiobooks (adventures, detectives, horrors, classics, children, non-fictions, philosophy, etc.) for you to download. You can listen to their mp3 audio books on your computer, SmartPhone, PDA, CD-MP3 or portable MP3 player. Convert their mp3-files into ordinary CD-audiotracks. Some packages are available for a cost.

<http://audiobooksforfree.com>

Baen Books

A publisher of science fiction, will provide its books to “fans who are blind, paralyzed, or dyslexic, or are amputees, in electronic form free of charge.” Application for the free ebooks will be processed by ReadAssist <http://www.readassist.org/> , a volunteer group devoted to helping disabled readers find the books they want in the form they need.

<http://www.baen.com/>

Bibliomania

This site contains many of the classics, like Little Women, poetry, fiction and nonfiction, and even full-text Shakespeare. Since the content is purely textual, it is easily accessible for students with sensory impairments or learning disabilities who are using screen readers, text readers, or simply text-to-speech software programs.

<http://www.bibliomania.com/>

BookShare.Org

Bookshare.org gives print disabled people in the United States [legal](#) access to over 31,000 books and 150 periodicals that are converted to Braille, large print or text to speech audio files. As of Fall 08, registered users will be able to download Read:OutLoud, a text reader with study/comprehension supports.

<http://bookshare.org/>

Digital Content in the Classroom

A resource page available at the CAST website. An extensive list of links to digital text resources.

http://www.cast.org/teachingeverystudent/toolkits/tk_resources.cfm?tk_id=41

DMFC - Daisy Multi Format Converter

The Daisy Multi Format Converter allows conversion of DAISY books between different formats.

<http://www.oatsoft.org/Software/dmfc-daisy-multi-format-converter>

E-text Resources

This site is through Freedom Scientific & lists all sorts of electronic text resources, free and subscription based.

http://www.freedomscientific.com/LSG/resources/industry_links.asp#elec

Chapter 7 – Assistive Technology for Reading

HighTech Redwoods

This website is dedicated to creating accessible documents of all types. This link has tips and the process for creating accessible podcasts.

<http://hightech.redwoods.edu/accessibility/podcasting>

International Children's Digital Library

A digital library of outstanding children's books from around the world.

<http://en.childrenslibrary.org/>

Just Free Books

JustFreeBooks searches the content of more than 450 web sites. With JustFreeBooks you can find public domain texts, open books, free audio books, ad-supported books and more

<http://www.justfreebooks.info/>

Librivox

Librivox uses volunteers to record chapters of books in the public domain, and then release the audio files back onto the net (podcast and catalog). Their objective is to make all books in the public domain available, for free, in audio format on the internet. They are a totally volunteer, open source, free content, public domain project.

<http://librivox.org/>

Lit2go

All of the Gutenberg books available in Mp3, html and pdf format. So, you can listen and read the book at the same time! It nicely done with great chapter summaries.

<http://etc.usf.edu/lit2go/>

Literative

Literative provides reading material for pre-school, kindergarten and grade 1 students online. The program is comprised of carefully leveled guided readers, comprehensive phonic activities and a wealth of supplemental reading material which gradually develop a child's reading skills in a sequential manner. Developed and approved by teachers and parents across the United States. Many of the "talking books" can be read with a mouse click. All the material is available for free from this site but you need to register.

<http://www.literative.com/Home/index.asp>

Microsoft ® Reader

Create eBooks from Microsoft ® Word version 2002 or 2003 files. The Reader in Microsoft ® Reader (RMR) add-in enables you to convert any Word document into a Microsoft ® Reader format eBook. It is free and has many features found in more expensive programs: text to speech, alter font sizes, annotations color coded bookmarks, notes, colored highlighting, extraction of annotations.

<http://www.microsoft.com/reader>

Chapter 7 – Assistive Technology for Reading

National Center for Supported Electronic Text

The Center has created a Delicious site:

This list has been vetted and has descriptions to help you locate text.

http://delicious.com/Supported_etext

One More Story

An online library (subscription) with contemporary and classic children's literature.

Professionally narrated, highlights word by word, or student can use "*I can read it mode*" to only hear individual words read as needed.

<http://www.onemorestory.com/>

Project Gutenberg

E-texts and e-books that are over fifty years old and are part of public domain. There is no charge for these books.

<http://www.promo.net/pg/>

Recording for the Blind and Dyslexic ®

RFB & D is the nation's largest audio textbook library. They offer audio books for school, recreation and professional reading in addition to playback equipment and software. Schools pay a fee and must provide documentation of student's print disability.

<http://www.rfbd.org/>

Resource Room Hi-Lo Reading

Lists of books which librarians & publishers have gathered 'for reluctant readers,' and sites with books specifically written with "hi-low" readers in mind.

http://www.resourceroom.net/older/hilow_sources.asp

Route 66

A beginning reading instructional tool for adolescent and adult learners, particularly those with significant developmental disabilities. Access features as well as essential components of literacy development are built into the program.

<http://www.benetech.org/literacy/route66.shtml>

Storyline Online

Well known actors read books using different voices for characters, good expression and more.

The books are in a movie format so you hear the actor reading but you see pictures from the books, however the words to the books are not shown.

<http://www.storylineonline.net/>

Teacher Taps: Electronic Books and Online Reading

A comprehensive listing of sites for electronic books. It lists sites for age levels Pre-Adult. It also includes a legend identifying which sites are easy readers, have audio, require Macromedia Flash, etc.

<http://eduscapes.com/tap/topic93.htm>

The Key

The Key is a newspaper written for new but not beginning older readers. It provides reading material for adults with limited reading skills. These include adults who have not completed their high school educations, those learning English and those with learning disabilities. All material in *The Key* is copyright free for nonprofit, education purposes.

<http://www.keynews.org/>

Modified Electronic Text

BookBuilder

Use this free site to create, read, and share digital books for students. Your universally designed books can engage and support diverse learners according to their individual needs, interests, and skills.

<http://bookbuilder.cast.org/>

Classic Book Shelf

An awesome collection of the classics. Choose your best font, size, even color with a mouse click and the book redraws itself at once using the new font. Do you like parallel margins? Justify or don't, it's up to you. Each time you change an option or turn a page the book redraws itself. It bookmarks where you are in the book when you stop reading and will send you an email with a link that takes you right back into the book and retains your color and size changes.

www.classicbookshelf.com

eStoryMaker

A simple means for assembling text, picture and sound files into an e-story that supports multiple access means.

<http://www.oatsoft.org/Software/estorymaker>

KidBook

Available as downloadable freeware from Switch in Time. It enables users to convert all standard books into electronic documents that can be highlighted, magnified, colored, and speech-synthesized.

<http://www.switchintime.com/>

WordFlashReader

This is an open source program that flashes one word or a chunk of text on the screen at a user-determined rate. The appearance is completely customizable. It can be set up to cover the full screen with giant words in whatever font or color preferences needed. WordFlashReader allows the user to pause, rewind, fast-forward...all very important if the reader needs to review for comprehension or just because they blinked or had to look away from the screen. For emerging or fluent readers who want to increase their reading speed.

<http://wordflashreader.sourceforge.net/>

Text Reader

Adobe ® Reader

Use Adobe Reader to read pdf documents. These are documents that are frequently downloaded from web sites. Once the document is open in Adobe Reader, go to the View menu then to Read Out Loud.

<http://get.adobe.com/reader/>

AMIS

AMIS is a free software program that you can use to read DAISY books. AMIS is a multilingual player for reading books complying with DAISY standards.

<http://www.oatsoft.org/Software/amis>

Awesome Talking Library

Awesome Talkster combines a browser, directory, search engine, and text-to-voice technology. This allows you to select online text and have it read to you. Children can have the Web pages read to them slowly, but adults can have pages read at normal speed.

http://www.awesomelibrary.org/Awesome_Talking_Library.html

Click, Speak

A free download extension that enables text to speech in the Firefox ® web browser

<http://clickspeak.clcworld.net/>

DSpeech

A free Text-to-Speech program (Windows) that allows you to save the output as a .WAV or .MP3 file. You can select from different voices.

<http://dimio.altervista.org/eng/index.html>

Google™ Directory of Desktop Readers

A directory with links and brief descriptions of simple text readers.

http://www.google.com/Top/Computers/Speech_Technology/Speech_Synthesis/Desktop_Readers/

HELP Read™

HELP Read™ is FREE software that reads along with you while you do the reading.

<http://www.oatsoft.org/Software/help-read>

Orca

Orca is a free, open source, flexible, and extensible screen reader that provides access to the graphical desktop via user-customizable combinations of speech, braille, and/or magnification.

<http://www.oatsoft.org/Software/orca-1/>

NaturalReader

The free version of this text reader uses Microsoft ® voices. The fee version uses natural “human” voices.

<http://naturalreaders.com>

PowerTalk

Free download for reading PowerPoint® slideshows/books. You can add in page-forward buttons requiring an action from the reader (switches, touch screen, mouse, headmouse) or leave it to "flip pages" on its own.

<http://fullmeasure.co.uk/PowerTalk/ReadMe.htm>

Readthewords.com

A free and versatile online text-to-speech service which allows the user to enter text with the keyboard, to copy and paste it, or to upload text files in a variety of formats from the computer or from other websites. Speech is generated quickly, with a choice from 15 high quality voices whose reading rate can be varied easily. Users can listen online, download an mp3 file for use offline. ReadTheWords.com offers text-to-speech in French and Spanish as well as in English.

www.readthewords.com

ReadPlease

A free text reader (also one for purchase) for Windows. Reads any text out loud that you can select and highlight.

<http://www.readplease.com>

Spoken Text

This free resource allows you to record PDF, Word, plain text, PowerPoint files, RSS news feeds, emails and web pages, and convert them to speech. You can download your recording as an iPod book or mp3 file. Every member gets a personal podcast URL, which they can use to download recordings to iTunes or their iPods.

<http://www.spokentext.net/>

WordTalk

Free download that works with MS Word. It highlights each word as it is read, and it has a talking spellchecker and talking thesaurus.

www.wordtalk.org.uk

WebAnywhere

A web-based, self-voicing web browser that enables blind or other print disabled web users to access the web from almost any computer that can produce sound without installing new software.

<http://webanywhere.cs.washington.edu/wa.php>

Scanner with OCR with Text Reader

Badger Accessibility Services

This service at UW-Madison offers a scanning service for a fee. They will convert with or without "optimization". Quick turnaround for small amounts of text.

<http://www.bas.wisc.edu/documentconversion.htm>

PACER Simon Technology Center

The PACER Simon Technology Center has compared four scan and read software programs to help consumers and families choose which program best suits their needs. This information is current as of November 2008, but is subject to change. It is not intended to endorse one product over the other.

<http://www.pacer.org/stc/pubs/ScanandRead.pdf>

TechSolutions

Offer a scanning service where they will copy and make text files "Kurzweil ready," offering a proofing and editing service. This includes spell checking the underlying text as well as zone editing the documents. TechSolutions has also started a library of scanned documents, making some books readily available. For more information call (1-866-538-9984) or go to

<http://www.tech-solutions.org>

Text Reader with Study Skill Support

Talking Dictionary

Talking Dictionary is a speech enabled encyclopedic dictionary that can be used with or without a screen reader. This free talking dictionary is based on the Wordnet 2.1 database and contains over 250,000 words.

http://www.download3000.com/download-Talking_Dictionary-count-reg-6527.html

UDL Editions by CAST

Cast has combined digital text with the Texthelp Toolbar to provide text to speech, highlighters, other study skills and leveled supported reading strategies.

<http://udleditions.cast.org/>

Professional Resources

AAC-RERC

The AAC-RERC is a collaborative research group dedicated to the development of effective AAC technology. Augmentative and alternative communication (AAC) refers to ways (other than speech) that are used to send a message from one person to another. Research Project R1-A: Literacy Support Technologies for AAC Users has a number of resources outlining types of literacy supports for AAC users.

<http://aac-rerc.psu.edu/index-61327.php.html>

BrainConnection

The concepts important for teaching reading in the classroom have been revealed by decades of research in both education and cognitive psychology. What are they and how can a better understanding of how they connect with one another improve reading instruction?

<http://brainconnection.positscience.com/library/?main=eduhome/reading-language>

Chapter 7 – Assistive Technology for Reading

CAST (Center for Applied Special Technology)

A resource for NIMAS, NIMAC, Universal Design for Learning, and a support for school teachers and administrators through professional development, consultation, publications, and online resources.

<http://www.cast.org/index.html>

CAST Strategy Tutor is an online multimedia program that provides adolescent learners with customizable mentoring and support as they conduct Internet research, and teachers with supports for using Web-based resources more effectively in the classroom. Strategy Tutor helps students read, research, collect and understand information better and more efficiently.

<http://cst.cast.org>

CITEd

Home of the TechMatrix 2.0, an initiative of the National Center for Technology Innovation and the Center for Implementing Technology in Education. Users create a customized matrix by subject and/or learning support such as access to multiple representations of text, notation and symbols or access to electronic resources, means to organize and plan, opportunities to learn concepts and other reading, writing, math and assistive technology supports.

<http://www.techmatrix.org/>

DAISY

An introduction to DAISY books and what they are.

http://www.daisy.org/about_us/

ECB (Educational Communications Board) Educational Resources: Surf Report

Public resource for Wisconsin Educators. The Literacy Center is full of ideas and strategies for developing literacy skills. There are some e-books, but primarily the site is a good resource for supplemental reading activities which may or may not need adaptations for access.

http://explore.ecb.org/surf/surf_report?subject=0

F.A.C.E.S. (Functional Academic Curriculum for Exceptional Students) Curriculum

The primary purposes of the F.A.C.E.S. curriculum are to teach meaningful, age appropriate skills within school and non-school settings and to systematically evaluate students' progress within those settings. Functional literacy skills are included in the curriculum.

<http://www.esc12.net/faces/documents/LanguageArts/default.html>

Florida Center for Reading Research

This research site includes a chart that describes types of reading programs (core, supplemental, tech based, remedial, implemented by tutor); reading components; empirical research, and misc. notes. Each of the reviewed programs included a pdf narrative.

<http://www.fcrr.org/FCRRReports/reportslist.htm>

Free Reading

An open source Website where teachers can access a free, sequential, research-based reading intervention program for grades K-1. Free-Reading.net offers a complete intervention program in phonics and phonological awareness for grades K-1 with plans to expand to include vocabulary

and comprehension. Teachers can follow the full 40-week scope and sequence of lessons or tailor materials to individual students' learning needs. The expansion and evolution of the site will be guided by an Advisory Board of leading reading researchers.

http://freereading.net/index.php?title=Main_Page

Learning Through Listening

From Recordings for the Blind and Dyslexic. Educators can download subject/grade level lesson plans, research articles and other materials for free even if the school doesn't subscribe to the service.

<http://ltl.rfbd.org/>

Literacy Profile for Students with Physical Impairments

The purpose of the Literacy Profile for Students with Physical Impairments is to provide a guide to the teacher of students with orthopedic impairments in making literacy decisions.

<http://education.gsu.edu/PhysicalDis/mono.html>

Never Too Late: Approaches to Reading Instruction for Secondary Students with Disabilities

Part of OSEP's IDEAs that Work documents for Instructional Practices. Gives two different models for helping older students with reading disabilities increase their skills. Document can be downloaded & printed

http://www.osepideasthatwork.org/toolkit/InstPract_never_to_late.asp

Nonverbal Reading Approach

The Nonverbal Reading Approach is a reading strategy designed for students with severe speech and physical impairments. It provides nonverbal students a strategy to sound out words. It also provides a way for teachers to assess if the student can read targeted words.

<http://education.gsu.edu/PhysicalDis/mnon.htm>

Project Forum

Identified 15 critical topics within the field of special education and conducts policy analyses on these topics. NIMAS and Reading First initiatives are topics in 2007.

<http://www.projectforum.org>

Project LITT: Literacy Instruction through Technology

Focuses on the role that technology can play in improving the reading skills of students with learning disabilities, specifically "talking books".

http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/16/13/66.pdf

Reading Rockets

From LD online. Takes teachers and parents through a series of questions about a student's reading problems. Describes the process & explains it from the student, parent and teacher perspective. Then gives tips for all three how to help.

<http://www.readingrockets.org/helping/target>

Chapter 7 – Assistive Technology for Reading

Tech Matrix

NCTI and CITED sponsor technology matrices that compare different features for a number of products. Search by areas such as “Providing Electronic Resources’ or “Providing text in alternative formats”, etc.) The site also contains a comprehensive literature review of the impacts of technology on students with reading disabilities. “*A Review of Technology-Based Approaches for Reading Instruction: Tools for Researchers and Vendors*”.

<http://www.techmatrix.org/>

The Industry Profile on Education Technology: Learning Disabilities Technologies and Markets

A comprehensive profile of educational and assistive technology, products for students with learning disabilities in reading, writing and math.

<http://www.nationaltechcenter.org/index.php/2007/04/25/industry-profile-on-education-technology/>

Wayne RESA (Regional Area Service Agency)

Wayne Co., MI resource page has a number of pdf. documents that can be downloaded including digital text lists, online books for reading, tips and supports for struggling readers and writers and more.

<http://www.resa.net/teacherresources/materials/>

Zamzar

A free online file converter for pdf files to documents. With the free version, you submit the pdf file and Zamar emails the document to you, generally within 24 hours.

<http://zamzar.com/>

Chapter 8 – Assistive Technology for Mathematics

Overview	1
Using the SETT Process	2
Decision Making Guide	3
SETT process.....	4
Mathematics Continuum.....	11
Continuum Expanded.....	12
Resources	19
References.....	26

Assistive Technology for Mathematics

Marcia Obukowicz, OTR

Overview

Building mathematical skill has life long implications for students but can be easily overlooked. Basic life tasks such as paying bills, balancing a checkbook, creating budgets, arriving at work on time, and measuring can be the make or break point(s) for a student to move out of the house and live independently. More advanced skill(s) may determine the type and pay of a student's employment. Skills such as measuring in the building trades, estimating the amount needed in inventories, budgeting business expenses and reading stock charts and graphs for investing or insurance purchases also use mathematical skills.

The performance level of math for the average American student is not spectacular. The National Center for Education Statistics 2003 found only 32% of fourth graders and 29% of eighth graders scored at or above the proficient level in math. Lynn Steen (n.d.) in her article *How Mathematics Counts* noted two studies: "1 in 3 students who enter college must remediate major parts of mathematics as prerequisite to taking such courses as college Algebra or Statistics" and "College students in the natural and social sciences had trouble conveying the meaning of data they were looking at" This data comes from the regular education research.

The special education picture is grimmer. Very few special education students advance into upper level mathematics.

Statistics suggest that many special needs students who struggle with the early computational focus of elementary math elect not to take upper level classes where they may actually excel in the theoretical applications of math that these classes explore. This choice affects their college or technical school preparedness and needs to be considered as students prepare their transition plans. A small percentage of these students find their way back to the math curriculum at the tech or college level, but a greater number of them do not. (Stefanich 2007)

Educators need to help students look forward and to help them prepare marketable skills for an increasingly technical workforce. Students are often surprised to find that many college and technical college course of studies require math and algebra as prerequisites. They end up paying expensive fees to take classes they could have completed for free in high school had they only known they needed them. Even students who choose not to continue their education may need to look at charts and graphs to interpret meaning. They may need to measure with precision. They will need to manage their budgets, understand the impact of various mortgage choices and manage their retirement portfolios. They will need more than math facts, they will need to interpret math data and may even need to present gathered information in acceptable mathematical formats to others. This means that at least a percentage of special education students currently absent from upper level math classes may need to reconsider.

The challenge providing assistive technology to accommodate and modify math experiences is much more than decreasing a problem set. The bigger picture is how to assist students in gaining an understanding of the language of numbers and apply what they know to the problems they are encountering. Diane Bryant (2004) calls this new focus “the shift from mechanics to meaning.” Teaching mathematics can no longer focus just on teaching procedures, students need to know why they are doing what they are doing. They need to understand the **process** of math. Assistive technology can then assist the students in gaining or demonstrating this understanding.

This chapter will utilize the ASNAT process to look at assistive technology tools to support students with disabilities in the area of mathematics. Included will be an overview of some of the issues in the current system of mathematic instruction that challenge students with disabilities to succeed. A continuum of tools and strategies and resources will be provided to support further inquiry into the subject.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies
- Implementation Plan to assign trials, dates, responsibilities and data collection
- Follow-Up Plan to set a date for the team to reconvene and review the student’s progress

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Math

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities and difficulties related to the area of concern? • Learning Strengths • Understands math concepts and mathematical notation • Does not understand steps to solving a problem • Difficulty reading • Does not know how to recognize a problem • Ability to handle multiple steps • Physical difficulties, fatigue • Visual processing • Other concerns	What environmental considerations impact the area of concern? • Curriculum approach is different than previous approach • Are materials accessible? • Manipulatives and e-text versions available • Teacher or aide available to adapt curriculum • Support for staff development in math	What task(s) do you want the student to do that relate(s) to the area of concern? • Gain fluency in reading math • Demonstrate ability to perform math computations • Align a problem and apply steps • Write or draw a mathematical notation • Apply math skill in context (purchasing, filling online form, check writing and balancing accounts)
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts learning? (i.e. visual, auditory, tactile)		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming only No Decision Review Continuum	Use a feature match process to discuss and select ideas(s) from Solution Generation	AT Trials/Services Needed: • Objectives to determine effectiveness of trial • Training needed • Date • Length • Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

- Struggles to read math problems and notation.
- Doesn't understand the language or vocabulary of math.
- Difficulty identifying and organizing the steps to a problem.
- Notation errors such as aligning numbers and forming shapes.
- Math instruction does not tap into visual strengths.
- Understands math facts and can use a calculator but is not allowed to move on.

What do we see in the classroom?

- Struggling with vocabulary
- Confusion with word problems and what to do next.
- Poor recall of math facts.
- Mismatches between problem and notation.
- Missed steps.
- Poorly aligned work.

Common myths related to math performance:

Teacher

- We have to work on math facts until they get them.
- Special education students can't handle upper level math.
- If they can't do math facts quickly they can't do higher level math.
- If they don't get the times table they don't get moved on.
- With limited time during the school day, it is more important to work on reading than math.

Student

- Math is hard.
- I am never going to use math in real life.
- I am never going to get this.
- I don't "see" it.

In reality the student may have difficulty with the math curriculum for a variety of reasons. Poor visual processing can affect how they align numbers or work with geometrical shapes, interact with manipulatives and add data points to a graph. Difficulties with language may impact their understanding of math, draw out the key points of a word problem or interpret meaning from a chart or graph. Slow or inaccurate computational speed may convince the student or others that they are not ready for higher level math concepts; writing struggles may impact their ability to write symbols and fractions in small answer spaces. These are just a few of the challenges they might face. It is important to figure out what is the underlying cause of a student's difficulties, before choosing the tools or techniques for intervention.

Chapter 8 – Assistive Technology for Mathematics

Visual Processing, Visual Spatial or Visual-motor Integration Challenges: This grouping looks at how a student’s brain perceives, manipulates or navigates visual information related to math. Coordinating these challenges with motor actions needed to draw or represent math notations can also be impacted.

The student with difficulty in this area may have problems counting a group of items. They may visually lose their “place” as they count or labor to differentiate numbers like 6 and 9, 2 and 5 or 7 and 1. The student may stumble on operational symbols like $<$ or $>$, miss the placement of a decimal point, struggle to visualize 3 dimensional shapes on a 2 dimensional medium or correctly perceive a color/shape pattern. They may have a difficult time reading or completing charts or graphs correctly, work from left to right or “see” the axis points of a parabola. Add the spatial component and they may struggle to work right to left (which is opposite of reading), up to down, correctly align the numbers in a vertical math problem, work a number line or correctly find coordinates on a grid or graph. Add in the motor components and they may struggle to copy problems from the chalkboard or textbook or draw an intricate geometric design. They may also be challenged when they need to fit a number into a small space on the worksheet.

Physical Access

Students with physical issues may struggle to engage with the tools used in the math curriculum. Even mild forms of decreased trunk control, shoulder and arm strength and fine motor/ hand skills may affect performance. The child may have difficulty writing numbers or equations legibly and in the spaces on the worksheet. They may find that their writing legibility decreases as support muscles fatigue. They may lack the finger strength, control or dexterity to work with manipulatives, pull the tape measure, align the ruler or generate the graphics needed to depict a math problem. Students with visual impairments may struggle with the color coding of manipulatives and gaining understanding of visual representations of math concepts such as how shapes look in 2, 3 or multiple dimensions.

Math Facts

A significant amount of research suggests that students are having difficulty remembering math facts or using them at speeds necessary for functional computation. While a calculator can help a student generate the answer needed to work a problem through routine procedures, the literature suggests that understanding the process behind those math facts is critically important to further math progress. This may be a challenge to determine in the individual student but is important to note that there is a growing body of literature [Hasselbring(n.d.), Campbell and Stuart(n.d.), Suydam and Brosnan (n.d.)] that does not support holding a student back if they **understand** the facts process but haven’t mastered the memorization math facts demand. If they get the concept of multiplication, division but get mixed up writing the steps, get out the calculator and move on!

Math literacy: Math offers a new set of language skills for students to acquire. Math terms, numbers and symbols are, in a sense, the alphabet. Some teachers actually go so far as to call math a language of numbers and like other literacies must be navigated in similar challenge steps such as **reading** math notation, **organizing** the steps needed to solve the problem, **writing** math notation and **sharing** the completed project which in a math context may be some type of geometric structure, graph, or equation set. This may contribute to the challenge of word problems for many students. Hyde found “to help develop a deeper understanding of

Chapter 8 – Assistive Technology for Mathematics

mathematics concepts, use reading and thinking strategies adapted to math”. He felt this helps students gain process understanding so that they would know what procedures to apply. Marilyn Burns found that real life connections, building comfort with math vocabulary and tracking thinking through math writing help struggling students catch up.

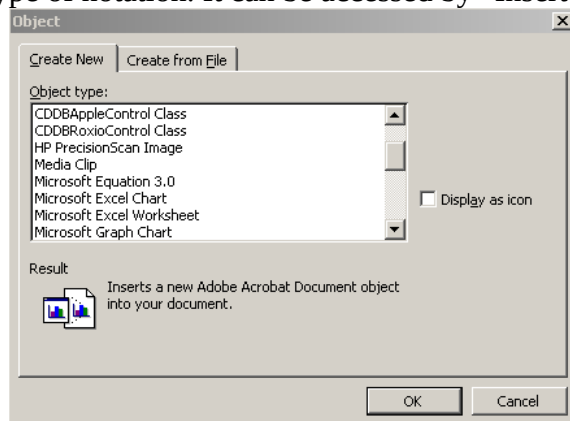
Multiple Steps/ Operations

Students can struggle with calculation, attending to the operational sign, applying multiple operations, following the steps in the correct order or sequencing the appropriate steps to complete a math problem, missing the carried number in an addition problem, or the regrouping of numbers during subtractions. These challenges often emerge in the elementary grades where computation is heavily stressed. When working a word problem, students may need to apply more than one operation. Using a math graphic organizer may help them plan out the sequences they will need to solve a problem. There are several good websites that carry printable and digital organizers. *Inspiration/ Kidspiration*, a software commonly found in the school environment, offers several examples of math graphic organizers at their website.

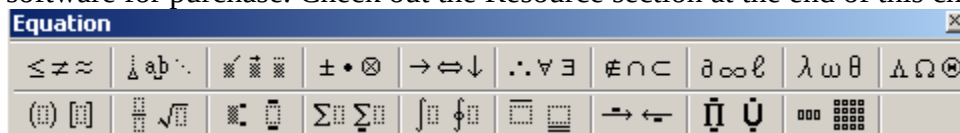
Reading and Writing Math language

Mathematical and scientific notation offer an entirely different vocabulary set to learn. Number, Symbol- and image-based, it may be helpful to add a vocabulary instruction component to the math lessons. There is a wonderful interactive math dictionary at <http://www.teachers.ash.org.au/jeather/maths/dictionary.html> that offers definitions and graphics to help explain various math terms.

Finding and typing the math symbols and sentences on the computer is not intuitive on the keyboard. *Microsoft Word* does have a toolbar called Equation Editor that can be used to do this type of notation. It can be accessed by “Insert Object”.



If you have trouble finding it use the help menu. There are higher end versions of this type of software for purchase. Check out the Resource section at the end of this chapter.



Environmental Considerations

1. **The recent shift in the way math instruction is handled means older students missed the new way and younger students are coming into a support system designed for the old.**

The math curriculum has experienced significant changes in its delivery at this writing. The focus has shifted from multiple problems of a similar nature to a more inquiry-based approach. It is important to note that many of the older students' (middle and high school) early training differs greatly from the experiences of younger students. The focus has shifted to making math feel more life applicable. The impact of the change in instructional focus hasn't worked completely through the K-12 system so the impact/outcome for upper level instruction is not known. The dramatic change means that regular and special education instructors may need to revisit some of the earlier concepts and maintain communication with elementary and middle school regular education on the need for a different set of accommodations and modifications.

2. **Access to materials**

Since the change in instruction is so dramatic, staff should be aware of the need for accessible tools for manipulation and construction. These tools may be hands on or digital. Staff may need time to explore and learn how to use these new tools. An explosion of computer programs and online support activities are available but students need to be able to access them easily. This may be difficult in a busy classroom with only 1 or 2 computers. Students who need mathematical text read with a text reader face an interesting challenge. Current text readers were not designed to convert print math notation through their optical character recognition (OCR) to digital text or to recognize the symbols and math notations used to write equations. The error rate can be high making the conversion process slow and there is usually a greater amount of time needed for staff to do editing. Mathml is an emerging tool that may simplify this process of print to digital conversion. Companies are aware of the problem, so watch for newer version text readers that can handle the task better. Some of the current text reader programs can handle reading math text that is already in digital format, such as math found in online sources with minor hurdles in reading notations like fractions and math symbols. It is good to try this out before working with the student. To reiterate, adapting math materials so that a text reader can read them is currently very time consuming. Choosing online sources may save time and improve accuracy of current readers. A final challenge is having enough student work stations available if more than one or two students need access the digital text. Most regular classrooms are not set up for multiple users.

3. **Teachers need time** to integrate new concepts in math instruction, to create or find materials that work, to teach support staff the new system, to develop alternative manipulatives and measuring tools, and to scan math text when needed. If a teacher's or paraprofessional's expertise in math is limited, there is an increased need to have time to work with the math instructors. It may be difficult to make the necessary adaptations with limited expertise or comfort level with the material.

4. **Administrative Support**

The intense focus on literacy for state testing may lead some to a feeling that math is not as

Chapter 8 – Assistive Technology for Mathematics

critical. Studies suggest the intense administrative focus on literacy shortchanges the time needed for math. One study found students were pulled from math and science to gain extra work time for literacy activities. This presents a challenge for students whose strength may be in this area or the functional math student who will need time to solidify the math skills needed for various work opportunities. Another study found that while schools offered a plethora of development options in literacy there was a lack of professional development opportunities for math and strategies for accommodation and modification.

5. Common Environmental Barriers

- Students are not enrolled in classes they need.
- Struggle with concepts because they are taught procedure instead of process.
- Minimal or no support for poor math fact recall.
- Instructional content not related to real world.

6. Common Environmental Myths

- Students should memorize math facts before moving on to upper level math skills.
- Over-reliance on calculators.
- Upper level math is hard to support.

Tasks

As a team, discuss and write on chart paper the reading tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: What are the tasks the student needs to do? In this instance what does the student need to read and then what does the student need to do with the information read? These are some questions to consider:

What Tasks do you want the student to do?

- Gain fluency in “reading” math
- Understand math processes
- Gain mastery of math facts
- Organize steps to solve the problem
- Align and apply steps
- Draw or write mathematical notation

Sensory considerations

- Visual Processing
- Visual Perception
- Ability to work in 3-D
- Ability to sequence

Chapter 8 – Assistive Technology for Mathematics

Task considerations

Visual Processing

If a student has visual perceptual, visual spatial or visual motor difficulties, he/she may struggle with:

- Aligning elements on the page, vertical numbers, working left to right versus up to down, drifting margins and writing on the lines when paper is unlined.
- Drawing from perspective or conceptualizing 3D object from 2D images on paper.
- Locating graph coordinates.
- Completing paper and pencil tasks after creating a model using manipulatives.
- Fitting numbers into answer spaces.
- Copying from the book or board.
- Accurately reproducing a model.
- Difficulty creating patterns, fractions, etc.
- Visual impairments may also make it difficult for the student to read the textbook.

Physical Issues

- Writing legibility.
- Fatigue while writing.
- Fitting writing into small answer spaces.
- Accurately drawing shapes or models.
- Managing manipulatives (blocks, pop beads, etc.).
- Managing measurement tools.

Lack of arm and hand strength, fine motor skill and dexterity may affect the student's ability to successfully complete math assignments. Math concepts are often taught by using manipulatives, such as blocks, especially in the early grades. If a student is unable to physically engage in these activities, they miss out on the hands-on learning aspects of the instruction and may lose out on the concept that is being taught. Poor hand skills can affect measuring with a ruler or scale, manipulate a protractor or a compass, pressing buttons on a calculator or using various tools to draw geometric structures. Marking map coordinates or writing in small answer spaces may provide additional challenges. Finally, a student's writing speed may be too slow when writing longer, multi-step equations.

Visual Issues

There are several visual components to math to consider. The color of manipulatives as placeholders or used as a pattern marker has little meaning when a student can't see it. Understanding what shapes and structures look like can take on new meaning for a student with a visual impairment.

Math facts

Traditionally math facts were handled with a fair amount of drill and practice. While the strategy works for some students, teachers need to be aware of alternatives. A student may struggle to memorize or not be able to recall basic math facts even though they have drilled and practiced repeatedly. Sometimes attention issues lead a child to make mistakes, missing steps or working too quickly. Common supports such as a calculator or smart charts may help the student keep up with their peers, but it is important to ascertain whether they **understand** the underlying

Chapter 8 – Assistive Technology for Mathematics

concepts of math facts (**process**) and struggle with **procedural** steps or not. It is the understanding piece that is important for higher level math skills. (Hyde, 2008) The same challenges may arise when a student is measuring or telling time.

Laskerzewski and Susi (2008) used fractions to delineate this challenge of student understanding of math process and procedure. Students were given a fraction pretest. Questions focused on process math, i.e., given a circle prompt and asked to represent fractions such as $\frac{1}{2}$ or $\frac{1}{4}$. Teachers were surprised that students did poorly on the pretest because they had already covered fractions and the students “knew” them. Upon review, the researchers found that a math procedure was taught for fractions. The teachers typically provided the lines dividing the circle in half or fourths, then asked the students to fill in the sections to represent the fraction. In the pretest, no lines were given. The students needed to understand the process of fractions. Take a whole, divide into parts and then select enough parts. To help students the researchers found the Chicago Reformed Approach (CRA) model worked well for most of their students. CRA-based instruction starts in concrete manipulatives and activities, then moves to drawings and finally on to the more abstract numbers and symbols. Some students have difficulty switching between these formats or applying different functions in the same problem, whereas other students may take longer than their peers to acquire understanding of abstract ideas. Different strategies are necessary to help students understand more abstract ideas when they are still at the concrete level; *Every Day Math* and *Math Experience* are examples of the reformed approach.

Multiple steps

Math “language” follows the steps we see in the literacy continuum when we look at problem solving. The student reads the problem and then organizes the strategy (equations) needed to solve the problem. Several authors suggested students highlight key words in a story problem and then associate those words with their math equivalent.

Below is an example using the underlining technique with a math graphic organizer.

Story Problem: Millie must fly from New York to Minneapolis. The distance is 1227 miles and takes her 2 hours and 37 minutes. How fast was she flying?

Graphic Organizer:

What do we need to know? - Speed

How do we notate speed? - Miles per hour

Do we have miles and time information? – Yes but time is in minutes and hours

How can we make time all one type? 60 minutes =1 hour so 2 hours and 37 minutes is **60 + 60+37= 157 minutes**

How can we make a math sentence for this? - Speed equals miles per hour (one hour equals 60 minutes per hour)

Can you write this using math notation? Speed = 1227miles/157 minutes x 60 minutes/1 hour

Decoding the meaning from story problems is often a first step. When a solution requires multiple steps the student may struggle to break the problem into the smaller solvable units, a little like highlighting key points when reading a text. Graphic Organizers may help support students through the step making process.

Narrowing the Focus

As a team, identify by circling or other means those few tasks the student needs to do for reading that will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for reading. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

Math

Low Tech Tools for Reading/Writing



Math Manipulatives



Low Tech Physical Access

(Rulers, stamps, adapted manipulatives)



Abacus/Math Line



Adapted Math Paper

(Enlarged worksheets, graph paper, guideline paper)



Adapted Math Tools

(Calculators, adapted measuring devices, adapted time tools)



Math "Smart Chart", Math scripts



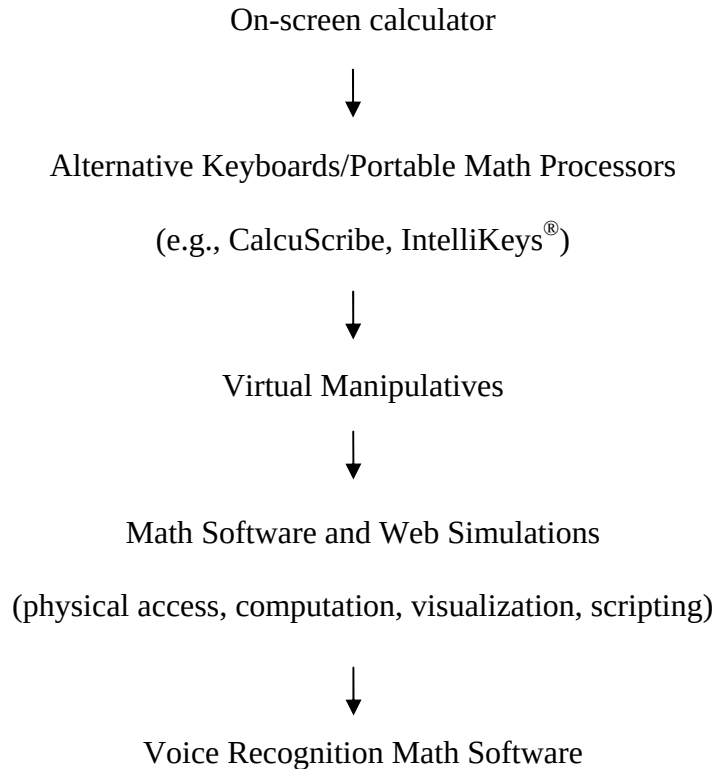
Digital Access to Math



Math Tool Bars

(Equation editor)





Low Tech Tools for Reading/Writing

Math manipulatives - Math manipulatives act as physical representations of math concepts such as numbers, shapes or place holders. They can include base ten blocks, coins, clock-faces with moveable hands, colored or textured shapes of varying sizes, pattern blocks, tangrams, spinners, rulers, fraction bars, *Cuisenaire*, *Algebra Tiles*, *Geoboards*, moveable number lines, geometric plane and solid figures. Blocks or small plastic toys may be used to teach 1-to-1 correspondence, counting, addition and subtraction. Colored blocks that snap together or number rods can correspond to place holders for units of tens or hundreds. Shape blocks or tangram pieces may be used to explain or explore early geometry concepts of shape or symmetry, while pie pieces correlate part-to-whole concepts of fractions.

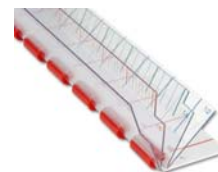
Students with fine-motor or visual-motor issues may be a struggle to even interact with the manipulatives. The struggle to control the manipulatives may come down to the size and type of manipulative used. Kathie Snow (2008) identified with this idea when working to adapt math for her son. Her son couldn't pick up the traditional little beads and buttons. So Snow used a *Thomas the Tank Engine* set her son enjoyed as a large motivating manipulative. The type, size and relevance of manipulatives can make the difference for a child learning math or being labeled a "failure." There are a lot of choices of small plastic or foam toys that could be used. Increasing the size of the counting toy may make it easier to grab. To 'add' toy pieces together for concepts such as addition and subtraction, consider adapting blocks with Velcro so they stick together or adding handles so they can be easily be manipulated. Texture codes may be added to symbolize colors for students with low or no vision. They might also be used for a student that learns better kinesthetically can work a pattern activity similar to the colored versions of their

Chapter 8 – Assistive Technology for Mathematics

peers. Enlarging or shrinking these tools as needed is another common access strategy. For some students the management of little parts and pieces is distracting. Moving to online or contained units can help. Check out mathlines and virtual manipulatives in the resource section.

Low Tech Physical Access – Selecting manipulatives with an easy grip is important for access. If a student needs more assistance, foam or wood pegs can be added to aid pick up. An array of low-tech number, thermometer, fraction and clock stamps, easy grip rulers, and other low-tech math tools can be found at *Onion Mountain Technology* as part of their *LOTTIE Math Kit* or are available individually. Stencils can be used to create basic or more intricate shapes. Students can explore number relationships at a pre-algebra level with an algebra balance.

Abacus/Math Line/Master ruler/Master fractions – An abacus or Math Line products offer a physically contained counting system for calculating/counting early math problems. They come in different sizes with up to 100 rings for counting. Each time you move a set of rings, the number they represent is exposed on the math line. They are color-coded to assist counting by fives and tens. There is even one in Braille and one with tabs for easy manipulating using a head pointer or a mouth stick. The master ruler breaks measuring down into layers. Items can be measured first in inches, then viewed in smaller units by turning the “pages” to smaller unit measurements that define the measurement more accurately. Math Line also offers a similar product to help break down time and fractions from part to whole in layers. The Master Fraction is a three-part set for teaching fractions. The white plastic base of each shows four different shapes. Each clear layer divides these shapes into progressively smaller fractions (halves, thirds, fifths).



Math Line Products

Adapted Math Paper - Math work sheets, graph paper, or assignments can be enlarged on a copier. Font, grid size, and/or colors can be manipulated before printing an assignment. A range of printable or digital graph paper and dot paper (used for Geoboard, area and perimeter concepts) can be found on the web. The choice of styles allows the adapting and printing to meet student needs. Regular notebook paper can be turned sideways for aligning vertical math problems. Add color coding on the math columns, such as green for ones and red for tens. Glue or *Wikki Stixs* can be added to paper to help define textural boundaries for writing or to outline shapes on the paper.

Adapted Math Tools

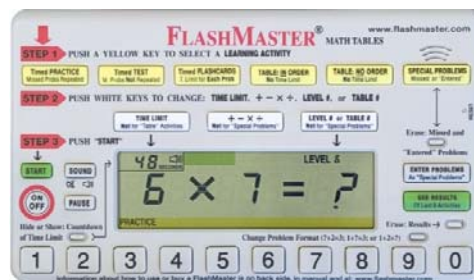
Adapted Calculator - Calculators come in an abundance of forms: large displays; large keys; small keys; lighted or talking displays; graphing and audio graphing functions; scientific; speech

Chapter 8 – Assistive Technology for Mathematics

output; and tactile input. The number of functions can range from a basic addition/ multiplication version all the way to graphing and college level calculators. There are special calculators for figuring out percentages and money. Some calculators offer a print out, useful for tracking steps used or as a tape that can be glued into a worksheet space. Calculators can also be found that convert a variety of items such as metric-to-US measurements for weight, length, area, liquid volume, cubic volume and temperature (*Radio Shack English/Metric Conversion Calculator*). The *Coin-U-Lator* is a calculator with keys shaped and sized exactly like coins and a dollar bill. It adds or subtracts money amounts and has voice output. The *MoneyCalc* is a standard calculator and money calculator in one device. It also features one touch figuring of tax and tips as well as help with unit pricing. Both of these calculators are available from *Onion Mountain Technology*. The *Math Keyboard* and *Fact Master* are portable low-tech push the button to get the answer type gadgets for students practicing or needing quick answers for math facts.



Math Keyboard



Flashmaster

Adapted Measuring Devices - Talking measuring tapes, thermometers, scales and other devices help children who have trouble seeing or reading the numbers or amounts. The *Master Ruler* from *Onion Mountain Technology* helps to teach length, measurement and their divisions. The ruler has transparent overlays that can go over a white one-inch incrementing ruler showing $\frac{1}{2}$ ", $\frac{1}{4}$ ", $\frac{1}{8}$ " and $\frac{1}{32}$ " increments. Because these different layers are transparent, the student can see the other layers and understand the relationships between different units of measurement.

Adapted Time Tools – There are a number of watches that can give verbal feedback. Some like the *Watchminder* can have messages programmed in while others will say the time with the push of a button. There are watches that show digital and analog readouts on their face piece, decreasing the confusion of telling time from just a clock face. *Onion Mountain Technology* offers a special set of clock stamps to add a time element to schedules that allow you to add the minute and hour hands. A *Timetimer* (right) uses a visual face of disappearing red to convey the passage of time for a student who is not ready for numbers on their clock faces. The *Timetimer* comes in watch and stand alone models.



Math Smart Charts/ Scripts – Math smart charts/scripts work as reference guides. They contain math facts, conversions or process steps for solving tasks challenging a student. They can encompass multiplication tables, geometric functions, conversion tables such as inches-to-metric and Fahrenheit-to-Celsius, fraction and decimal procedures, percentages etc. These charts can easily be created on your own, found and printed from online sources such as www.wati.org or at several of the teacher sites, or purchased from manufacturers like *Really Good Stuff*.

Chapter 8 – Assistive Technology for Mathematics

Another great set of tools for organizing are math graphic organizers. There are several online sites that offer samples that can be printed out or used online to solve an array of math questions. *Inspiration/ Kidspiration*, a popular software program commonly used to organize literacy projects, can be used to build a math graphic organizer as well.

Digital Access

Math Toolbars - There are a couple of great digital math dictionaries that explain various math-related vocabulary items and include interactive models that explain various math concepts. There is a nice listing of math-based <ALT> key commands that can insert math notation on the fly. See the Resources section for these. If a student needs to write equations or solve math problems on the computer, use the built in *Equation Editor* in *Microsoft Office* (if you have it). *Math Type*, an advanced, easier-to-use version of *Equation Editor* is available for purchase. *Scientific Notebook* offers math notation as one of its built in features and may already be available in high school computer labs. These toolbar-based programs offer the typist the symbols they need to use to write equations. *Mathpad* and *Mathpad Plus* (by *IntellTools*), makes math assignments easier to do on the computer, especially when computing multiple digits. These types of problems are typically solved moving right to left, starting with the ones column. Most word processors work the other way when you type. Mathpad holds the correct format for solving these types of problems. Programs such as Excel and Geometer Sketchpad offer a way to digitally create graphs and geometric objects by adding coordinates or parameters. These programs are also common in regular education. The Department of Educational Statistics has created an online tool for generating a of variety graphs. Their website is <http://nces.ed.gov/nceskids/createagraph/default.aspx>. There are several online drawing and graphing sites if students need a digital format to create graphs. For those that need a math text reader, *Read and Write Gold*, *Math Player* and *GH player* are able to read mathematical Markup language (MathML). OCR conversion of printed materials involves a lot of labor. Students who need assistance with working through the steps of the problem may want to check out online supports like <http://www.webmath.com/>

Onscreen calculators - There are onscreen versions of calculators available. One is built into the Microsoft operating system, several are web-based/online calculators, and there are some available for purchase. An onscreen calculator is useful if the student is already using a computer to write..

Alternative Keyboards/ portable math processors - Alternative keyboards provide access to the computer and provide computational experience with mathematical concepts. The *IntelliKeys* keyboard can be tailored by key size, pressure needed to activate a key, and the amount of key choices. The keyboards look/layout can be modified to ease access and/or the number of keys can be reduced. Activation areas can be big enough for a student to press. *On-screen Keyboard Magic* is an MS utility that creates an onscreen keyboard that can be accessed through a touch window or pointer. *Calculuscribe* works like a portable word processor that can handle math notation and then connect to a computer for download into a variety of text documents.

Chapter 8 – Assistive Technology for Mathematics

Virtual Manipulatives - The digital version of manipulatives adds movement and interactivity to math concepts. They also increase the potential for adaptation and access. Online manipulatives offer a greater array of problems and the full spectrum of complexity, which is hard to mimic with real manipulatives, especially at the middle and high school levels. There are digital forms of *Cuisenaire*, *Geoboards*, counters, tangrams and algebra tiles. There are more complicated versions including an abacus, fractals and vectors. *The National Archive of Virtual Manipulatives* houses an amazing number of interactive manipulative to meet the K-12 grade level content needs. Use a *Google* search to find interactives for the desired math concepts. Key words like simulation, model, interactive or tutorial should generate the visuals or manipulatives that you need. Educator-friendly search engines like *Thinkfinity*, *Nettrekker* or *Awesome Library* can find leveled, interactive activities that have been “kid” checked by teachers.

SMART Notebook software offers a nice choice of math interactive tools that can be built into lessons and activities. They have a number of pre-made activities. One of these includes a rolling dice. A simple addition activity can be created where students roll the dice a couple times and the amounts are added or multiplied. Promethean boards also offer some of these interactive tools.

Palm/ PDA technology provides students with a portable math notation tool. Being mobile means accessible computing power can go out into the world and help students explore math in a whole new way. Various probes can provide data for research projects or the student can gather data from experiments in the field that help ground abstract math concepts into real life experiences. They can also add drawings to their work on these devices.

Math Software and Web simulations:

Math graphic organizers can help a student systematically organize their solutions to math problems. Macinni and Gagnon (n.d.) in their article *Math Graphic Organizers for Students with Disabilities* found that three types of organizers worked well with math: hierarchical diagrams, sequence charts, and compare and contrast charts.

Hierarchical diagrams can be created in word processing or graphic organizing software such as *Inspiradata* or *Inspiration*. They are used to document entities and their relationships, with the constraints that bind them. The relationships can be linear or branching. In other words, if we were looking at an algebra problem we might want to know how polynomials work. We can break polynomials into multiple categories; indicate the relating notation and any equations that challenge that level of thinking. The process of hierarchical structuring is used heavily in computer software generation and in creating visuals of various business models. Advanced versions can be used to create visualization diagrams. Students with strong visual skills may be able to understand concepts better in these visual formats that hierarchical formats create. Sequence charts use visuals that should flow in one direction. They tend to follow the more typical procedure type instruction plans seen in math classrooms today. Venn diagrams, a type of compare/contrast chart, can help students visually categorize by offering spaces to sort out similarities and differences in a problem.

An emerging opportunity is the new tidal wave of math- and science-based digital labs/ simulations. Like virtual manipulatives, these programs can put math concepts into real life perspectives. There are simulations to run businesses, track the stock market or play out

Chapter 8 – Assistive Technology for Mathematics

probability and statistics in a virtual lab. Other online sites track student progress, provide tutorials on subjects not understood, generate the geometrical shapes or patterns a student may be studying in geometry, or show the fluid movements of calculus. Again, digital search engines can help locate what you need by topic and level.

Voice Recognition Software

For students who use voice recognition (VR) for their writing assignments, entering equations and science notations can prove challenging. *Math Type* is a software program designed to add this capability to the popular *Dragon Naturally Speaking* line of VR software.

Solution Selection Tools and Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the reading tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify reading objectives and criteria of performance to determine the effectiveness of the trials.

Resources

Math Manipulatives:

General manipulative

www.lakeshorelearning.com

www.beacon-ridge.com

Adaptations for Algebra and Geometry for VI students

<http://www.tsbvi.edu/math/tools-blind.htm>

Unifix cubes and Cuisenaire rods: snap together manipulative

<http://www.onlinetoyworld.com/search>

Directions for making various math manipulatives

<http://mason.gmu.edu/~mmankus/Handson/manipulatives.htm>

<http://www.mathcats.com/mathtoolbox/>

40 Easy to Make Math Manipulatives, a book of how to make by Carole Resnik (see references for full citation)

Low Tech Physical Access

Math Lottie Kit: contains an array of low tech access tools to try with students

Finger grip ruler

www.onionmountaintech.com

Balance Scales, Stencils

<http://catalog.beacon-ridge.com>

Number stamps: Stationary stories, several outlets online

Abacus, math line:

Math line <http://www.howbrite.com/>

Master ruler/Math Fraction <http://www.themasterruler.com/> 908-859-1788

Adapted math paper:

Free online printable graph paper

www.printfreegraphpaper.com

Incompetech: variety of math paper

<http://incompetech.com/graphpaper/>

Math bits: look under student resources for graph paper, high school math

www.mathbits.com

Science graphing paper

<http://geolab.seweb.uci.edu/graphing.phtml>

Chapter 8 – Assistive Technology for Mathematics

Math Smart Chart, Math Scripts:

Touch math: Multisensory program for teaching and working with numbers

www.touchmath.com

Math folder, smart chart

www.reallygoodstuff.com

Percentage and upper level math charts

www.helpingwithmath.com

Graphic Organizer

Inspiration/ Kidspiration/ Inspiradata

www.inspiration.com

<http://www.inspiration.com/Examples/Inspiration#Math>

Elementary Middle school math graphic organizers

<http://www.teachervision.fen.com/graphic-organizers/printable/6293.html>

Higher level math organizers

<http://math2.org/>

simple equations to calculus

<http://www.sw-georgia.resa.k12.ga.us/Math.html>

Adapted Measuring Tools:

Talking calculators, large print calculators, talking or large print watches, clocks and measuring tools

LS& S:

<http://www.lssproducts.com/>

Attainment:

www.attainmentcompany.com

American Printing House for the Blind:

www.aph.org

Calculators:

Large Screen

www.independentliving.com

Talking:

www.independentliving.com

Talking Graphing: Grid comparing talking graphing calculators:

<http://www.tsbvi.edu/math/talk-sci-calc.htm>

Online calculators:

Large number, talking desktop calculators:

www.independentliving.com

Chapter 8 – Assistive Technology for Mathematics

Giant onscreen calculator

<http://mrjennings.co.uk/teacher/maths/calc.html>

Graphing

<http://www.webgraphing.com/>

<http://www.coolmath.com/home.htm>

www.calculator.com

<http://www.math.com/students/calculators/calculators.html>

www.middleschool.net

www.independentliving.com

Scientific: The Sci-Plus 300 large display scientific calculator with speech output

www.tfeinc.com

Audiographing calculator

www.tfeinc.com

Audio Graphing Calculator

www.tfeinc.com

Online calculators and converters

<http://www.gamequarium.com/onlinemathtools.html>

Calculator Practice site:

<http://everydaymath.uchicago.edu/educators/samplegames.shtml>

Time:

Time Timer: color display for time passage

www.timetimer.com

Talking time pieces:

LS& S:

<http://www.lssproducts.com/>

American Printing House for the Blind:

www.aph.org

Watchminder: messages can be added to the watch

www.watchminder.com

Digital Access Options:

Math Dictionary

<http://www.teachers.ash.org.au/jeather/maths/dictionary.html>

<http://www.coolmath.com/reference/online-math-dictionary.html>

Alt codes list for math

<http://www.usefulshortcuts.com/alt-codes/maths-alt-codes.php>

Chapter 8 – Assistive Technology for Mathematics

Equation Editor: tool within MS Office for typing math symbols

Math type: Win/Mac equation writer with advanced math symbols
www.dessci.com

Online Unit Conversion
www.onlineconversion.com

Virtual Ruler
<http://www.desktopruler.com/products-dr.htm>
<http://www.svet-soft.com/ruler.shtml>
<http://www.spadixbd.com/freetools/>
<http://www.downloadjunction.com/product/store/15482/index.html>

MathML Readers:

Kurzweil
<http://www.kurzweilededu.com/>
Read and Write Gold
www.texthelp.com/
Mathplayer
<http://www.dessci.com/en/products/mathplayer/tech/accessibility.htm>
GH Player
www.gh-accessibility.com

Graph creators:

MS Excel has the capability of graphing coordinates

Kid Zone Create a Graph
<http://nces.ed.gov/nceskids/createagraph/default.aspx>

GraphSight Junior 1.0 highly rated freeware for drawing 2 D graphs
http://www.freedomdownloadcenter.com/Utilities/Automation_Uutilities/GraphSight_Junior.html

Geometer Sketchpad: Drawing tool for geometry figures
www.dynamicgeometry.com

Scientific Notebook Tool bar for writing scientific notation
www.mackichan.com

Online higher level math/ graphing tools
http://people.hofstra.edu/Stefan_Waner/realworld/utlilsindex.html

Alternative Keyboards and Portable Math Processors
Calculuscribe portable keyboard
www.calculuscribe.com

Chapter 8 – Assistive Technology for Mathematics

Math keyboard-They keep multiplying: Math fact portable tool

<http://www.wonderbrains.com/math-keyboards-they-keep-multiplying.html>

IntelliTools: Math Pad and Math Pad Plus

www.intellitools.com

Onscreen keyboard magic: Onscreen keyboard with enhanced features

<http://oskm.ifastnet.com/>

Virtual Pencil digital pencil for writing math

www.hentermath.com

PDA Probes

www.pasco.com

Moneycalc

Coin Abacus

www.tfeinc.com

Flashmaster portable digital math facts generating tool

www.flashmaster.com

Virtual Manipulatives:

Web search Engines:

www.nettrekker.com

www.thinkfinity.com

www.awesomelibrary.com

National Library of Math Manipulatives

<http://nlvm.usu.edu/en/nav/vLibrary.html>

Smart Notebook software has a large number of interactive tools to “visualize” math concepts including money, several premade activities as well. <http://www2.smarttech.com/>

Promethean Boards also have math related interactive tools

www.promethenworld.com

Shodors www.shodor.org/interactivate/activities/

Illuminations: Interactive online/ manipulatives/ lesson plans. Excellent set of fraction activities

<http://illuminations.nctm.org>

Computing Technology for Math Excellence

http://www.ct4me.net/math_manipulatives.htm#Calculators

Chapter 8 – Assistive Technology for Mathematics

Math Playground (Elementary concepts)

www.mathplayground.com

Virtual Cuisenaire Rods: <http://www.arcytech.org/> (Select educational java programs)

Algebra Tiles: http://my.hrw.com/math06_07/nsmedia/tools/Algebra_Tiles/Algebra_Tiles.html

Geogebra: Virtual tools for algebra, geometry and calculus

<http://www.geogebra.org/cms/>

Virtual Fractions:

www.virtualfractions.com

Visual Fractions:

www.visualfractions.com

Real Money

www.attainmentcompany.com

Math Educational Java Programs simple money, time manipulatives

<http://arcytech.org/java/>

Math Software and Web Simulations:

Gizmos

www.explorellearning.com

Operations/Tutorials

Clear Math (Edutron Corp.) - algebra I & II and pre-algebra topics; self-paced

www.clearmath.com

Hey Math! E math lessons based on Singapore Math

<http://www.heyath.com/main/howitworksschool.jsp>

IntelliMathics - (IntelliTools, Inc.) - interactive math manipulative program with a variety of manipulatives, e.g., base ten blocks, Venn diagrams, attribute blocks; for middle school concepts not learned.

www.intellitools.com

Simulations:

Real World Math

www.realworldmath.org

Math for the Real World, Davidson, grades 5-6 Real world experiences with time and money

<http://www.knowledgeadventure.com/school/catalog/mrw.aspx>

Chapter 8 – Assistive Technology for Mathematics

Math Workshop Deluxe, grades 3-6

<http://www.smartkidssoftware.com/ndbro40.htm>

The Math Work shop

www.themathworkshop.com

Math Problem Solver, Curriculum Associate, grades 1 - 8 & Adult Ed, teaching/reinforcing key concepts

www.mathway.com

Math simulation games

<http://www.techtrekers.com/sim.htm>

Microsoft Math is a purchasable add on program that creates graphs and provides a nice adv. feature online calculator

<http://microsoft-math.en.softonic.com/>

Voice recognition Math software

Math Talk Works with dragon products to write math

<http://www.mathtalk.com/>

General Web Resources

FDLRS/TECH, frequently updated web options in many areas

<http://www.paec.org/fdlrstech/math.html>

Select Math Program with Boston Public Schools

<http://boston.k12.ma.us/teach/technology/select/index.html>

The Math Forum at Drexel, Ask Dr. Math

www.mathforum.org/te/index.html

<http://mathforum.org/mathtools/>

Online tutor or help sites for various math concepts:

www.math.com

<http://www.aaamath.com/>

www.shodor.org

http://mathforum.org/math_help_landing.html

<http://illuminations.nctm.org/>

Online utilities for writing upper level math notation

http://people.hofstra.edu/Stefan_Waner/realworld/utlsindex.html

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Chapter 8 – Assistive Technology for Mathematics

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Chapter 9 - Assistive Technology for Organization

Introduction.....	1
Using the SETT Process	2
Decision Making Guide	3
SETT Process	4
Background	8
Self-Management	10
Continuum for Self-Management.....	12
Continuum Expanded.....	12
Continuum for Information Management.....	14
Continuum Expanded.....	14
Continuum for Time Management.....	19
Continuum Expanded.....	19
Continuum for Material Management.....	23
Continuum Expanded.....	23
Organization Problems Inventory.....	28
Executive Functioning	31
Writing AT in the IEP	35
References	36

Assistive Technology for Organization

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Organization is the name commonly applied to an underlying skill set needed to be successful throughout the education process. It is often not a targeted component of the curriculum but plays a significant role in the achievement of curricular goals. Definitions may vary but for the purposes of this chapter and the assistive technology tools and techniques, we will discuss skills in the areas of self-organization, information management, time management, and materials management.

Introduction

Lack of organization can be a barrier to student's performance of everyday tasks and assignments. Although specifically not addressed as a subject area for instruction, different methods of organization are taught throughout the educational process. As early as their first educational experience, students are expected to follow the organization utilized in the classroom: using a cubby or locker to store their belongings; following a daily schedule to delineate when there are different classes; and recess and lunch times. As the students move up in the grade levels, other techniques and tools are used to help students stay organized: folder and notebook procedures to distinguish between what goes home and what needs to come back to school; daily planners or organizers to write down and remember assignments; templates for assignments, etc. Some schools have begun to move their organization of information to a digital format, listing class assignments, scores, grades on their web site which is accessible to their students anywhere anytime. Yet despite these structures put in place for them, some students still struggle with various aspects of organization.

This chapter is organized in accordance with the Decision Making Guide following the SETT format (Student, Environment, Task and Tool). The *Student* section will assist you in determining skills and abilities exhibited by the student to perform the organizational skills necessary for functioning in the academic environment. The *Environment* section poses questions to consider concerning the impact of the students environment, the teachers expectations, and how the environment might impact on the choice of assistive technology for organization. The section on *Tasks* for organization poses questions to help determine what is required of the student in order to appropriately choose an assistive technology solution. Following *Tasks* is a section on *Tools* beginning with the continuum of assistive technology to be considered. The continuum is organized from low to high technology. A more extensive listing of tools and strategies under the continuum subtitles follows. The chapter concludes with a discussion of a feature match process and steps for implementation. Chapter appendices include sample IEP objectives, references, resources, and product charts.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

Disclaimer: this is a brief introduction to an understanding of organization not meant to be all-inclusive, but to give the reader a basic understanding of organization to better select appropriate assistive technology supports.

For a review of the literature related to organization and articles addressing a multitude of organizational information, refer to the reference section at the end of this chapter.

WATI Assistive Technology Decision Making Guide

Area of Concern: Organization

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to organization? Does the student have strengths or learning styles that could facilitate an organizational system? Identify specific issues: • Organization of time, information, or materials? • Self-regulation? • Cognitive strengths? • Classroom issues? • Managing time? • Missing deadlines? • Poor use of work time? • Frequently late? • Messy work areas/lockers? • Difficulty getting started or prioritizing work tasks?	What environmental considerations impact the area of concern? Are any of these barriers interfering: • Time to teach organizational skills? • Organizational skills in curriculum? • Time between classes? • Sufficient physical space? • Study rubrics, learning grids? • Structured work environment? • Sufficient materials, time, and work spaces? • Performance variable? • Does the teacher struggle with their own organizational issues?	What task(s) do you want the student to do? • Arrive on time? • Arrive ready for learning? • Have materials needed for class? • Organize papers and materials independently? • Organize their work area/locker? • Retrieve needed materials in a timely manner? • Complete projects successfully? • Generate a multistep plan for longer projects? • Develop their own organizational system?
Sensory Considerations		Narrowing the Focus
Hypersensitivity or hyposensitivity to stimuli such as: visual clutter, different lighting; classroom and background noise; tactile stimulation; awareness of physical space / personal space; other individual specific sensitivities		i.e. Specific task identified for solution generation (such as) one from the list of tasks above
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision	Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Date/Length/Person Responsible
		Follow-Up Plan Who & When-Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to organization. Please complete and review Section 8 of the WATI Student Information Guide: Organization (Chapter 1, page 38).

Indications of difficulties of organization are demonstrated in many ways. The student needs adequate support and skills to perform educational tasks. To help the team to better understand the abilities and difficulties there are questions that may be asked to elicit the child's current level of functioning with regards to organization.

What are the student's abilities and difficulties related to organization?

- Is the student able to self-regulate?
- Does the student have fully developed cognitive strengths?
- Does the student struggle to organize information?
- Does the student struggle to organize their time?
- Does the student struggle to organize their materials?

What evidence of organizational problems do we see in the classroom?

- Does the student have difficulty managing time?
- Do they miss deadlines, have difficulty managing work time or are they frequently late?
- Does the student have difficulty managing materials and workspaces?
- Does the student have work areas\desks\lockers that are a mess?
- Does the student have difficulty organizing information for projects or completing longer assignments?
- Does the student have difficulty getting started on projects, and extracting important or pertinent information?
- Does the student have difficulty prioritizing work tasks?
- Does the student have trouble handling multiple or multi-step assignments?

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation
- Awareness of physical space / personal space
- Other individual specific sensitivities

Below are factors that are not directly related to organization, but can impact the student's ability to focus on instruction and learning. Consider the following:

Chapter 9 - Assistive Technology for Organization

- What sensory challenges does the student have that impact organization?
- Do they like or dislike certain textures, visual information or clutter? For example folders or book covers that have various surfaces: shiny, smooth, bland.
- Does the student have the ability to explain why they need to use fidget toys or other types of self regulating strategies?
- Does the student have tools and strategies to assist their own sensory regulation as it relates to self-organization?
- Do they prefer flat storage or upright as in a locker?
- Do they use a separate container or a holder inside the notebook to store pencils or other small items?

Other Considerations

Each individual student has specific skills and areas of concern. Be certain to address those as you capture the particular traits of the student in this part of the SETT process.

Some questions to consider:

- Does the student have tools that can assist their cognitive strengths?
- Does the student have and/or use materials that meet their learning style?
- Does the student have specific tools to help focus their attention on educational tasks?
- Does the student have organizing strategies that match their needs?
- Has the student/parents been interviewed about current organizational challenges and strategies that have been tried in the past?

Environmental Considerations

As a team, discuss and write on chart paper any environmental considerations that might impact the student's organization such as auditory or visual input, placement of the student in the classroom, number of different environments or any other environmental impacts.

What environmental considerations impact the area of concern?

Are these common barriers interfering with the acquisition of organizational skills?

- Is there time to teach organizational skills?
- Are organizational skills built into the curriculum?
- If the student has to move between classes, is there enough time between classes?
- Are time and space management still emerging skills for many elementary and middle school students?
- Does the teacher struggle with his or her own organizational issues?
- Is there sufficient physical space to organize materials?
- Are study rubrics, scaffolding or learning grids available to help students break large tasks into smaller units?
- Does the student have cognitive strengths deficits that may be impacting their processing? Is there time to back track and work on these underlying skills?

Chapter 9 - Assistive Technology for Organization

- Is the student's organizational performance variable?
- How structured is the work environment?
- Does the lesson structure include strategies that support students with cognitive strengths difficulties?
- Are there enough materials, time, and work spaces?

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory issues influence the student's learning, identify the sensory levels in each environment that impact the student's ability to organize.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Tasks

As a team, discuss and write on chart paper the organizational writing tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: what are the tasks the student needs to do? These are some questions to consider:

- Does the student arrive ready for learning?
- Does the student arrive on time?
- Does the student arrive with materials needed for class?
- Does the student organize papers and materials independently?
- Is the student able to organize their work area?
- Does the student retrieve needed materials in a timely manner?
- Does the student arrive with projects completed successfully?
- Is the student able to generate a multi-step plan for longer project?
- Is the student able to identify or articulate emotional issues that may cloud or interfere with attention needed for organizing?

Narrowing the Focus

As a team, identify by circling or highlighting those few tasks the student needs to do for organizing that will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

At this point, the team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for organization. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology. Subsequent to the continuum is a more in-depth description of select tools.

Background

Organization is a complex process requiring many components. This skill is important to overall student success. Throughout a student's educational career multiple methods and systems of organization are required. Many students struggle with how to use organizational skills to improve their work. Numerous components are involved in the organization process. These include: self-organization; information management; time management; or materials management. Understanding the components required to complete a task is paramount and helps us to provide assistive technology that supports a deficit area. Having background information in an area of study known as executive functioning helps staff to understand its role in supporting and contributing to organizational needs of students.

Executive functioning

Organizational skills are components of a broad set of skills often referred to as executive functioning (EF) skills. Currently there is no standard definition for EF, but the following definition outlines EF: executive functioning is a neuropsychological concept referring to the cognitive processes required to plan and direct activities, including task initiation and follow through, working memory, sustained attention, performance monitoring, inhibition of impulses and goal directed persistence (Dawson & Guare, 2004). Authors and practitioners (Dawson & Guare, 2004) (Warner, 2008) acknowledge several different categories of these skills, agreeing with the following 10 types of executive functioning (EF) skills: sustaining attention, shifting attention, inhibiting impulses, initiating activity, planning and organization, organization of materials, time management, working memory, and emotional control. All of these executive functioning skills work together to support self-organization, information management, time management and materials management.

To understand the underlying skills needed for organization, a brief explanation of EF taken from Warner (2008) will delineate the components of EF and their relationship to the different areas of organization in this chapter.

Sustaining attention

The proponents of Executive Functioning (EF) literature would suggest that sustaining attention is a significant precursor to organization. Sustaining attention is the ability to hold one's focus on the task at hand long enough to complete it. It is a pre-requisite to other executive function skills. It is difficult to stay with or stick to an activity without sustained attention, so even the best organizational methods can't be utilized if the student can't attend to the teacher explaining the task, the organization or any other information.

Shifting attention

Shifting attention is the ability to move freely from one situation, activity or aspect of a problem to another. This includes the ability to respond to feedback by letting go of an idea or strategy that is proving ineffective. Flexibility in solving problems, making transitions, and coping with unforeseen events is also part of the concept of shifting attention. Students may have difficulty making transitions because they are "stuck" on activities due to anxiety, perseveration or compulsiveness. Students may also have difficulty "settling in" once they enter a new classroom or start a new subject.

Inhibiting impulses

The ability to control impulses is an important part of determining what needs to be attended to as well as the ability to appropriately stop one's own behavior at the proper time. Lack of impulse inhibition allows the student to attend to information beyond what is important. The inability to tune out extraneous information is often observed as distractibility. Students may appear distractible because they have difficulty stopping themselves from responding to distracters. The capacity to think before acting and the ability to resist the urge to say or do something long enough to evaluate the situation and how our behavior might affect it will also influence the ability to follow through on organizational tasks through the school years.

Initiating activity

Another component of EF is the ability to initiate activity. This is the ability to begin a task or activity without undue procrastination. It also encompasses the ability to independently generate ideas and the drive, desire, or motivation to complete work.

Planning and organization

Planning and organization is the ability to prioritize and develop steps necessary to complete a task. It often involves multiple steps and components to complete a task, and without the proper planning and organizing many school-based activities are not successful. Many times a teacher is able to note that the student has difficulty in this area, but they (both student and teacher) are unable to figure out the steps, where the difficulty is occurring, or the type of difficulty that is causing the lack of success with planning and organizing.

Organizing of materials

The organization of materials is often an area easily identified by the teacher as an outward picture of lack of organization. This is the ability to keep one's workspace, play areas, and materials orderly. It also encompasses the ability to determine what materials or resources are necessary for a task and have them readably available. Students who have difficulty with organization may lose materials and/or fail to turn in completed work. Organization of materials does not always equal neatness. Many people are able to have a system of organization that on the surface appears messy. However, the true test of an organization system is whether materials, information or any other needed item can be found in an efficient manner.

Time management

Time management is an area of Executive Functioning (EF) that is also easily observed by teachers in the classroom. It encompasses the ability to estimate how much time a task will take. The student must have the ability to estimate how much time one has, how to allocate it and how to stay within time limits and deadlines. It is the simple fact that the student recognizes time is important. Often when time management is an issue, the use of a parking lot will allow an extraneous idea to be acknowledged and set aside or 'parked' on a separate paper to be addressed at a later time. This allows the student to acknowledge that the other information may be important but that it is not part of the current project.

Working memory

Working memory is the ability to hold information in your mind while you complete a task. A student must be able to keep information needed to complete a task in their mind. The student must also be able to hold and move between different sets of information long enough to use them. This also encompasses the ability to draw on past learning and apply this to situations in the present and the future.

Emotional Control

Emotional control is the ability to manage emotions in order to achieve goals and complete tasks. The ability to control one's emotions is a significant factor in achieving executive functioning. Students who have difficulty with emotional control may go into a fight/flight mode about an issue and are then unable to focus on the task at hand. Teachers may note that the student comes to the classroom already in an emotional state and that it is very difficult for the student to move beyond the emotional state to address the learning that is to take place.

Self-Management

Sensory input as a basis for self-organization

A student needs to sort through a constant stream of sensory information and needs to employ self-regulation strategies to help decide what needs to be attended to and what extraneous information is. Much of our early learning experience is triggered by what we process at a sensory level. For some students, especially a student with sensory processing limitations, the skill set of learning may be skewed.

How does a child with visual impairments learn that there are objects to reach for and in the process develop the arm and hand functions needed for reaching? How does a child with motor problems learn the joy of catching something rolled or tossed their way? What happens when they miss the early social interactions of throwing the object back and forth with a parent or sibling? How does a child with attentional difficulties focus on the important sensory information (auditory/visual) required to comprehend the directions or information from their teacher when there are many environmental sensory distractions?

Acquisition of Information

The brain creates a “filing system” that expands constantly to accommodate new sensory information. That experiential filing system plays a critical role during a student’s school career, as new information to be learned is often compared or tied to what they already know. For some students, the filing system they have created may not match up with the expected experiences needed for successful school performance. Programs such as Birth-to-Three Interventions, Head Start and Early Childhood are designed to increase the early experiences of children so they are ready for the demands of school and life. Even with these programs in place, some students may not arrive with the filing tools they need. It is important to assess and perhaps take a step back and build the cognitive strengths needed for later learning tasks.

Chapter 9 - Assistive Technology for Organization

A child with a physical disability may miss out on some of the experiences that peers take for granted. A child in a wheelchair may not get to experience the social connections that his classmates get sitting at their worktables. The tool for mobility impacts the social and access components of learning. The wheelchair may make it difficult to pull up to the table or motor issues may make getting on the floor to play with a friend difficult. A child with communication difficulties, whose only means of expression is a simple picture board, does not get the same practice using words that a talking peer, affecting the development of conversational skills, play with words and sentence structure. The reality is that a student arrives at school with a set of experiences and a system that processes sensory information in a way that is unique to them. Sometimes it is important that we step back and help them to learn and navigate with new skills they may not have encountered before. It is never too late for a child to develop cognitive strengths and there are tools that can help these students navigate the school experience with more success. The question from an AT perspective is how we can use technology tools to support sensory systems, learning styles and cognitive strengths in the school environment.

Sensory Engagement

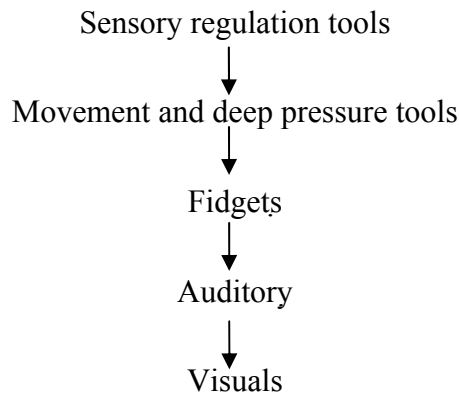
Eric Jensen in *Tools for Engagement* (2003) talks about strategies that tap into sensory strengths to increase student engagement. He uses simple routines (similar to motor feedback loops) repeated constantly to help clue young students into the actions, such as upcoming transitions, returning attention to the teacher after group activity, or drawing the children's attention into learning experiences. Simple strategies that can be employed to help children focus include: deep breathing to calm and focus an excited group or calm a tense situation; simple call back games; or playing certain types of music.

Use of Motor activities to reengage

The popularity of *Brain Gym* or *Yoga for Kids* may be due to the use of a motor feedback loop between movement and attention to help students stay focused. Tapping into any of the sensory loops can be effective for "brain access". Sensory diets and fidgets may be used to help a student stay in an attentive state. One example would be to use a wind chime as the call-back mechanism after group activity. The pleasant sound draws student attention gently and the teacher's beatific smile reward the students' quick response and attentive behavior.

Judy Sweeney, a professional and specialist in the area of assistive technology, found sensory processing played a role in technology tool selections depending on the student's preferred learning style. She found that visual schedules and *Time Timers* worked well for students with visual preferences, while print schedules and alarm sound features worked better for those who preferred auditory feedback. Sweeney created an Organization Problem Inventory which can be viewed at her website www.onionmountaintech.com It is also at the end of this chapter.

A Continuum of Considerations For Assistive Technology- Self-Management



AT Tools for Self-Management

Sensory Regulation Tools

Talk with your occupational therapist about resources to learn more about sensory processing tools that can regulate student sensory systems. Sensory Diets are quickly gaining popularity in many schools, especially for students with an autism spectrum disorder. While general suggestions such as deep breathing, heavy work, motor breaks, fidget toys, white noise or music are useful tools to help a student regulate their attention, it is important to work with an occupational therapist trained in these types of interventions while putting programs in place. Sensory stimulation activities can be very prescriptive. Swinging, deep pressure, heavy work and brushing/ joint compression programs can be very effective tools in self management, but need to be monitored regularly by someone who understands the neurological ramifications of what is being done to the child. Misinterpretations of a child's behavior can have a negative impact on their school performance.

Movement and Deep Pressure tools

Movement tools may include *Activa Disc*, *Disc O Sit* as well as *Move-n sit* cushions, ball chairs, swings, bikes or rocking chairs. The student uses the movement to help them maintain attention. The cushions, ball chairs and rocking chairs may provide in-class tools a student can use to move less obtrusively while maintaining attention. Swings provide rhythmical or arrhythmical movements for a child who needs to regulate their sensory system. It is important to work with a trained occupational therapist when using this type of tool. Some students may need sensory breaks that allow them to move outside of the classroom. Bikes and playground equipment such as swings or merry-go-round can help calm some children. Movement may be paired with a heavy work activity such as carrying the full milk crate back from lunchroom or wearing a weighted or pressure vest. Heavy work and deep pressure tools are also used as calming activities.

Fidgets

Fidgets include small objects that can be compressed, stretched, manipulated, or moved. These may include a small rubber ball, silly putty, small fine motor toys, add-on pencil erasers that have a squishy or movable component or toys that fit in the hand but can still move. Fidgets are used to add movement in a non-obtrusive way. The movement may be needed to help the child maintain attention or to relax an anxious student. The challenge for these tools is to ensure that they are not misused and become more of a distraction for the individual student or peers than a tool for helping the student focus on tasks. Rules for use of these items are needed.

Auditory Tools

Music: Music can be a useful tool in self-regulation. Think of your own experiences. What kind of music do you listen to when you're happy? What music do you choose when you're sad? Is the music you choose on Friday night as you are going out to meet friends, the same music you would study to on Sunday evening? For most people, the answer for each of these questions would be different. Music theory has looked at the beats per minute as one means of moderating sensory experiences <<http://faculty.washington.edu/chudler/music.html>>. A Stanford study used functional magnetic resonance imaging (fMRI) technology and found that music engages the areas of the brain involved with paying attention.

White noise: some students may benefit from a headset that uses white noise as a block or filter for environmental noises that are distracting them. The white noise works to block the distracting background noises.

Hemisync: There has also been brain research on using music to help the brain achieve a higher level of attention, concentration or relaxation. Some students may benefit from certain types of music while they work. *Hemisync* is just one example of this type of specialized music; they also have a CD recording of white noise.

Noise reduction headsets: Noise reduction headsets can be used to block out all external noise to help students maintain a focus on school tasks.

Visual Tools

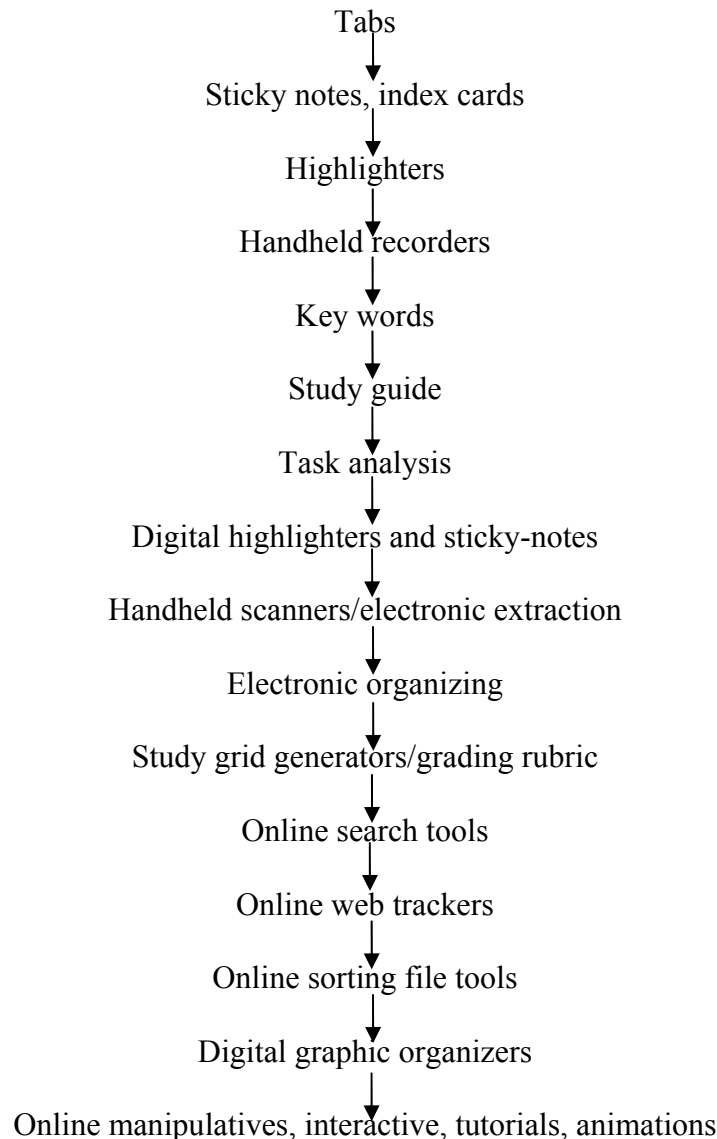
Social stories, paper, symbol or visual clean video

Social stories were designed to help students anticipate changes or particular situations they might encounter during the day. Some students may have difficulty reading the subtle cues a teacher or classmates send to prepare for transitions in their day, such as going out to recess, changing classes or getting ready to go home. The social story is created to step them through what will happen during the transition using a simple structure that explains what needs to happen, give the steps needed and acknowledge feelings.

Social stories can take several formats. Some students may need real pictures, showing step by step what they need to do. Others may have picture schedules generated from a symbol library such as *Boardmaker*© or *Picture It*©. These systems are usually paper-based. Sometimes there are removable pictures that the student takes off as they complete the expected routine. With the emergence of video, some students may benefit from short video clips demonstrating what they are expected to do. These video clips are becoming more easily accessed through handheld devices. They can also be reviewed multiple times at school or at home for as long as is needed.

A Continuum Of Considerations For Assistive Technology

Organization - Information Management



AT for Information management

In the school setting students are expected to acquire, retain and use information. Managing information can be a challenge. Technology can help students manage and sort information to facilitate communication and comprehension. For the purposes of this section we are going to look at tools that can help a student manage and utilize information to complete required tasks.

Tabs: Most students in middle and high school have large textbooks that they need to navigate. These textbooks may have key sections the student may need to reference frequently such as a

map section, appendices, a dictionary or vocabulary definition section or the last page accessed. Removable book tabs can be put in the book to help students locate these sections quickly. The tabs can also be used to mark the questions at the end of the chapter, selections that contain pertinent information or any other place that needs to be referred to frequently.

Sticky-notes/ index cards: Sticky-notes may be used as temporary book tabs to mark where they stopped reading or to mark a chapter they need to reference. Another use of index cards or sticky-notes is to gather information as it is found in resource materials. The student writes the key points that they needed for their project onto the sticky-notes or index card. These can then be moved around on a desk or wall as a portable paper graphic organizer. Students can start to learn to chunk pieces of information that are similar or to look for patterns in the ideas they have noted from the information they have read. This organizational step is often missed by struggling students and is a very concrete way to start organizing a project.

Highlighters: Highlighters offer another way for students to interact with the informational text they are reading. The student may use a highlighter that is erasable or use a regular highlighter to mark handouts or worksheets. Highlighting offers a visual reminder about the text having some importance for the student. Some students may use a range of colors to mark text by category, i.e., all items that address timeline issues during the Civil War are in blue and all items that talk about causes of the war are in pink.

Steps for highlighting include:

1. Read the passage to obtain general idea of the material.
2. Reread and look for key words and concepts.
3. Highlight important information.

Students often do not follow all of these steps as they involve multiple reads of the information and they may have difficulty reading through it once or have issues with analyzing or synthesizing skills. This may be why they highlight too much information. Providing keywords to look for may help them start to learn how to identify important information. Highlighters come in several formats: erasable, some have built-in caps, which help keep all the pieces in one place, or highlighter tape.

Hand held recorders/Pocket minders: Digital or audio recorders may be used to capture thoughts and ideas verbally. A student records a message such as “I need to remember to bring flour for the papier-mâché project tomorrow” or “Read chapter 8, answer the study guide and questions on p.44 and 45.”

Keywords: Understanding key vocabulary is critical to organization of projects that are going to be written. Marking in a book or creating keyword sheets can work as a quick reminder about what the words they are using actually mean.

Study Guide: A study guide can help students navigate print and digital information and aid a student’s comprehension. It can provide a framework for learning tasks and classroom expectations. The study guide design can incorporate leading questions, to drive the process of information gathering, and shape the supports a struggling student may need. It can help

students identify and organize important information and help the students learn to think about and ask questions to support their comprehension while they are reading text.

Task analysis: Students may need paper or digital worksheets to help them analyze bigger projects. The purpose of a task analysis is to break down bigger elements into smaller more manageable chunks and to identify potential problem areas a student must navigate to complete the project. For sample sheets see the Resources section at the end of this chapter.

Digital highlighters and sticky-notes: Digital versions of highlighters and sticky-notes, often freeware or inexpensive software, allow students to highlight a webpage. Some of these highlighters will allow the highlighted text to be extracted to a word processing document or a digital graphic organizer such as *Inspiration* for future sorting. Sticky-notes are also available in digital form allowing a student to add their thoughts as they read from the web. These notes can also be sorted and added to a graphic organizer. These are built into programs like *WYNN*, *Solo*, or *Microsoft Word* (see Chapter 7 – Assistive Technology for Reading).

Handheld scanners and electronic extraction: Handheld scanners and electronic extraction can be used to convert paper documents into digital formats. A typical scanner would convert the document into a picture, but some of these tools are even able to convert a paper text document into a digital text format using OCR (Optical Character Recognition- see Reading CH. for more information). This may help the student access the text via a text reader or to highlight, cut-and-paste, or move text into a graphic organizer. The systems mentioned below are small enough to fit in a pencil case or pocket for on-the-go use.

- *Infoscane*
- *Kurzweil Krb reader*
- *Docupen 800* (OCRs with paper port) - http://planon.com/docupen_rc800.php

Electronic organizing:

There has been an explosion of web-based tools to support organizing information gathered on the Internet. Tools range from the development of study grids and task checklists to an array of online search, interact and track features. There are tools that can highlight or clip key information. Other tools may help track information as it is collected for later referencing. Web tracking software captures the sites a student is using. Other sites can help a student identify the type of form that is needed to complete a project with an outline of that format. This form can help guide the student through the creation process. There are even sites that can format references and resources.

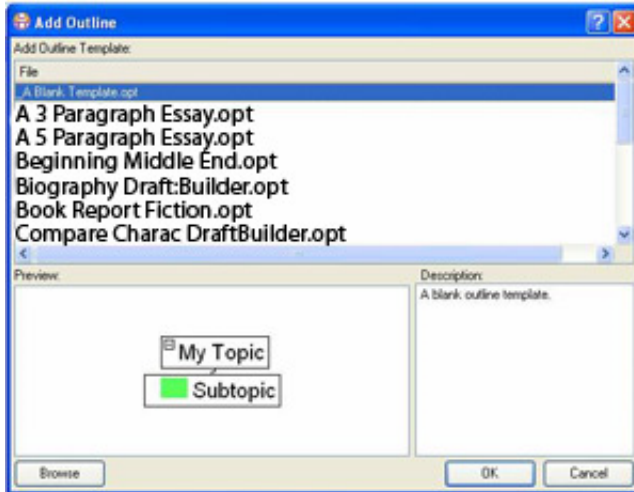
Study grid generators, grading rubric:

A study grid helps students organize the search for information by identifying key concepts or questions a student may have as they read a text. These questions guide student to develop the internal thinking needed to extract meaning from information they read.

- Don Johnston's *Solo* product has ready-made templates and space to develop a study guide as part of a reading assignment. The product also has a read-aloud support feature to help students struggling with decoding.
- *Report Writer Interactive* is another tool that provides a study guide concept around reading/ writing activities. Identify the desired end product such as an essay or persuasive

argument and the program asks the user to answer questions that can guide their thinking on the topic.

- *Rubistar* is a web-based tool that templates study rubrics and is customizable to project needs.



Solo Templates

Image from Don Johnston, Inc.

www.donjohnston.com

Image used with permission.

Here are some other study guide templates with read aloud support

- <http://ksdl.ksbe.edu/writingresource/typeswriting.html>
- http://www.donjohnston.com/downloads/solo_templates/index.html (need *Solo* to view)
- <http://www.brainpop.com/english/writing/typesofwriting/preview.weml>
- Rubistar <http://rubistar.4teachers.org/index.php>

Online search tools: *Nettreker*, *Thinkfinity*, or *Awesome Library* offer age appropriate as well as protection from inappropriate sites while searching the Internet for information. Online search tools can be used by students to gather information or by the teacher to find alternate forms of the information that may better meet a student's particular learning style.

Online web trackers: Online web trackers track where a student has traveled during a web search. Useful for later referencing of sites, it helps when a student forgets where they found something and helps teachers leave a trail of sites for students to visit.

Online Sorting File Tools: In addition to online tracking software, file storage may be needed as a student works on a specific project. Teaching students to create files to store their information is common. Unfortunately there is a tendency to over bookmark and save files, just like we do with paper. This can make finding what you need tedious. Social bookmark sites such as Delicious (<http://delicious.com/>) allow the information to be tagged in multiple locations.

Digital Graphic Organizers: Graphic organizers can help students organize bits of information into summarized units. These organizers help students capture information in a format that can be sorted and then moved to the linear format. *Inspiration* is a common program in many schools that follows this concept and then allows the outlined to be exported to a word processing document for finishing. *Spark-Space* (<http://www.spark-space.com/>) adds a rotational

Chapter 9 - Assistive Technology for Organization

3D view that can help students with strong visual spatial skills. Additionally there are 2 free organizers, *C-Map* and *Bubbl:us*, that allow access to graphic organizing on the web.

Payne (2003) found that students could use digital graphic organizers, such as *Inspiration* and *Kidspiration* to capture their circular thinking in the diagram mode and then connect those thoughts in the outline mode to create an informational linear document a teacher would expect (p 49).

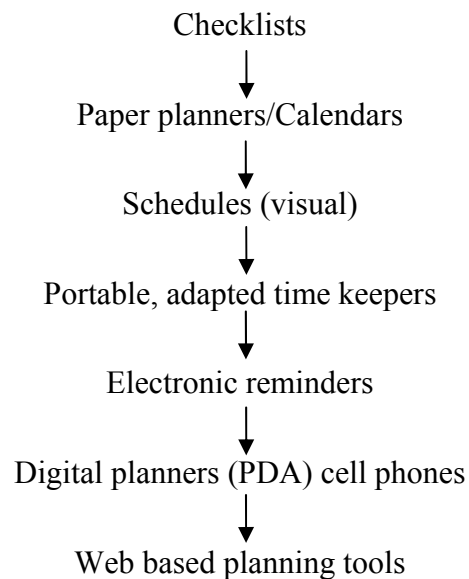
Lynne Anderson-Inman (n.d.), in her research on electronic study tools, found a connection with improved student performance when she used digital graphic organizers with students. The students could move the information pieces surrounding a topic in order and then switch the data into another view called outline mode. She found that the students using outline mode could see the gaps in their information and take corrective action.

Online formatting: The goal of these programs is to ease the pain of referencing projects by helping students keep track of their sources or to assist in the formatting. The following are some tools that are readily available.

- End notes in MS word <http://www.endnote.com/>
- Ref Works, Bibliographer in *Read and Write Gold*
- Format sites <http://www.refworks.com/>

Online Manipulatives, Interactives, Tutorials and Animations: These tools allow students to interact with content material in a format that fits their learning style. To find these, use Internet search engines and the key words such as animations, interactives, manipulatives or tutorials. *Thinkfinity* and *Nettreker* offer streamlined searches to look for these types of websites.

A Continuum Of Considerations For Assistive Technology Time Management



Time Management

Time is an abstract concept that can be difficult for a student to understand. At a construct level, time is a way to sequence events, bring visual or kinesthetic expression to the chunking of routines throughout the day, demonstrate how a routine can be measured into systematic and expected units, understand that those units are known as “time” and build the duration a student may need to sustain attention, work, or stay in their seat for a period or “unit” of time.

Using Task Analysis to make tasks more manageable

Use of task analysis may help determine how time fits into the required activity. There is a tendency for students to underestimate how long project components can take. Task analysis is not necessarily an intuitive skill but is essential for learning time management not only for school projects but for the work tasks students may be asked to take on later in life. Task analysis asks the student to take a project and break it down into small, sequential tasks. To use a garden analogy, if the goal is vegetables in August, a student would need to prepare the soil, plant the seeds, weed and mulch, water, and weeks later harvest the results. There won’t be any vegetables if they forget to plant and water.

Helping students learn to break larger tasks into smaller more manageable phases of the project with intermediate deadlines can be helpful. Just like study guides help students read for meaning, task analysis helps a student gain understanding on what needs to be done and how long it will take. Students learn that big projects are just a series of little steps sequenced together and that smaller steps can make a project feel more manageable.

A student’s understanding of how much time each step really takes is another challenge in learning how to manage time. One strategy that may assist is to use a stopwatch to time how long

a task takes. The student estimates how long they think a task will take and then use the stopwatch to see how long it actually takes. Many students in middle school, in particular, are surprised by the time it takes to complete tasks. Estimations may be based on completing the task without any interferences, glitches, or interruptions.

AT for Time Management

The student's ability to manage time is an important aspect of organization that greatly influences success in the educational setting. The following are devices and techniques that can assist with the student's ability to manage their time.

Checklists

Checklists work as the first step of integrating time management and task completion. Generating a dated checklist can help a student stay on track for assignment completion as they identify the task to be done and the date that it is due.

Planners - paper or electronic

As the child moves into late elementary, assignments may grow in length and complexity. Planning the steps and time needed to complete the task may be facilitated by a task analysis of the activity and creating a project checklist. Paper planners, calendars or assignment notebooks can help define, plan, or visualize the time needed to finish work tasks. Graphic organizers as simple as a calendar can be used to plot out how much time is left before a project is due or to set interim goals. This is not an intuitive skill for most students so instruction in breaking big projects down into smaller components can be a real help to successful completion.

Personal daily planners, portable calendars or notebooks can be used to keep track of what needs to get done each day. Reference information that is needed frequently may be added to these systems such as phone numbers, website links, reference materials or e-mails are just a few bits of information that may be added. One digital tool is the *Pocketmod System*, which uses a piece of paper as the base for a simple portable organizing tool. It can be found at the following web site: <http://www.pocketmod.com/v2/>.

Graphic organizers, either the paper or digital varieties, can help students visualize the smaller steps and organize those steps into a sequence. Examples of digital graphic organizers include: Inspiration, bubbl:us (located at <http://bubbl.us/>), *Spark Space* or *C-map*.

Perhaps the most widely recognized graphic organizer is the calendar. Students may need a calendar program to organize the day, week or month. Paper versions can come in handy as students plan out when they will complete multiple assignments and long term projects. They may also need to schedule appointments and after school activities. Paper is often used in the early stages of this type of organizing but students may also utilize computer digital options that allow more flexibility in adding or subtracting new events. One common version is *Microsoft Outlook*, which offers not only a calendar feature that can be accessed at home or school, but can be integrated with phone and email contacts. *Outlook* can also send reminders to a student's screen when they turn it on in the morning. Another calendar resource is available at <http://www.calendarsthatwork.com/membership.php>.

Schedules (visual)

Any type of schedule helps to frame the events that will happen in a day. Items like class times, transitions, and special events can be shared with a student so that they can anticipate or plan for the various activities. These schedules can help students who do not transition well or who are upset by routine changes. The schedule is reviewed with the student throughout the day to help them anticipate what comes next. There are several formats for these schedules dependent on what a child needs. Some schedules may just use words; others may use pictures, symbols or videos. The schedule can contain a general overview of each day, or step a child through chunks or difficult sections of the day.

To understand the sequencing aspects of time, a teacher may want to create a visual schedule that is reviewed with a student to help them prepare for transitions or for what is coming next. Social stories may help a student successfully navigate a routine on their schedule. A kinesthetic component can be added by having the child move pictures to a “finish” box on a picture schedule as they complete each task. Consistent review of the day’s schedule can help students prepare for what will happen next. Even a student who is unable to read can use a list of pictures of their daily activities to make note of the activities they have accomplished in a school day. They can then use this list to communicate with those at home to show what was done at school.

Picture-based schedules may be used to assist a child who does not understand verbal or word based schedules. Real pictures from the classroom or symbols may be used to represent various parts of the schedule. Some versions have the child remove pictures as they complete the task. Others are more static. The choice to use pictures or symbols must also be considered. A picture can be confusing if there are a lot of extraneous details in it.



*Images from Silver Lining Multimedia, Inc
<http://www.silverliningmm.com/>
Used with permission.*

Combining pictures and symbols may also be helpful, especially for a child using a communication device or symbol systems to communicate. Using symbols in the schedule can help them build vocabulary as well. In general, it is easier and faster to generate symbols, and those symbols can be applied in multiple ways.

Portable, Adapted Time Keepers with Visual/Auditory/Kinesthetic Feedback

Students may use a clock, watch or cell phone to alert them at certain times of the day. All three have visual as well as auditory alerts and some even have vibration modes to use as alerts. Watch and clock faces with the hour and minute hands can give some visual cues of time passage. There are a number of different types of clocks and watches that students can access based on sensory or physical needs. High contrast, Braille, and talking clocks may help a student with visual impairments read time. There are clocks that use a tactile component such as vibration to alert a student at certain times. Some watches, such as the *Watchminder* can be programmed to give messages to the wearer. These messages can be text or verbal. For example, a *Watchminder* (watch that has programmable alarms) may be used to cue a student to go to the nurse's office for medication. Sources for these types of watches and clocks can be found in the resource section.

Some students may need a visual or auditory representation of time passing. A popular version of time passing in visual representation is the *TimeTimer*™. A red section slowly disappears as time passes. An ordinary kitchen timer can be used to help students learn about time. These systems have worked well to help students “visualize or feel” time passage. This can really be helpful for a student learning to work independently for periods of time.

Electronic Reminders

Alert systems can be used as personal electronic reminders and can cue a student to tasks they need to do or switch to independently. A timer, pager or watch can be set to go off. For students with visual impairments, the alert may be auditory. For students with hearing impairments the alert system may be visual, with the watch flashing at key times. Please check the chapters on visual and hearing impairments for more resources in this area. Some students may need cueing for certain activities that are time sensitive. They may set the alarm on their watch to queue them to go to the nurse's office for medication or know that it's time to go to the office to meet their parent for an appointment. These systems can also be digital and used to track long assignments and obligations.

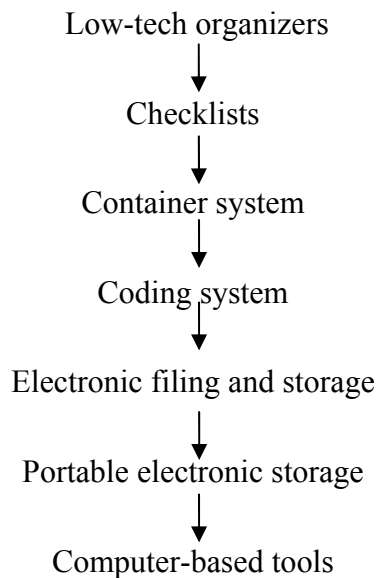
Digital Planners

Digital planners are gaining in popularity, especially those that are carried in a pocket, such as a PDA or cell phone. Having critical information like calendars, contacts and resources in one place, readily accessible, and able to be integrated, can help a student plan their time, organize their work-load, and connect with those that can help them succeed. The speed at which these items are developing has been incredible. Many of the organizing features once found only on a computer can be loaded into these convenient portable devices, so that a student can have instant access to their calendar or datasets. Because these items are usually with the student at all times and are highly prized, they may prove to be useful tools in getting information back and forth between home and school as well as helping students organize their time through reminders, contacts, or access to digital sites.

Web-based Planning Tools

Wikis, *Google Calendar* and other web-based environments allow students to access tasks and progress on projects.

A Continuum of Considerations for Assistive Technology Material Management



Material Management

Managing the “stuff” that enters and moves through a student’s world can be especially challenging for those lacking in organizational skills. There are papers, and resource materials, projects in process or completed and tools needed for the work tasks of school. At least the “stuff” gets to stay in one room during the early grades. But in just a few years most students will begin moving from place to place needing to have the right materials at the right time. They will have to learn which stuff to keep and which can leave. They will need to do this within the limited space of their desk and locker areas. Without consistent and proper cleanouts disorganization will reign. There are various systems to manage materials, including SPACE and containment systems.

S. P. A. C. E.

Julia Morgenstern, a professional organizer offers some insight to the problem in her book, *Organizing from the Inside Out* (1998). Morgenstern addresses problems such as not enough space, unassigned homes for key items, inconvenient storage, or confusing systems that can make organizing one space a challenge. Morgenstern helps individuals organize using two strategies. The first considers personal preference by helping a student analyze what's going on with their space. It's important to know what's working and what is not, what items are critical for everyday use, what will work as a motivator to keep things organized, and anticipate potential problems that can hold a student back when they are attempting to organize their space.

Her second strategy focuses on the principle of S. P. A. C. E. for attacking the spaces that need to be organized. The S stands for Sort. Sorting looks at grouping similar items, identifying categories and identifying what's important. The P stands for Purge. This is when we toss what is not needed. Store only critical materials in the small spaces provided. A stands for Assign a

Chapter 9 - Assistive Technology for Organization

home. Morgenstern suggests getting items into zones or homes as important for being able to find them later. The C stands for Containers. The trick here is to find a container that really works in the space. And finally E stands for Equalize. This requires planning for and executing the cleanout strategies on a consistent basis, perhaps every week or two so that materials don't pile up. Her book is filled with a number of strategies and suggestions for helping all of us organize our spaces.

Schools create a constant stream of paper that must be sorted into levels of importance. Early elementary teachers may use a mailbox or sorting tool attached to the chair back to get finished work and permission slips out the classroom door. Older students may use trapper keepers or multiple folders to store or sort out papers from various classes. At this level, the sorting task is not just what goes home or what gets thrown away. There is a third level of paper called resource materials. These are materials needed for a short time to complete particular projects.

Containment

Containment systems are often a starting point. Some students can use a trapper keeper, a large binder that can hold multiple folders and notebooks. It can be closed or zipped shut to contain papers. Students may use color-coded folders to match their notebooks, the color helping them to match folder to class so only the right papers get in the folder. Some students may find the colors confusing, and struggle to find papers that may have been lost in transit. One idea is to use clear or translucent folders, well marked, helping them visually sort their folders by what is inside them. Providing sorting bins and/or time for sorting can help. Practicing organization can help reign in the chaos of a desk or locker. Sorting and classifying paper into the appropriate actions of throw or keep are great; however, one-size-fits-all classification categories do not work. Organizing strategies need to be flexible enough to match a range of student preferences and learning styles. Understanding student preference is critical to student performance in this area.

Work and storage spaces may provide a challenge for some students. Some students like a filing system with neat, organized folders to hold materials. For others, this type of filing system is a large black hole, where papers go in and may never reemerge. Desks and lockers are common catch-alls for student books, papers and materials. It is common in the early grades for teachers to help students by having Friday cleanups. Some middle schools may also work with students to help them organize their lockers. Be aware that some children may need a flat space to sort their materials on. Locating the desk near a worktable area may be a helpful strategy.

AT for Organization of Materials

Teachers are easily able to identify when students are in need of assistance with organizing their materials. However, even when given structured plans for organizing, some students are still not able to manage their materials. Struck (2004) would suggest that involving the student in the prescriptive or planning stages of any assistive technology it is more likely that the assistive technology tools will get used and not abandoned. This may explain in part why a single system doesn't work for all students. Learning styles also affect the students' choice of an organization system. Teachers tend to choose the organizational system style that works the best for them. If this system doesn't match the learning style of the student, the organizational system may not be

Chapter 9 - Assistive Technology for Organization

useful or successful for that student. Consider the students learning style. For a student with visual strengths, color-coding notebooks and folders may help. For a student with kinesthetic strengths, creating a bin system in the desk or creating a shelving structure in the locker with a shelf for each class may work better. Using a pocket pager or portable voice note, to remind the student to bring colored pencils class may help an auditory learner.

Low-tech organizers: Bins, boxes and closeable bags are examples of low-tech organizers. It is easy to overlook these tools for students who are working with small tasks and locker spaces. But they can be extremely helpful in containing critical tools in the same locations such as using a pencil box that captures pens, pencils and erasers. Once the box is shut, these items are all in one place and can be easily grabbed from a desk or locker. Other bins can contain tools such as glue, tape or pencil sharpener. Some people use bins to organize by class such as keeping the colored pencils with the geography folder, notebook and textbook. Make sure that the bins or boxes chosen fit the space and move easily within that space.

Locker or desk checklists: Checklists for materials stored in lockers or desks can be helpful for some students. A simple map that outlines the zones of storage in a desk can be used as a reference during scheduled cleanouts. Locker checklists might include a materials list for each class so the student make sure they take the colored pencils or markers needed and social studies or the right set of notebooks for science and math.

Everything box, Trapper Keeper, all in one folder: Paper can be quite prevalent in the school environment. The first challenge is not to lose the papers that are needed. For some students having one large folder or storage box can be helpful in training the first step of paper management. That step is “don't lose what you need”. Papers quickly add up, so frequent cleanouts are needed for this system to work.

Coding systems, color or see through folders, box sorts, home and school pockets: The second step in paper management is to get papers in the right places and to sort out what is no longer needed. It is common to suggest using colored folders to match class notebooks. But colors may not work for every student. Some students need to see the papers inside a folder so that they don't “visually” lose them. Transparent folders can help with this problem. Some students may prefer a tray system and put materials from one class into each tray. Many younger students are given home and school pockets on the back of a chair or on the side of the desk to help them sort the papers that can go home from those they will need again.

Electronic filing and storage: The explosion of electronic information has created a similar management issue as paper. As information stacks up, easy retrieval is the key. Students may need to keep track of websites they visit or access resource information and online activities to complete projects. There are number of web-based organizing tools that can help students track Internet sites; organize bookmarks by folders or tags which allow bookmarks to be stored in multiple categories. Online learning areas such as Blogs or Wikis may also need to be accessed by students. These areas may have been developed by teachers to share course resources, handouts, worksheets and reminders about field trips or materials needed for special projects. Some schools are even posting daily assignments and other information online allowing access from any place the Internet is available.

Chapter 9 - Assistive Technology for Organization

Electronic files like their paper counterpart may also need to be sorted into files or topic folders. Help students create a filing system that makes sense for them. Teach them how to make files to store their Internet finds and documents so that related documents are stored together. A key is to regularly delete files that are completed and no longer needed. Periodic cleanouts may also be needed. The ease of saving and the lack of a physical pile can lead to e-folders that get too full to find things. Digital options do not take up more physical space, which is nice, but when the bookmark lists get too long it may be hard to find the sites you need. A nice feature of digital bookmarks is tagging. Unlike bookmarked favorites that are only listed one time, tagging allows the document to be sorted by code words and/or “attached” to multiple locations for easier retrieval when it is needed. Digital files allow speedier/ easier access. There is no searching through filing cabinets. Digital files are automatically cataloged in several different ways, by file type, by date completed, and by topic if folders were created. Access is also more mobile with digital files accessible at home, the coffee shop or anywhere Internet access can be found. Of course all of this depends on the student’s ability to access digital options out of the computer lab or through the school’s firewalls and protections.

Portable Tools: Handhelds and cell phones may offer new toolsets in the area of electronic storage and filing. As they increase their capabilities to connect with the Internet, work with word processing files, and download from various sites, they offer new ways to access digital materials. Built-in photo taking may help visual learners remember materials they might need. This photo capability may also help students who need paper text changed into digital text that can be read and listened to on the phone. This tool could be especially helpful for a non-reader or poor reader when they need to fill out job applications or complete classroom assignments.

Computer-based tools: There are many tools on the Internet, which can help students to organize their digital files. Bookmarking tools such as *delicious* or *diggo* can tag these sites in multiple locations. Internet front pages can be designed to bring needed information to the student each time they turn on the computer. These pages can house web addresses the student may need to complete assignments. Some teachers are creating learning blogs for their classes with free Internet-based software tools. These sites allow a student to check their assignments, drop-down missing worksheets or look for additional resources on the current topic in class. Tracking software can help keep track of the websites a student visits as they search for information to complete a topic. This way they can cite their work based on information at the sites.

Transportation of materials

Materials often need to travel with students to different locations. The shifting between classes and home brings with it a new organizational challenge. Having the right materials at the right time is imperative. Tools that need to arrive with the student when they shift from one location to another may include a variety of books and reading materials, writing and studying tools, and other project components. For some students it may work better to have multiple sets of materials to go in various locations where they are needed. It may reduce the stress for some students to determine what materials need to be mobile and what materials stay in a certain location.

Chapter 9 - Assistive Technology for Organization

Students moving from place to place via wheelchair or walker may have difficulty transitioning themselves and their materials in the short time available for class transfer. They may also have difficulty carrying the books, notebooks and materials needed for classes. Knapsacks, storage bags and baskets may not be easily accessible to a student with motor issues. The team needs to consider which option works best for the student to transport and access their materials. If they do not find an acceptable solution it is important to work with the regular education teacher to see if a second set of materials can be kept in the classroom or be available in the special education or home environments.

Strategies for Material Management

Use of multiple sets of materials

There are several reasons that using multiple sets of materials may be recommended. For a student with a physical disability, having an additional set of materials in each room could allow them to independently ambulate from class to class and prevent them from having to carry books home. Students with poor organization skills can also benefit from an additional set of materials.

Environmental challenges may be a reason to recommend use of multiple sets of materials. The transition time between classes might be as short as 5 minutes. Consider a student with physical disabilities adding the mix of physical challenges and sensory processing issues to grab all the right things quickly, and you can see the student's challenge. Several environmental changes could help the students' performance dramatically. These might include a time study to figure out the issues, moving their locker to a more accessible area, having an additional storage space nearer to the lunchroom, or even permission to leave the lunchroom early. Consulting the student about which of these changes he would be most willing to try or use will help him to be successful in following through with the changes.

Using materials as reminders

Some students may use materials as a visual cue or symbolic representation for the work that needs to be done. Sometimes a student may leave their pencil out to remind them to finish a work sheet or turn a paper sideways in a folder to remind them that it needs to be completed.

Materials to and from school

Some special materials may be needed from home which raises another challenge for some students, especially if their parents are unable to read the notes sent from school. Ruby Payne (2003) talks about this challenge of home-school communication. English Language Learners (ELLs) or students who have parents who can't read have difficulty following through on the notes that go home. Payne notes that these children will often return without a permission slip or needed materials. Some parents will just sign what comes home, not understanding that a swimming suit is needed for gym or a lunch needs to come with the child on a field trip. This can result in some frustrating experiences for a child and their teacher. Some schools are using verbal communication systems such as a *Message Mate*™ or online resources zones where a parent can access material lists with auditory or visual pictures to assist in their understanding.

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the motor aspects of writing tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify organizational objectives and criteria of performance to determine the effectiveness of the trials.

Feature match

The concept of using a feature match approach started in AT with AAC (Alternative Augmentative Communication) devices. Since there are so many variables of an AAC device to meet the needs of the individual, using a feature match system was a way to address those individual needs. Using a feature match allows the characteristics of the device to be matched with what the student receiving the device needs. Some examples might be size, weight, use of pictures or words, ease of programmability, voice output, etc. The use of a feature match for any type of AT is paramount in giving the AT a chance to succeed. When considering AT for organization there are many factors that can influence the choice of an AT tool for organization. Some examples have been alluded to in the organization chapter such as:

- Involvement of the student in choosing or designing organization systems
- Consideration of learning styles
- Level of comfort with technology tools
- Desire to perform better (motivation)
- Previously attempted techniques or strategies

Using Judy Sweeney's **Organization Problems Inventory** is another way to use a feature match with AT to support organizational skills. By figuring out which organizational areas are difficult for the student, problem solving, task analysis, using techniques, strategies or AT may help identify and/or improve the student's deficit areas.

<http://www.onionmountaintech.com/files/Organization%20Inventory.pdf>.

Organization Problems Inventory

For each of the following statements, consider whether this is a problem you (or a student) exhibits. If it is, place a checkmark in the white box to the right of the statement.

I (or my student) have/has problems with:	1	2	3	4	5	6
1. Being as need as other people expect me to be						
2. Completing long and complicated assignments						
3. Concentrating or remembering information when I am distracted by what is going on around me						
4. Deciding how to tell which tools, books, & notebooks go with each task or class						
5. Dividing a big job into sub-tasks						
6. Doing the hard work first before I am too tired or bored						
7. Doing things in the right order						
8. Estimating how much time is left						
9. Figuring out what is wrong if I accidentally skip a step						
10. Finding something if it's not exactly where I thought it should be						
11. Finding the right place (so I can find them again) for all the "things" I need to organize						
12. Finding things in my locker or desk						
13. Finishing a long task without a checklist or outside help						
14. Finishing detailed work without recueing or incentives						
15. Finishing work when the assignment is too vague or when I'm not given specific due dates						
16. Getting a task done without daydreaming						
17. Getting my work done in the allotted time						
18. Highlighting just the most vital information						
19. Keeping my notebook in order						
20. Keeping track of assignments						
21. Knowing how long something takes to complete						
22. Knowing which papers I should keep in my notebook / files						
23. Learning new things while sitting perfectly still						
24. Lining up math problems						
25. Listening to long and complex directions						
26. Making the best choices						
27. Memorizing seemingly unrelated information so I can retrieve it for a task or test						
28. Moving smoothly from one task to another without anxiety						
29. Not just putting everything in one pile						
30. Putting things in the correct folder						
31. Reading clocks						
32. Remembering how to do something unless I have practiced it over and over						
33. Remembering how to do things without a lot of repetition						
34. Remembering the final goal because I'm so caught up in the step-by-step process						
35. Taking in all the details that everyone else does						
36. Understanding how things are related						
37. Understanding the benefit of doing things in a structured set of steps						
38. Skipping steps in a task unless they are written out						
39. Staying on one topic while writing						

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Chapter 9 – Assistive Technology for Organization

I (or my student) have/has problems with:	1	2	3	4	5	6
40. Studying the most important information the longest						
41. Taking and organizing notes for a research paper						
42. Taking organized notes from reading						
43. Throwing unnecessary things away						
44. Waiting for anything						
45. Working in a small space or area						
46. Working on multi-task, long term assignments without waiting until the end to finish them						
47. Working with graphic organizers that require I sort ideas into topics						
48. Writing on the lines or within the margins						
Total Checks per Category						

- 1 = Sequential Organization Problems
- 2 = Prioritization Organization Problems
- 3 = Temporal Organization Problems
- 4 = Spatial Organization Problems
- 5 = Categorical (Semantic) Organization Problems
- 6 = Attention Organization Problems

Scoring and Interpretation:

Generally speaking, we have found the following is true of the total checks per category boxes scores:
 0-3 checks indicate a low to non-existent degree of organization problems in this category.

4 checks in a category can be symptomatic of problems for some people but could still be found in a person who is functioning with some degree of organizational success in this category.

5-8 checks almost always indicate functional problems in this category of organizational problems.

Most people who have organizational problems have one category that is relatively high (7-8) and 2 other areas that are less problematic (4-7). We always suggest trying to deal with the category that has the most problems because “fixing” it can affect other areas.

if attention is the major area, regardless of its number score, start trying to deal with it first. it always affects the other categories of organization problems.

Specifically, we also have noted:

That sometimes problems are related to learning styles. For example, someone who checked #3 and #26 may have attention problems or they may simply have problems with auditory distractors.

Students, parents, and teachers often see problems quite differently. For older students, I try to have all three categories of people fill out the inventory for the student being evaluated. While most everyone recognizes the most problematic categories, what is seen as most problematic by the student is often not the same category reported by parents and teachers. Starting with what the student thinks is most problematic is a good way to start dealing with organization problems

Chapter 9 - Assistive Technology for Organization

because the student is most invested in finding a way to remediate the problem they identify as their worst area of organization.

A few people have told us that they need to fill out the inventory for different environments in their lives (home, work, school, etc.). While some problems seem to carry across environments, spatial problems, in particular, reportedly differ according to the environment the person is in and with whom they are living or working.

Executive functioning

The following charts are taken from the work of Colleen Wagner and are a way to address some of the issues that arise from difficulties with EF skills. Although they are not all necessarily AT, some may be considered AT and others are good strategies for working on deficit areas.

Executive Functioning Chart

Area of Executive Functioning	<u>Accommodations</u>	<u>Interventions</u>
Sustaining Attention	• Write start/stop time on assignments • Use incentive system • Break tasks up & give breaks • Use a time/challenge to increase excitement (not for the anxious child) • Do difficult tasks when most alert • Tasks need to be at appropriate level of challenge • Use “Grandma’s rule”—eat your peas before dessert • Decrease amount of work & work on quality	• Model, assist, prompt, chunk assignments • Practice focusing for short periods of time and gradually increase the time
Shifting Attention	• Visual calendars • Increase supervision at transitions • Anchor changes with known situations (remember last week when ...) • Provide preparation & warnings prior to schedule changes. Provide verbal structuring • Prompts for stopping • Prompts for shifting • (“Now we are going to do something different. English is over. Math is starting. Put away....”)	• Practice switching from one activity to another • Play games that require changing strategies (UNO) • Make change fun!!
Initiating Activity	• Provide prompts to begin • Work with child to complete the first portion of task then fade involvement • Structure routines • Provide options or choices • Raising motivation. Raising anxiety • Use “Grandma’s rule”	• Teach self instruction • Work with child to develop independent cueing system • Use incentive systems • Monitor amount of time from giving instructions to beginning the task. Encourage child to beat his/her own time
Planning & Organization	• Have adult provide a plan or schedule for student to follow • Use scoring rubrics for assignments • Break long-term or long assignments into clearly defined subtasks • Create an assignment template • Provide separate grades or points for each step of a project	• Teach one planning strategy that can transfer across situations • Use preferred activities to model skills as well • Have child be coach for another child on a task they enjoy • Follow child’s lead for what works for them • Break larger tasks into smaller steps • Have students use planner/organizer • Walk child through planning process many times. You plan

Chapter 9 - Assistive Technology for Organization

Planning & Organization continued		and talk out loud. • Provide specific prompts for child to do the planning. • Provide general prompts • Have child verbalize as they plan • Child plans independently and you check plan
Organization of Materials	• Develop rituals or routines for organization. Cue & reinforce their use • Teach us of “launching pad” or “in/out” box • Simple organizational schemes • 2nd set of texts at home. Assignments and materials available online	• Model strategies with gradually decreasing cueing • Development of these skills takes a long time
Time Management	• Provide a schedule & prompts for each step • Extend time limits. If a time limit is given provide prompts for how much time is left • Use cueing devices such as clocks, bells, or alarms	• Practice estimating how long something will take and then actually timing it. Discuss accuracy. • Develop temporal reference points (length of a CD, song, TV. show) • Develop schedule & routines • Teach concepts of “work time” and “non-work time”

Chapter 9 - Assistive Technology for Organization



Area of Executive Functioning	<u>Interventions</u>	<u>Accommodations</u>	<u>Teaching the Skill</u>
Inhibiting Impulses	• Consequences don't work • DO NOT WITHDRAW RECESS!!!! • Provide lots of physical activity • Provide redirection • Provide a "wobble ball" or other object to direct physical energy • Use of weighted vest • Provide cues of what to do instead of telling them what not to do	• Increase external controls—restrict access to settings or situations • Increase supervision • Proximics!—stay close • Find ways to provide cueing without drawing attention to it	• "Stop & Think" program • Identify impulse to work on & a competing skill • Explain to child what you are working on and how • Have child practice the skill in a contrived situation • Reinforce for using the skill immediately, even if success is only moderate • Cue the skill just prior to situations • Ignore (when possible) disinhibited behavior • Gradually fade cueing and reinforcement
Working Memory	• Avoid multi-step directions • Reduce demands • Expect to repeat directions • Provide prompts for each step of an activity	• Provide word lists or other prompts for material needed to complete an assignments • Recognition tests over recall tests • Storage devices • Cueing devices • Natural cues in environment (placement)	• Digit span practice • Teach use of concrete reminders • Provide written cues then over time move to child writing cues & you double check • Teach memory techniques (mnemonics, chunking, visualization, repeating information, using rhythms)
Emotional Control	• "Get out of jail free cards" • Teacher must stay calm	• Quiet place to calm down • Anticipate, avoid, or prepare for situations likely to be difficult • Offer choices • Avoid reasoning or power struggles • Give breaks when tension is rising	• Teach emotional vocabulary • Teach self monitoring skills • Teach relaxation skills, distraction skills, "anger management" skills • Practice positive self statements • Practice skills, don't just talk about them • Therapy

Writing AT into the IEP

There are many correct ways to write AT into the IEP. It must be considered on the special factors form of the IEP and a listing of AT may be included there. It may be listed in the present level of performance. It may be included as a related service and may also be included as a supplemental aid or service. Purcell, Grant, (2002, 2004, 2007) and Bateman, Herr (2003) state many examples of writing present level of performance, objectives and goals.

The following is a four step formula for writing an IEP goal.

Time Frame: In 36 weeks

Conditions: given an agenda with areas for each subject

Behavior: Eric will fill out agenda

Criterion: daily 4 of 5 days

Another example would be the following:

Given modified daily planner (condition), the student will circle the assignment to be completed (behavior) daily for each class (criterion) 4 of 5 days (time frame).

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Chapter 9 - Assistive Technology for Organization

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Chapter 10 – Assistive Technology for Recreation and Leisure

Introduction.....1

Using the SETT Process 2

Decision Making Guide 3

Decision Making Guide Expanded 4

Recreation and Leisure Continuum 8

Continuum Expanded.....8

Internet Resources and Links 12

Assistive Technology for Recreation and Leisure

Laura Comer

Introduction

If, as Aristotle said, “The quality of life is determined by its activities,” then finding meaningful avenues for recreation and leisure is a key part of working toward the best life outcomes for students with disabilities. Because school has traditionally been focused on academic learning, this vital aspect of preparing students for fulfilling adult lives is sometimes pushed aside in favor of meeting academic standards. However, almost every measure of quality of life begins with health and social connectedness. Dr. James A. Rimmer of the Department of Disability and Human Development at the University of Illinois, Chicago says, “Participation in play, recreation and sport has a profound impact on overall growth and development and are essential elements for a satisfying childhood and adolescence.” (2008) He also points to improved life outcomes and better health for everyone who participates in active recreation, but particularly for those individuals whose health may already be compromised by disability (Rimmer, 2005). Unfortunately, children with disabilities are almost twice as likely to be sedentary than their peers without disabilities (US Department of Health and Human Services, 2000). Not surprisingly, a 2004 National Organization on Disability survey found that people with disabilities were 27% less satisfied with life than those without disabilities.

While the scope of recreation and leisure activities certainly goes beyond the school setting, opportunities to learn and benefit from play, sports and the arts abound in our schools. Specific classes in visual and performing arts, and physical education are obvious. Less obvious, but no less valuable, are the skills developed on the playground, or the interests engaged during field trips to museums, on nature hikes, and in gardening projects. Extra-curricular activities like sports teams, theater, band, dance, gaming clubs, FFA, and many more can provide important health benefits, social relationships, and boosts to self-esteem for students with disabilities.

The goal of this chapter is to provide a framework for identifying assistive technology needs and a range of low- to high-tech solutions for students participating in recreation and leisure activities. By eliminating the barriers to involvement (physical, social, cognitive) in these activities, schools encourage all students to find and enjoy the improved physical and mental health that come with community engagement, creativity and exercise. Of course, fun and engaging activities provide wonderful, pain-free opportunities to teach and learn, too!

With a virtually limitless array of recreational options, one chapter cannot provide specific information for every option. Online resources and contacts for specific activities are listed at the end of the chapter and will provide avenues for further research. Please consult with an Occupational and/or Physical Therapist for student-specific suggestions and safety considerations, especially for physical accommodations. OTs and PTs and Recreational Therapists are trained to provide this kind of information on an individual basis. Some of the adaptive equipment described should be used under a therapist’s supervision or direction. In

addition, many of the issues regarding access to appropriate recreational and leisure choices are addressed in the ASNAT chapters on Mobility, Computer Access, Communication and Activities of Daily Living.

Using the SETT process and Decision Making Guide

It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory of Sensory Considerations included with Student and Environment. Additional categories include:

- Narrowing the Focus to help identify a specific task in order to select appropriate assistive technologies.
- Implementation Plan to assign trials, dates, responsibilities and data collection.
- Follow-Up Plan to set a date for the team to reconvene and review the student's progress.

Again, this is intended as a guide; during the actual assessment process, each topic should be written in large print where everyone can see (i.e., on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference. For more information about using the SETT process, please refer to Chapter 1 of this manual.

The questions posed in the guide are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology tools and strategies for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Recreation and Leisure

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to the area of concern? - Interests, skills, familiarity, social motivation, knowledge of rules and protocols - Health and safety concerns - Physical limitations - Ability to comprehend expectations	What environmental considerations impact the area of concern? - Access to necessary adaptive equipment - Availability of knowledgeable staff (coach, teacher, para) - Family and community support - Transition from one location to another	What task(s) do you want the student to do? (for example) - Activate a musical keyboard - Act in a play - Create a picture - Swim w/o 1:1 support - Shoot a basket - Use playground equipment at recess - Play a game of cards - Hike on a nature trail - Make a snowman - Play team Wii bowling
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts this area of concern? (i.e., visual, auditory, tactile) With such a wide variety of settings for leisure activities (from school gymnasium to snowy hill to quiet reading room) the importance of considering the extremely different (light, sound, temperature) and sometimes surprising (bees, cymbals, fast-moving projectiles) sensory input and the child's ability to process that input in the each setting cannot be overstated.		Identify specific task(s) for solution generation After the team has generated a list of tasks that the student wants to do, you may choose to refine the list to limit the tasks that the team will focus on. The tasks that remain can become your new focus at a later date.
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decisions yet Review the area continuum	Use a feature Match Process to discuss and select ideas(s) from Solution Generation	AT Trials/Services Needed: - Date - Length - Person Responsible - Formulate objectives/criteria to determine success of trial/AT
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to recreation and leisure. Please complete and review Section 9 of the WATI Student Information Guide: Recreation/Leisure (Chapter 1 page 39)

Cognitive/Social/Emotional Considerations

In the area of recreation and leisure, a student's interests and personal preferences are particularly important to consider. Recreational choices are just that: choices. The goal is for the student to develop interests and behavior patterns that will be intrinsically motivating and, therefore, likely to continue throughout adulthood. In school settings, a specific curriculum may set limits on students' freedom of choice, but remember that people engage in recreation and leisure activities because doing them feels good in some way.

- How will the "task" at hand make the student feel good: better health, improved self-esteem, social connections, a quality product or performance?
- Is this endeavor meaningful to the student?
- Can it be connected to past experiences, immediate goals or plans for the future?

The student's ability to understand how and why to participate in a "fun" activity is also important to consider.

- Does the student understand the rules and expectations of the situation?
- Is the student familiar with the activity? Do friends or family participate?
- How does the student learn, understand directions and make choices best?
- How will the student communicate in this situation? If augmentative communication is used, can it be accessible (in the pool, on stage, during a hike)?

Physical Considerations

Physical considerations are very student and situation specific. Look first at what the student is able to do. Note physical challenges that may make the student's ability to participate different than their typical peers'. Then, consider the task and what assistive technology will provide the best access for successful participation. Again, be sure to consult a physical or occupational therapist for guidance in making significant physical accommodations (adapted skis, horseback riding equipment).

- Can the student participate in the activity safely (with appropriate accommodations)? Be sure no medical conditions contraindicate participation (allergies, spinal cord conditions, seizure disorders etc.).
- Is the student independently mobile? What equipment, if any, is needed to provide safe mobility?
- What position (of the student or of the items related to the task at hand) is the best to allow for active engagement in the process?

- Can the student grasp/hold on to necessary tools (a paintbrush, cards, toys, a fishing pole, a ball, a musical instrument)?
- Does the student have impaired vision or hearing?
- Do fine or gross motor skill deficits interfere with the student's participation in other activities, and is that interference likely in this task?

Environmental Considerations

As a team, discuss and write on chart paper any environmental considerations that might impact the student's participation in the activity such as auditory or visual distractions, temperature and weather variables for outside locations, placement in the classroom, number of and transitions between different environments or any other environmental impacts.

Again, recreational environments vary so widely that making generalizations is difficult. Some points to consider in most situations include:

- Availability of adaptive equipment (from adaptive grips to protective gear for sports to computer software).
- Group size.
- Outdoor terrain and/or physical layout of the classroom (look at accessibility and potential risks).
- Knowledge level and availability of adult support.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not always discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Changes in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Some students are adversely affected by environmental stimulation that others can filter out or ignore. Some common factors that can impact a student's learning and focus include hypersensitivity or hyposensitivity to stimuli such as:

- Visual clutter
- Fluorescent lighting versus full spectrum lighting
- Classroom and background noise
- Tactile stimulation

- Awareness of physical space
- Other individual specific sensitivities

Recreation and Leisure activities are rife with sensory stimulation. Unusual textures in art class, bright lights on stage, cacophony in the band room, strange smells in a barn, balance challenges on the playground, temperature extremes outside and many more sensory processing issues are likely to arise. Be sure to understand the child's sensory profile and to consider sensory input in each environment.

Tasks

As a team, discuss and write on chart paper the recreational activities and relevant tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: what are the tasks the student needs or wants to do? In this instance what does the student need to do to participate as fully as possible? Thinking broadly and then more specifically about "tasks" may be helpful. For example:

- 1) Arts and Crafts: Activity: make a collage. To better understand what assistive technology is required for this task, consider each step and the student's ability to perform it. Tasks:
 - a. Sit at art table
 - b. Manipulate paper
 - c. Cut pictures out of magazines
 - d. Paste pictures on paper
 - e. Put project on drying rack

For a child with multiple impairments, each step may require different assistive technology for seating and positioning, grasping, cutting, pasting and moving through the classroom.

- 2) Games and Play: Activity: play "Go Fish!" Tasks:
 - a. Sit at game table
 - b. Deal cards
 - c. Hold cards
 - d. Look at cards
 - e. Communicate "Go Fish"
 - f. Pick up cards

Does it make more sense for this student to learn to play a computer version of "Go Fish" that will facilitate the play with a switch?

- 3) Sports and Exercise: Activity: play basketball. Tasks:
 - a. Get on court
 - b. Communicate with other players

- c. Hold ball
- d. Dribble ball
- e. “Shoot” basket
- f. Block other players
- g. Move up and down court

Can the game be adapted so that dribbling is not required and only half the court is used?

- 4) Performing Arts: Activity: play percussion in marching band. Tasks:
- a. Hold instrument
 - b. “Hit” or play instrument
 - c. Move in time
 - d. Play in time

Should the student master a simpler task such as playing in the concert band first?

Narrowing the Focus

As a team, identify by circling or other means those few tasks the student needs to do to participate in an activity that will have the most impact.

After the team has generated a list of tasks that the student needs to do, you may want to refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies

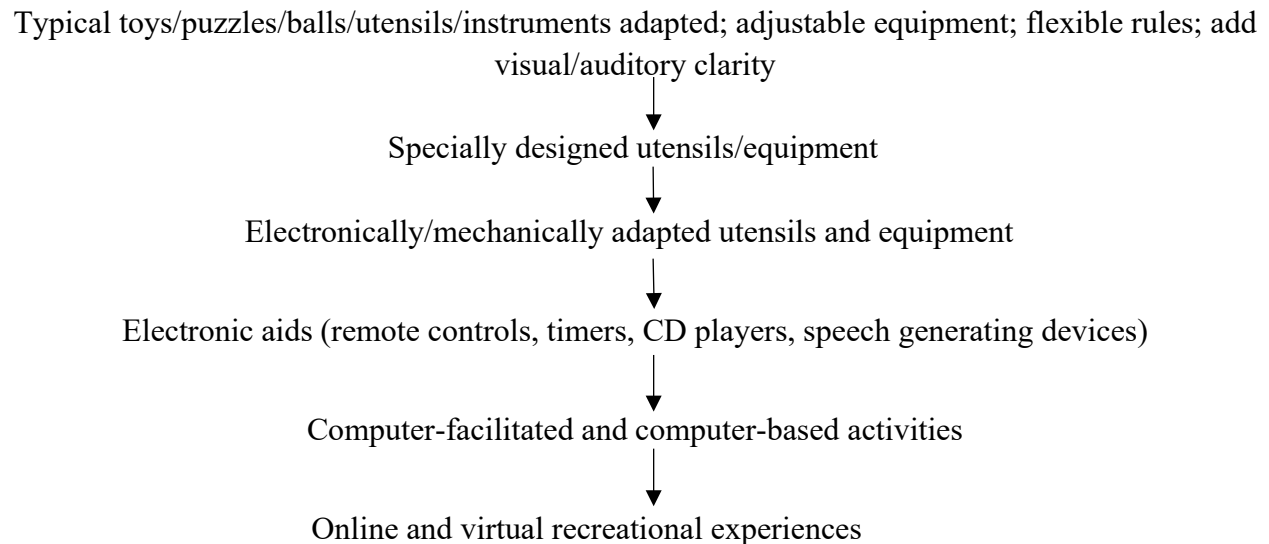
As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of assistive technology.

The following continuum and descriptions of solution considerations simply provide examples of the kinds of technology that might be considered for various recreational opportunities. They are by no means exhaustive. The chart that follows provides more detailed information for specific

activities and products. Resources and web links at the end of the chapter suggest places to get more information on a wider range of interests.

A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY Recreation and Leisure



Typical activities, utensils and equipment adapted for greater accessibility

Often times, recreational activities can be adapted to accommodate various needs by simply adding cues or creating modifications with items that are readily available in most environments. For example:

In Arts and Crafts...

- Add something sticky or increase the handle diameter with foam to make utensils easier to hold.
- Use clay or moldable foam to shape into the form of the student's hand to use as a grip.
- Adjust the workspace for easier access.
- Use a Lazy Susan to hold art supplies.
- Try a tabletop easel.
- Use no-skid/non-slippery surface.
- Use portion controlling caps, glue sticks or rolling glue bottles.
- Add color to the glue to make it easier to see.
- Use stamps or cookie cutters or sponges instead of brushes and pencils.
- Simplify projects.

In Games and Play...

- Use larger cards and game pieces.
- Outline significant areas in puffy paint.
- Put dice in a bottle, use bigger dice and/or use numbers instead of dots.
- Add magnetic tape to keep pieces (of games or puzzles) or cards in place.
- Add handles to toys that are difficult to grasp.
- Simplify directions; use visual cues.

In Sports and Exercise...

- Use adjustable height basketball hoops.
- Clarify boundaries with colored tape/chalk lines.
- Try balls of different weights and sizes and firmness.
- Add padding to hard objects and other things that might hurt to bump.
- Use fishing rod holders.
- Try sticky mitts, bigger bats, or lighter balls.
- Use flotation devices.
- Add flexible time limits.

In Performing Arts...

- Use visual cues or prompting.
- Add handles, foam or tacky tape/putty to help hold instruments.
- Add pictures and colors to sheet music.
- Choose pieces that are short and clear.
- Use scarves, body socks, wall mirrors for dance.

Specially designed utensils/equipment

Many standard equipment companies offer adapted equipment and utensils as well. In addition, many companies specialize in providing adaptive products for people with disabilities.

In Arts and Crafts try...

- Adapted scissors and other utensils.
- Universal Cuff to hold tools/items.
- Arm supports to guard against fatigue and to provide stability.

In Games and Play try...

- Adapted spinners.
- Braille or other adapted games.
- Card holders.
- Puzzles with large pieces and/or handles.

In Sports and Exercise, explore the possibility of (and don't forget helmets and other safety equipment)...

- Transfer belts to help move or support a student in action.
- Fully adapted and accessible playground equipment.

- Specially designed adaptive equipment for golfing, baseball, basketball, hockey, fishing, kayaking...virtually any sport has adapted equipment available.
- Mounting blocks, ramps, saddles with handles and trunk support, and ladder reins for horseback riding.
- Bowling ramps, bumpers, holder rings, ball pushers for bowling.
- Sport or all-terrain wheel chairs.

In Performing Arts, try...

- Plays written for and/or by people with disabilities.
- Specially designed musical instruments.

Electronically or mechanically adapted equipment/utensils and electronic devices

At higher levels of technology the somewhat arbitrary division of recreation and leisure becomes less necessary as many activities share the same tools such as switch-operated devices and toys, amplification, and light.

For Arts and Crafts:

- Switch operated devices such as paint spinners, pottery wheels.
- Focused/colored lighting.
- Motorized easel.

For Games and Play:

- Switch adapted card shuffler.
- Electronic or mechanized games and toys (possibly switch activated).

For Sports and Exercise:

- Beeping or lighted balls.
- Buzz-off bobber, electronic fishing wheels.
- Pool lift.
- Motorized wheel chair.

For Performance Arts

- Personal PA system.
- Voice output devices.
- Remote controls or switches for CD players, electronic instruments.
- Video cameras.

Computer-facilitated or computer-based activities

The computer is such a versatile tool that its benefits can apply across the spectrum of recreation and leisure activities. A wide variety of software is available that can teach skills, provide real games (cards, board games, sports) to play alone or with partners or groups. Computer and video games are popular and age-appropriate recreational choices that are often easily accessible to students with disabilities. Some game systems are sensitive to movement and can provide motivating and meaningful physical exercise. Touchscreens and interactive whiteboards offer different access and more physical involvement in computing.

Online and virtual recreational experiences

Online communities can provide invaluable social connectedness and leisure pursuits. Students can chat, share interests and play games with their peers on the web. Virtual worlds allow people to experience activities and to assume other characters in a way not tied to their own limitations. It can provide good practice and valuable freedom.

Solution Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the leisure “tasks” that the student is most interested in performing. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time. Input from the student, family members and those who understand the student’s social network will provide valuable guidance in choosing the most successful path.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including procurement of trial materials, team member(s) responsibilities, start date and length of trial, training needed and any other student/staff specific issues. Be certain to identify recreation and leisure objectives and criteria of performance to determine the effectiveness of the trials. While quantifying “fun” or “enjoyment” is difficult, the willingness or eagerness of the student to participate, in addition to levels of independence and actual performance *can* be measured.

Be sure to include Occupational and/or Physical therapists in discussing and implementing the plan.

Internet Resources/Links

Disability Resource Directory
Sports, Recreation and Leisure page
Shared lessons and activity planners (based in Oregon)
<http://www.kansas.net/~cbaslock/sports.html>

Inclusion Toolkit
Offers links to resources with a focus on inclusive recreation
<http://www.inclusiontoolkit.com/Recreation.php>

National Center on Accessibility
<http://www.ncaonline.org>

Therapeutic Recreation Directory
This is a comprehensive site with links to articles, resources, and lesson plans
<http://www.recreationtherapy.com>

Focus on Arts and Crafts

Free computer drawing program
<http://www.draw4free.com>

Scratch-free
Animation and art program
<http://www.scratch.mit.edu>

Tuxpaint-free
Free, intuitive art program
<http://www.tuxpaint.org>

Vendors

Alternative cutting
www.kitchenkapers.com/i-slice-ceramic-slicer.html

Non-slipping mat
<http://www.Abledata.com>

Discount School Supply
Extensive arts and crafts selection
www.discountschoolsupply.com

Nasco Arts and Crafts
Art supplies & adaptive materials
<http://www.eNasco.com>

Sax Arts and Crafts
Art Supplies and adaptive equipment
<http://www.saxarts.com>

Tabletop Magnetic Markerboard
<http://www.abcstuff.com>

Ergo Rest®
Arm support
<http://www.infogrip.com>

Rotating supported drawing surface
<http://www.dickblick.com>

Clicker “Paint”
Single switch or traditional computer access
<http://www.cricksoft.com>

CoreFX
Leveled art program with realistic media effects
<http://www.core-learning.com>

KidPix 4 Deluxe
Traditional art program with stamps, easy to use
<http://www.learningcompany.com>

Focus on Games and Play

Able Play
Offers evaluations and guidelines for toys for children with disabilities
<http://www.ableplay.org>

Lekotek Resources
Provides “how to” recipes and guidelines for activities and creating adapted toys
<http://lekotek.org/resources/informationontoys/packets.asp>

Print n’ Play Games
50 games to use for language development
<http://www.mayer-johnson.com.ProdDesc.aspx?SKU=M1E3B>

Lets Play

Information about playing with switches and Universal Design for Learning and PLAY

<http://letsplay.buffalo.edu>

Life Skills and Social Skills board games

<http://www.pcicatalog.com/Default.aspx>

Adapting Board Games

<http://www.ataccess.org/resources/wcp/enpdf/en03BoardGames.pdf>

Simple Access Game Spinner

<http://www.switchintime.com/FreeStuff.html>

Games for Young Children

<http://www.illinoisearlylearning.org/tipsheets/games.htm>

Puzzle Ideas

<http://www.ataccess.org/resources/wcp/enhtml/en16Puzzles.html>

Another great site for accessible games

<http://www.game-accessibility.com/index.php?pagefile=games>

Video of adapted gaming

<http://assistiveware.com/videos.php>

Vendors

Toys for young children

<http://enablingdevices.com/catalog/specially-adapted-toys>

Able Net

<http://www.ablenetinc.com>

Video gaming accessibility

<http://www.broadenedhorizons.com/videogaming.htm>

Adapted Pinball game

<http://www.northjersey.com/print>

Focus on Sports and Exercise

Adapting Games for Children and Adults who are Deaf-Blind

http://www.aph.org/pe/art_lieberman1.html

NARHA

Therapeutic Horseback Riding Association

<http://www.NARHA.org>

Fishing has No Boundaries

<http://www.fhnbinc.org>

US Adaptive Recreation Center

Focus on Olympic-type sports

<http://www.usarc.org>

Special Olympics Home Page

Offers information on Olympic style sports events for people with disabilities

<http://www.specialolympics.org>

National Center on Physical Activity and Disability

Has good links to information and organizations for “lifetime” sports

<http://www.ncpad.org/lifetime>

Disabled Sports USA

Provides a LONG list of web links to specific adaptive sports

<http://www.dsusa.org/links-drsr-links.html>

National Sports Center for the Disabled

Homepage <http://www.nscd.org>

(Check out adaptive equipment page, too)

Vendors

Abilitations

Adapted sports and sensory equipment

<http://www.abilitations.com>

Sportime

Sporting equipment

<http://www.sportime.com>

Sprint Aquatics

Adaptive swimming equipment

<http://www.sprintaquatics.com>

Flaghouse

Adaptive sports equipment and more including beeper ball, cuff and transfer belt

<http://www.flaghouse.com>

Focus on Performing Arts

National Arts Disability Center

This site has links to adaptive ideas and equipment

<http://nadc.ucla.edu>

American Alliance for Health, Physical Education, Recreation and Dance

<http://www.aahperd.org>

Vendors

Sibelius™

Software that supports music creation

<http://www.sibelius.com>

Switch In time™

Software to create music

<http://www.switchintime.com>

Dancing Dots

Software to create Braille sheet music

<http://www.dancingdots.com>

Chapter 11 – Assistive Technology for Activities For Daily Living

Introduction.....	1
Eating and Drinking Continuum.....	2
Meal Time Continuum	3
Self-Care Continuum.....	4
Assistive Technology for Control of Environment	5
Multi-Function Electronic Aids to Daily Living Comparison Charts.....	6
Resource List for Daily Living Continuums.....	17

Assistive Technology for Activities of Daily Living

Jill Gierach, MSE ATP, Karen Stindt OTR ATP

Introduction

Past versions of the ASNAT manual had one chapter that included Assistive Technology for Recreation and Leisure, Activities of Daily living (ADL), and supports for students with multiple disabilities in the same section. In this edition of the manual we have separated these three areas.

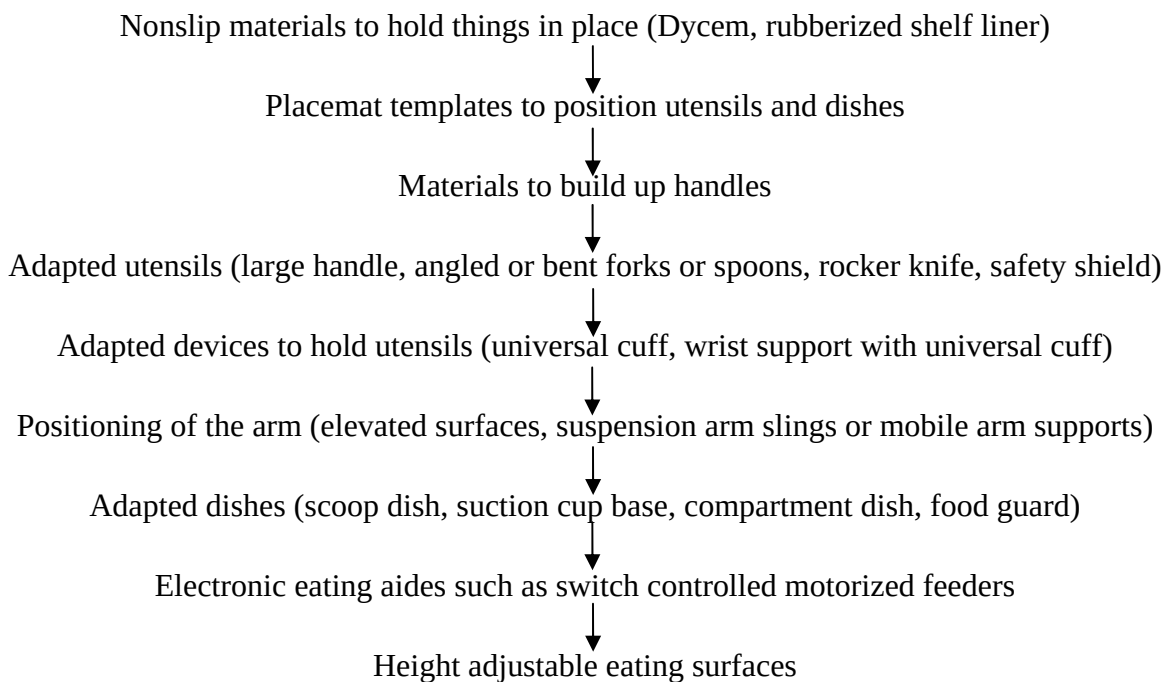
We have created three continuums to assist teams in looking at ADL goals in the areas of eating and drinking, meal time, and self-care. These areas are very specific and well supported by Occupational Therapists (OT). We strongly suggest that you rely on your OT for information on items in these areas. The section includes a chart on electronic aides for daily living.

At the end of the chapter is a very basic resource list of examples of the items mentioned in the continuums.

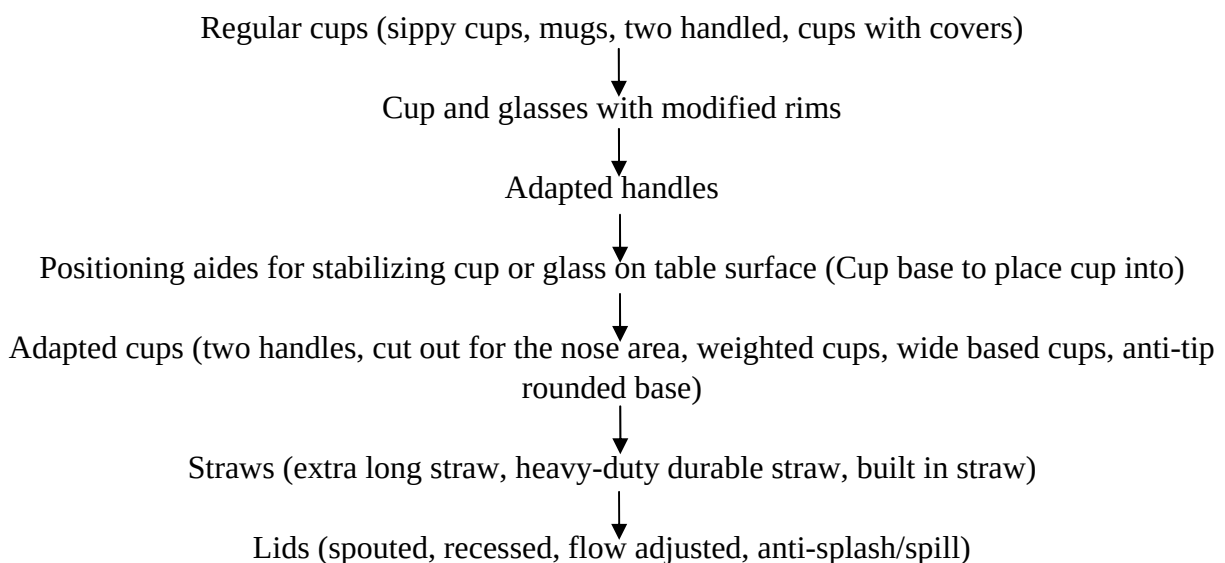
A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

Eating and Drinking

Eating



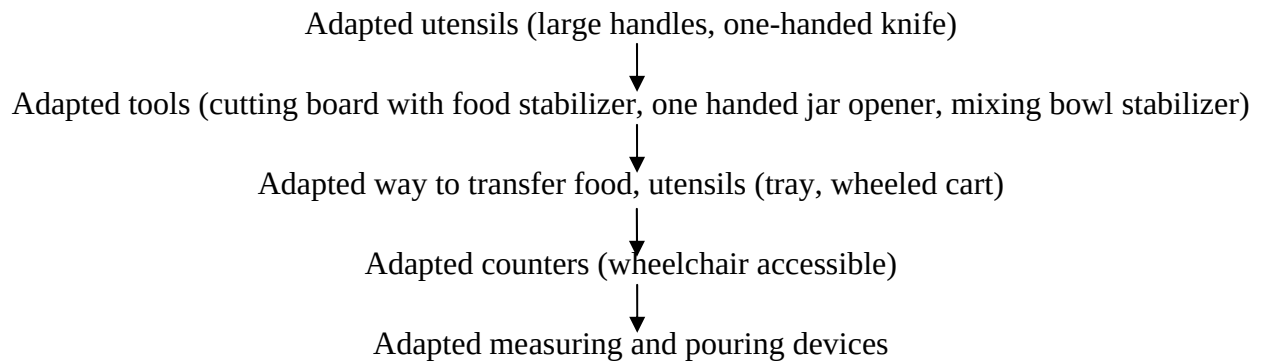
Drinking



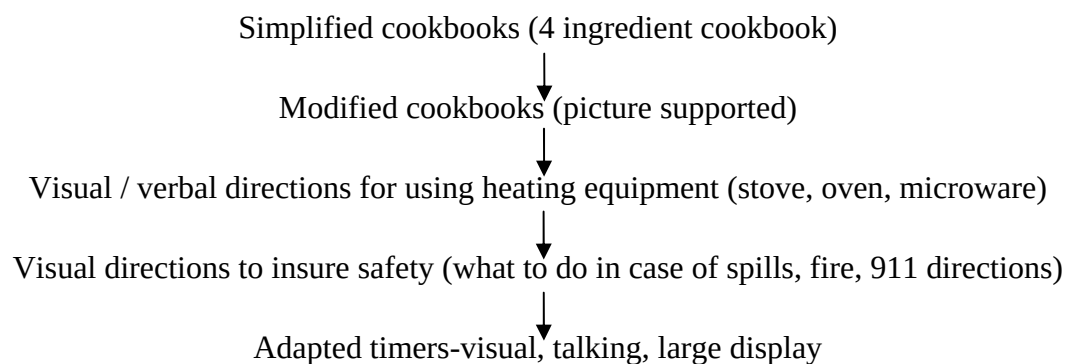
A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

Meal Time

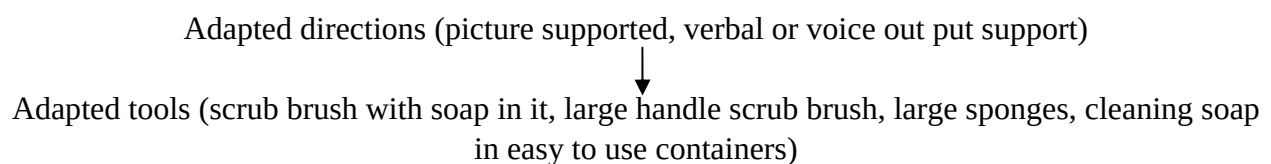
Food Prep



Cooking



Clean up



A CONTINUUM OF CONSIDERATIONS FOR ASSISTIVE TECHNOLOGY

Self-Care

Dressing

Specifically chosen clothing (elastic waist, pull over tops, easy fasteners)
↓
Adapted clothing (Velcro fasteners, large buttons)
↓
Tools to assist in dressing (button hook, stocking aid, large zipper pulls, dressing stick)

Hygiene Self-Care

Adapted tools
↓
Tooth brushes-large handle, vibrating, spinning tooth brushes
↓
Brushes and combs long, large handle or universal cuff hair brushes or combs; hair dryer stands
↓
Pump style containers (toothpaste, soap, shampoo, body wash, lotions)
↓
Adapted bathing aides tools (washcloth mitts, long handle back scrubber, tub chair)
Transferring devices (transfer chair, lift)
↓
Toileting aides- (toilet back support, mobile or stationary toilet chair, bath chair)
↓
Accessible bathrooms including non skid surfaces, grab bars, or other environmental safety items

Assistive Technology for Control of the Environment

Electronic aids to daily living (EADLs) enable the person with disabilities to have more control of their environment. They go beyond the technologies described in the previous pages on activities of daily living as they pertain to electronic devices only. By virtue of that characteristic, they tend to be higher, more complex technologies.

When the person lacks mobility, motor, or cognitive skills that prevent them from performing even the simplest tasks, EADLs can provide them with some basic control over their daily life. Individuals control even the smallest amount of movement by using various types of switches. Text or pictures can be used to access the devices. Different types of input (direct, switch, voice) are available. The user can accomplish control by using either X-10, which is a wireless communication "language" that allows compatible products to talk to each other using the existing electrical wiring in the home (on/off control for lights, appliances, door openers, etc.), or infrared (for TVs, VCRs, infrared phone, etc.).

The following charts, developed by Michelle L. Lange, OTR, ABDA, ATP, give the reader valuable information and detail about EADLs. The multi-function electronic aids to daily living comparison charts details the type of access, controls, signal use, portability, display, and battery backup for different devices. The reader can then begin to determine the features that will best match the needs of the person with a disability.

Chapter 11 - Assistive Technology for Activities of Daily Living

Electronic Aids to Daily Living (EADLs) control devices in the environment using an alternative method, to provide independent control for persons with physical, sensory and/or cognitive impairments.

Direct Access Systems											
Remote control models and prices change frequently. Check with the manufacturer.											
EADL NAME	PHOTO	ACCESS	CONTROLS	IR		MACRO	PORT	BATRY	DISPLAY	COMMENTS	COST/ PROD#
				Stord	lrm	OS	ABLE	BKUP			
GEWA Access Prog Zygo Industries 800-234-6006 www.zygo-usa.com		Direct One or two switches	IR functions: 205 X10 functions: through IR/X10 converter	no	yes	yes	yes	yes	Static overlays	Large 36 keys	\$1925 425602
Insteon RemoteLinc Wireless Remote Control Smarthome 800-762-7846 www.smarthome.com		Direct	Insteon functions: 6 scenes 417 devices	n/a	n/a	yes	yes	yes	Buttons	Remote works up to 150' from access point. Access Point required: #2443, \$39.99.	\$59.99 2440
Maxi Controller X-10 (USA), Inc. 800-675-3044 www.x10.com		Direct	X10 functions: 16 devices through powerline	n/a	n/a	yes	no	no	Text	Preset macros: all lights on, all lights off	\$24.99 SC503- HA
Universal 5-in-1 Learning Remote X-10 (USA), Inc. 800-675-3044 www.x10.com		Direct	IR functions: 5 devices X10 functions: 16 devices through RF and powerline	yes	yes	no	yes	yes	Backlit buttons Text		UR74A
Vizia RF Z-Wave Programmer Smarthome 800-762-7846 www.smarthome.com		Direct	Z-Wave functions: 256 devices Can create scenes	n/a	n/a	yes	yes	yes	Display Buttons		\$145.99 45020 \$49.99
Wireless Remote Control System X-10 (USA), Inc. 800-675-3044 www.x10.com		Direct	X10 functions: 8-16 devices through RF and powerline	n/a	n/a	yes	yes	yes	Text	To control more than 8 X-10 functions, must slide lever. Kit includes transceiver, receiver, 2 modules.	\$39.99 HR12A- SP-LAT- PS18

Chapter 11 - Assistive Technology for Activities of Daily Living



Switch Access Systems											
Choices are scanned and selected by a switch activation											
EADL NAME	PHOTO	ACCESS	CONTROLS	IR Stord lrrn		MACR OS	PORT ABLE	BATRY BKUP	DISPLAY	COMMENTS	COST/ PROD#
Angel FX Angel ECU 772-834-1989 www.angelecu.com		Switch: 1 - 2	IR functions: 1300 X10 functions: 18 devices Phone, bed, nurse call	no	yes	yes	option	yes	Dynamic graphic display	Auditory scanning, speech output, serial and relay output. Formerly Solo Act by Taplink.	\$6200
GEWA Control Prog Zygo Industries 800-234-6006 www.zygo-usa.com		Direct Switch: 1 - 2	IR functions: 241 X10 functions: through IR/X10 converter	no	yes	yes	yes	yes	Static overlays	15 levels, keyguard	\$870 425700
GEWA Progress Zygo Industries 800-234-6006 www.zygo-usa.com		Direct Switch: 1 - 2	IR functions: over 100 X10 functions: 256 through IR/X10 converter	no	yes	yes	yes	yes	Dynamic graphic display	Auditory scanning with recorded speech. Different scanning options available. 30 pre-built pages or can customize, various languages, graphics based, can back-up program.	\$5295 4253
Imperium 200H • Basic • With Bed Control • Complete Ablenet, Inc. 800-322-0956 www.ablenetinc.com		Switches: 2	IR functions: 6 devices X10 functions: 256 Integrated phone Bed control and nurse call on 2 nd & 3 rd models	yes	yes	no	Mobile Link option	yes	Dynamic display	Complete version is portable using Mobile Link. Auditory scanning with prerecorded words for most commands. Bed control and nurse call optional on Basic.	\$3580 86200 \$4200 86100 \$7200 86000
James SAJE Technology 847-756-7603 www.safe-tech.com		Direct Switch: 1			yes		yes	yes	Static paper	Row/column or step scanning Levels: paper display must be changed for visual feedback if level is changed Options: telephone, cell phone, bed, lights	\$2000 \$3000 with phone

no

Chapter 11 - Assistive Technology for Activities of Daily Living



- Relax II - Relax III Ablenet, Inc. 800-322-0956 www.ablenetinc.com		Switch: 1 - 2	IR functions: II: 40, 4 devices III: 30, 3 devices + phone X10 functions: 10 devices through RF	no	yes	no	yes	yes	Text	X-10 radio transceiver required. adjustable scanning (auto, hold, step). Relax III includes IR phone.	\$600 82000 \$1700 83000
Simplicity Switch Quartet Technology 978-957-4328 www.qtiusa.com		Switches: 2	IR functions: 240, 6 devices X10 functions: 64 devices Phone, nurse call	yes	yes	no	no	yes	no	Nurse call option. UL, CSA, CE approved. Speech feedback.	\$call 9164

Voice Access Systems											
Switch back-up access is critical in case voicing is not recognized.											
EADL NAME	PHOTO	ACCESS	CONTROLS	IR Stord	Irn	MACR OS	PORT ABLE	BATRY BKUP	DISPLAY	COMMENTS	COST/ PROD#
POWERHOUSE Home SAJE Technology 847-756-7603 www.saje-tech.com		Switch: 1 Voice	IR functions: unlimited X10 functions: unlimited phone	no	yes	yes	yes wireless headst	yes	no	Can use headset for computer voice commands, auditory feedback, 500' range	\$4500
- Sicare Standard - Sicare Light II Ablenet, Inc. 800-322-0956 www.ablenetinc.com		Switch: 1 – 2 Voice	IR functions: Standard: unlimited Light: 7 devices X10 functions: Standard: 256, RF Light II: 4, IR/X10 converter required	no	yes	yes	yes	yes	Dynamic display Large font	Optional IR phone, IR bed control, external microphone, mount. Speech feedback. Standard: 96 words, can customize menus, auditory scanning. Light II: 15 pre-set menus.	\$5700 88450 \$2100 88460
Simplicity - Voice/Plus - All in One(AIO)/Plus Quartet Technology 978-957-4328 www.qtiusa.com		Switches: 1 – 2 (AIO) Voice	IR functions: 240, 6 devices X10 functions: 64 Phone, nurse call	yes	yes	no	yes wireless headst	yes	no	Nurse call option. UL, CSA, CE approved. Speech feedback. Plus model provides full keyboard and mouse control.	\$call 9161/ 9162 \$call 9165/ 9166
VoicelR Infrared Voice Controller Broadened Horizons 612-851-1040 www.broadenedhorizons. com		Direct: remote Voice: 1 – 4 users	IR functions: 120 X10 functions: through IR/X10 converter	no	yes	yes	yes	yes, limited	no	Optional IR phone, IR bed control, switch output. Limited battery time. Can use one in each room or power off wheelchair batteries.	\$349

Computer Access Systems											
Home Automation Packages	Many Home Automation software/hardware packages are available that are primarily designed to set-up scheduled events in the home using X10 technology. Some of these also send IR signals. To control individual devices and functions, the consumer must be at the computer. These are not specifically designed for people with disabilities. Common examples include X10 Active Home, Hal 2000, Home Vision, Home Director and JDS Time Commander.										
EADL NAME	PHOTO	ACCESS	CONTROLS	IR Stord lnn		MACR OS	PORT ABLE	BATRY BKUP	DISPLAY	COMMENTS	COST/ PROD#
CINTEX 4 NanoPac, Inc. 800-580-6086 www.nanopac.com		Computer access method, including voice	IR functions: 416 X10 functions: 255 devices Phone	no	yes	no	Phone hdset	no	Computer screen	Bed controls and A/C optional. Phone headset options, including wireless.	\$2190 Base C40-30
EADL IR Package RJ Cooper & Assoc. 800-752-6673 www.rjcooper.com		Computer access method	IR functions X10 functions	no	yes	yes	no	no	Computer screen	Option: X10/IR converter and 1 module \$129 Software also runs on some SGD's	HW-4- 6F \$249
MEDIAssistant 200/200V Convergence Concepts 303-907-3050 www.convergenceconcep ts.com		Computer access method, touchscreen remote control 200V - voice	IR functions X10 functions Phone	no	yes	no	remte	10-15 minutes	Remote control screen	Remote control is very small	200 \$3200 200V \$4200
MotivAid 908-781-6595 www.motivaid.com		Computer access method, touch screen, voice, switch scanning	IR functions X10 functions Phone	no	yes	no	no	no	Computer screen	Dedicated computer	?
MultiMedia Max Multimedia Designs 888-353-3996 www.multimediamdesigns.c om		Computer access method. Includes Dragon Naturally Speaking for voice input.	IR functions: unlimited X10 functions: 256 devices Phone	no	yes	yes	no	yes	Computer screen: graphics of rooms	Includes computer, Dragon NS, hardware, software, installation, training, 1 yr. warranty. Optional bed control, thermostat, security camera	\$8995
Progress Star Zygo Industries 800-234-6006 www.zygo-usa.com		Switch scanning	IR functions X10 functions through IR/X10 converter	no	yes	yes	laptop	no	no	Progress dynamic display software uses onscreen graphic displays. Mini Progress Star does not include switch jack.	?
REACH Break Boundaries 513-645-4203 www.breakboundaries.co m		Touch screen, voice, head control, switch scanning	IR functions X10 functions Phone	no	yes	yes	yes	yes	12" screen	Can customize screen	\$6400

Speech Generating Devices		
Most high end SGD's send IR signals.		
- DynaVox M3 - DynaVox V/VMax - DynaWrite DynaVox Technologies 866-396-2869 www.dynavoxtech.com	Each of these communication devices sends nearly unlimited IR signals. X10 commands can be accomplished with an IR/X10 converter. Each offers a variety of access methods (direct, single and dual switch, joystick, mouse), customizable dynamic displays, auditory scanning for switch access, graphics and speech output. Each learn IR signals and can store macros. Auditory scanning means that the client just has to listen to scanned options, the auditory cue can be customized to the client's needs and no reading or even vision is required. The DynaWrite is a direct access device. The DynaVox V/VMax and the DynaVox M3 have an optional PhoneIT feature for phone control (\$315). The DynaVox M3 is the least expensive option (price listed) and can be used even by verbal consumers to provide reasonably priced switch accessed control of devices in the environment.	\$3285 
- ECO-14 - Pathfinder - Springboard Lite - Springboard Plus - Vanguard Plus - Vantage Plus Prentke Romich Co. 800-262-1984 www.prentrom.com	Each of these communication devices sends nearly unlimited IR signals. X10 commands can be accomplished with an IR/X10 converter. Each offers a variety of access methods (direct, single and dual switch, joystick, mouse), customizable dynamic displays, auditory scanning for switch access, graphics and speech output. Each learn IR signals and can store macros. Auditory scanning means that the client just has to listen to scanned options, the auditory cue can be customized to the client's needs and no reading or even vision is required. The ECO-14 has an optional Air Card to allow wireless control of a landline phone. The Springboard Lite is the least expensive option (price listed) and can be used even by verbal consumers to provide reasonably priced switch accessed control of devices in the environment.	\$2195 
Power Wheelchair electronics		
Some power wheelchair electronics packages send IR through the display. Invacare and PG Drives Technology are pending		
Quantum QLogic	The QLogic display (generally ordered when the consumer cannot use a joystick) sends multidirectional IR signals from the back of the display. It can learn up to 288 codes and store up to 3 macros. It can control X10 devices through a converter (4 devices per converter, 256 max.). The consumer uses the directional drive switches to scroll through and choose device and function options.	
Quickie iQ	The iQ display (generally ordered when the consumer cannot use a joystick) sends IR signals from the back of the display. It uses pre-set codes and can learn up to 22 codes. It can control X10 devices through a converter (4 devices per converter, 10 max.). The consumer uses the directional drive switches to scroll through and choose device and function options.	

IR: infrared control of audio/visual equipment, IR phone or other IR controlled device

X-10: on/off control for lights, appliances, fan, buzzer, door opener, drapery control, more. Uses existing house wiring (powerline) and, if remote, radio (RF) or infrared (IR) transmission to a converter.

Insteon: like X10, uses powerline and RF, more reliable, can control more devices. Can be given X10 address.

UPB: like X10, uses single band technology, powerline.

ZigBee and Z-Wave: like X10, single band RF wireless network.

Bed control can be accomplished with 6 X10 signals by X-10 System Electric Bed Operator #304, Jantek Home Controls, Inc., 416-620-5255, \$430.

Bed control can be accomplished with IR signals using the Ablenet IR Bed Control, \$1000.

Door Openers can usually be controlled with an X10 module. If the EADL is not portable, you cannot open the door from outside. IR Door openers are available, as well.

Any EADL transmitting IR may be programmable to send to an IR telephone. Check with the manufacturer.

Michelle L. Lange, OTR, ABDA, ATP, Access to Independence, MichelleLange@msn.com, 7/08.

BASIC ELECTRONIC AIDS TO DAILY LIVING – Battery and Simple Electrical Devices											
NAME	PHOTO	CONTROL MODE				SWITCH INPUT	SWITCH OUTPUT	COST	PROD. #	DIMEN SIONS	COMMENTS
		Direct	Latch	Time sec	Time min						
Battery Transmission											
Single SLAT Ablenet			X	0 - 60	0 - 60	1	1	\$75	100-SSLAT	2.25 x 3.75 x 1	
Choice SLAT Ablenet			X	0 - 60	0 - 60	2	2	\$95	100-CSLAT	2.25 x 3.75 x 1	2nd device will not activate until 1st device stops
Dual SLAT Ablenet			X	0 - 60	0 - 60	2	2	\$95	100-DSLAT	2.25 x 3.75 x 1	allows 2 people to use at one time
Tash Switch Latch Ablenet		X	X	2 - 52		2	2	\$125	43880	?	
LinkSwitch Adaptation		X	X	1-60	1-60	1-2	1-2	\$106	DLT-202	3 x 4.5 x 2.5	alarm mode
Switch Scanner Adaptation		X	X	1-60	1-60	1-2	1-6	\$159	SWSC	5.75x3.75 x 1.25	scans up to 6 outputs
5-in-1 Switch Modifier Enabling Devices		X	X	0-120		1	1	\$89.95	566	6.75 x 2.5 x 1.5	intention mode (adjusts activation time). Includes adj. pressure switch
Switch Modifier Enabling Devices			X	0 - 120		1	1	\$59.95	605	4.5 x 2.5 x 1	

Electrical Transmission											
PowerLink 3 Control Unit Ablenet		X	X	0-60	0-60	2	4	\$189	100-PL3D	9 x 5 ½ x 2 ¼	up to 1700 watts total remote switch access with AirLink (\$89)
Electralink Ablenet		X	X	1-60	1-60	1	1	\$200	34410	?	up to 1500 watts, 15A. Can be used with wireless Ultra One Transmitter
FreeHand Adaptivation		X	X	1-60	1-60	1	1	\$115	FH-ME	3.5 x 3.5 x 3.5	with transceiver module \$145
FreeSwitch Max Adaptivation		X	X	1-60	1-60	1-4	1-8	\$299	FSM-100	4 x 6.5 x 1.8	visual and auditory scanning (speech) X10 modules required Direct access option
Wireless Pal Pad Adaptivation		X	X			1	1	\$95	WPP	3.5 x 4	with transceiver module \$125
1-Switch Single-Appliance Unit Enabling Devices		X	X			1	1	\$107.95	1490	3 x 2.5 x 2	remote up to 600 watts
Environmental Controls Enabling Devices			X			1	4	\$149.95	591	4.5 x 2.5 x 1	Includes 2 receivers. 2 more \$63.95.

Basic EADLs provide direct, latched or timed on/off switch control of battery operated toys or simple electrical appliances. For control of more devices and features, please refer to the Multifunction EADLs chart.

Chapter 11 - Assistive Technology for Activities of Daily Living

Infrared Transmission							
a. Mini Relax - Scanning b. Mini Relax with Jacks c. Mini Relax with X-10 Ablenet		a. 1 b. 1-6 c. 1	a. 6 IR cmds b. 6 IR cmds, c. 6 IR cmds 1 X-10	\$300 \$325 \$400	82050 82060 82070	6 x 3.5 x 1.5	a. auditory and visual feedback, auto scan b. one switch required for each function c. includes X-10 radio transceiver
Wireless TV Remote Enabling Devices		direct or 5 switches	TV	\$142.95	1521	15.75 x 10.5 x 3.5	2" buttons or any 5 switches to control power, channels, volume
TV Remote Module Enabling Devices		1-5 switches	TV	\$72.95	5150	10 x 4 x 2.5	switch for each desired function: power, volume up, volume down, channel up, channel down

Basic EADLs send a limited amount of infrared signals to a limited amount of devices. For control of more devices and features, please refer to the Multifunction EADLs chart.

Infrared Controlled Telephones

An infrared controlled telephone can be used by virtually any Electronic Daily Living Aid (EADL, formally Environmental Controls) that can send infrared signal. Here is a comparison of features:

Features	GewaTel 200 ZYGO Industries, Inc. 800-234-6006 www.zygo-usa.com	Infrared Home or Office Accessible Landline Telephone Broadened Horizons 612-851-1040 www.broadenedhorizons.com	Prism Prism D Ablenet, Inc. 800-322-0956 www.ablenetinc.com	SiPhone Quickphone Quickphone f Dr. Hein www.SiCare.de (Germany)	TS Phone with TS Controller Technical Solutions 03 9737 9000 www.tecsol.com.au (Australia)
Photo					
cost	\$1,380.00	\$699.00	To be determined	?	\$360 (GST) phone only
access	-IR signal -Keypad	-IR signal -Keypad -Voice with voice dialer	-IR signal -Keypad	-IR signal -Keypad	-Single switch for answer and hang-up only -IR signal with TS Controller -Keypad
user can build #s	Yes	Yes	Yes	Yes	Yes
prestored #s held	50	50	5 speed dial Prism relies on directory in SGD Prism D adds directory of 100	SiPhone 200 Quickphone 50	20
redial	Yes	Yes	Yes	Yes	Yes
call waiting	Yes	Yes	Yes	Yes	Yes
battery back-up	Yes	Yes	Yes	Yes	Yes
Display	Yes	Yes	Yes	Yes	Yes
Volume Control	Yes	Yes	Yes	Yes	Yes

Chapter 11 - Assistive Technology for Activities of Daily Living

Privacy headset	\$115 earphone \$340 microphone	Wired privacy headset \$29.95 Wireless headset \$349.95 Expansion Microphone \$149.95	Pending	Optional	2 Options \$297 or \$498 (GST)
Interfaces	-any learning IR transmitter -any IR transmitting EADL -GEWA Prog	-any learning IR transmitter -any IR transmitting EADL -VoiceIR Voice Controller	-any learning IR transmitter -any IR transmitting EADL -SiCare Standard, Light II, Relax III	-any learning IR transmitter -any IR transmitting EADL -SiCare Standard	-any learning IR transmitter -any IR transmitting EADL
Transmission	Analog landline	Analog landline	Analog landline	Analog ISDN	?
Other	-can be used as standard phone. -commands pre-programmed into Quickie iQ electronics.	-can be used as a standard phone -voice dialer \$249.95 -same base phone as GewaTel 200	-same base phone as Quickphone -Prism D	SiPhone is cordless SiPhone takes pictures, sends via MMS "f" version has emergency call function, requires remote button press -can be used as a standard phone	-can be used as a standard phone

The GEWATel200 and Infrared Home or Office Accessible Landline Telephone are a Konftel 200 phone with remote. These are often available through various internet retailers for a lesser cost.

Michelle L. Lange, OTR, ABDA, ATP, Access to Independence, MichelleLange@msn.com, 7/08.

Resources List for DL continuums	This is a sample of some resources. It is not meant to endorse any one product over another. It is meant as a starting point when looking for examples.	
Eating , drinking, and Food prep Resources	Nonslip materials- Built up handles, adapted plates, cups, straws	http://www.dycem-ns.com/ http://www.sammonspreston.com/app.aspx?cmd=get_sections&id=100000 http://enablingdevices.com/catalog/useful-devices/household-products
Meal time, cooking, clean-up	Transfer items, carts, tools Simplified cook book	http://www.sammonspreston.com/app.aspx?cmd=get_subsections&id=100844
	Support for kitchen shopping and cooking	http://www.infinitec.org/live/kitchens/Cookshop.html
Electronic feeder	Self feeder	http://www.mealtimepartners.com/
	Picture based cook books	http://picturecookbook.com/ http://www.attainmentcompany.com/xcart/search.php?mode=search
Dressing	Resource with multiple links to adaptive clothing sites.	http://www.familyvillage.wisc.edu/at/adaptive-clothing.html
Hygiene	Assist in toileting Bathing, bathroom supports Oral care	http://www.medicaldepartmentstore.com/Self-Wipe-Toilet-Aid-p/725062000.htm http://www.sammonspreston.com/app.aspx?cmd=get_sections&id=100001 http://www.sammonspreston.com/app.aspx?cmd=get_subsections&id=100831

Chapter 12 - Assistive Technology for Students who are Blind or Have Low Vision

Introduction	1
Using the SETT Process and the Decision Making Guide	2
Decision Making Guide	3
Decision Making Guide Expanded	4
Assistive Technology Continuum	9
Assistive Technology Supports organized by visual impairments	10
Tools for Transition	17
Tools for Teachers.....	17
Accommodations	18
Assessments	19
Vision Profiles.....	19
Built-in Vision Accessibilities—Windows, Mac, Linux	21
Free Resources	22
Products for Low Vision.....	24
Products for Blindness and CVI.....	25
Solution Selection Tools and Strategies	28
Testimonials.....	29
Useful Resources	29
Text Formats	29

Assistive Technology for Students who are Blind or have Low Vision

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This chapter intends to provide information regarding a process for evaluating the assistive technology of students who are blind or have low vision. Assistive technology advances at a quick pace, requiring ongoing research and awareness on the part of the practitioner. The reader will find a list of low- and high-technology devices that offer students access to the academic curriculum as well as extra-curricular activities. Although the focus of this information is on assisting students who are blind or have low vision, these tools may also be helpful for many students with other disabilities. Included are specifically designed tools to assist students both in accessing and processing curriculum. It is important to understand the necessity of teaching the underlying skills needed to be independent in the use of assistive technology, which can be equally valuable in classrooms and community. For example, Braille notetakers are useful not only for note taking in class, but also for composing and printing essays, writing notes, send e-mails, or browsing the Internet.

Assistive technology can give students who are blind or have low vision support in all academic areas as well as in expanded core curriculum. The selection of devices is contingent upon a variety of factors. To begin the process of consideration, the student's vision condition needs to be identified. Additional information should be acquired regarding the students' appropriate media format through the learning media assessment. For the purposes of this information visual impairment is divided into three major categories – low vision, functional blindness/blindness, and cortical (cerebral) visual impairment. Each of these groups has specific characteristics that will govern the selection of appropriate assistive tools.

Visual Impairments Defined

Group	Description
Low Vision	An ocular condition where a person's visual acuity ranges from 20/70 to 20/200 (legally blind) after best correction, or visual field subtends the angle of 50 degrees or less.
Functional Blindness/Blindness	An ocular condition where a person perceives light or less, or is unable to efficiently use their residual vision.
Cortical (Cerebral) Visual Impairment	A neurological condition related to the visual pathway where a person has difficulty in interpreting visual information.

Using the SETT Process and the Decision Making Guide

The SETT process is designed to establish those characteristics in order to recommend the best possible solutions. The SETT process considers several factors that influence the choice of tools, devices, and interventions. It is imperative that the student's strengths and weaknesses are known. The needs assessment also considers the environment in which the student receives instruction. It is also important to know about the student's plans after high school graduation. When all of the above information is gathered, conclusive decisions can be made. It is worth mentioning that in some cases more than one solution may be implemented to obtain desired results. The process of decision-making about assistive technology can be complex and inexact, making it difficult to match one tool with a specific area. For example, to give a student with low vision better access to print, either a large print book, or regular print book with some type of magnifier can be provided.

WATI Assistive Technology Decision Making Guide

Area of Concern: Vision

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
• Print size • Reading visual or tactile medium • Illegible handwriting • Navigating the computer operating system and programs • Identifying & finding details in pictures • Touch typing • Need for audio enhancement • Color blindness • Photosensitivity • Activities of daily living • Participation in gym activities • Organization • Physical or motor-related issues	• Desk space • Classroom space • Location in the room • Visual access of board work • Visual access of classroom presentations • Type of learning medium • Type of light and level of illumination • External noises • Assistive Technology: past and present	• Reading • Writing • Note-taking • Large group distance presentations • Visual activities • Computer-assisted tasks • Converting print into electronic format • Activities of daily living • Gym activities
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts learning? (i.e., visual, auditory, tactile)		Identify Specific task(s) for Solution Generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming only— No decisions yet Review solutions in respect to type of visual impairment and the area that requires additional support.	Use a feature match process to discuss and select ideas(s) from Solution Generation	AT trials/services needed: Formulate specific task objectives to determine effectiveness of trial: • Training needed • Date • Length • Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them (i.e. on a flip chart or board). Information should then be transferred to paper for distribution, filing, and future reference.

Student's Abilities/Difficulties

Can the student read regular print?

Students with low vision and cortical visual impairments may require change in the print size and typeface. All of the changes will be contingent on students' vision condition and their preferences, and should be delivered through evaluation, functional vision assessment and/or learning media evaluation

What are the student's most effective reading media?

Reading medium is another important consideration. Some students may use a combination of media—visual, tactile, audio or electronic (e-text)—to enhance or support the primary reading mode. AT teachers of the visually impaired will determine what learning media will be most functional.

Can the student understand pictorial information?

When students with low vision need to interact with pictorial information, they may need some type of magnification. Enlarged material may be sufficient for some students. Others will need optical or electronic magnification tools. Magnification needs are determined through low vision clinical evaluation.

Is the student's print legible?

Writing can be problematic due to poor vision and hand-eye coordination. Some students with low vision may be able to write but the shape and size of the letters might make the handwriting illegible. In such cases, unless a student is a Braille user, typing needs to be considered.

Can the student type?

Typing is one of the most essential skills that allows for written communication. A computer or other typing device may offer large and high contrast keys, but to be an effective typist, touch-typing should be considered as a long-term solution.

Can the student navigate the computer system independently?

Students with visual impairments will require various types of operating system accessibilities to do computer-based assignments. For some, built-in accessibility features will suffice, while others will need full-fledged specialized software.

Is the student photophobic (extremely sensitive to light)?

Students that are photosensitive may require tools that allow them to adjust color schemes. Additionally, consideration must be given to students who are colorblind. Learning material may also need to be provided in preferred color combination to reduce glare and enhance contrast.

Can the student participate in gym activities?

Many games in the gym involve the use of a ball. Depending on the sport played the balls differ in size and weight. Students with visual impairment may require adapted gym tools. The way games are played may also be modified to include students with vision concerns.

What are the student's organizational skills?

Keeping items organized is an especially important skill for a student with visual impairments. Many students, especially younger students, need assistance in learning to keep material organized. It should be an ongoing part of instruction.

What motor challenges does the student have?

It is important to determine if there are any other physical or related issues that need to be considered. Certain motor impairments may affect a student's ability to interact with Braille or to navigate their environment effectively.

What does this student need to focus on in their Expanded Core Curriculum?

Students with visual impairments should participate in an expanded core curriculum that includes the use of compensatory skills, orientation and mobility, social interaction skills, independent living and personal management skills, recreation and leisure skills, career and vocational education, visual efficiency and need for/use in Assistive technology.

Compensatory skills include the use of tools, adaptations, modifications and behaviors that maximize the student's opportunity to access the environment, educational activities information and basic human needs. This can include a variety of communication tools, adapted reading and writing, organizational and counting tools.

Can the student participate in extra-curricular activities?

In most cases yes, many sports are fully accessible to a student with visual impairments such as wrestling, swimming, track and field. For a student with severe impairments or blindness adaptations can be created to cue location or destination. Sports that use a ball or object that moves may need to use a ball with colors are high contrast, larger or softer shape, or some kind of sound mechanism to help the student locate it.

For many non-athletic activities no special equipment may be needed, such as in front six debate or language clubs. Some activities may require cueing to location and/or destination. Materials may require adaptation to the appropriate media such as Braille or audio formats of information needed to participate effectively

Sensory Considerations

Different environments have different levels of sensory stimulation if the team is determined that sensory impacts are influential for the students learning identify the sensory level it in each environment that the student will be in. Coping with environmental noise is a fact of life. If a student is distracted by background noises, they may need to learn coping strategies or have the environment modified as they learn how to prioritize the sounds around them. For students who are deaf blind and have multiple disabilities, see chapter 14 for additional information on sensory considerations.

Environmental Considerations

Desk space

Ample desk space is required due to the size of material and supporting tools. That space is necessary not only to fit all the material and tools but also to help students get organized. If

sufficient space cannot be offered, tools that take up less space but meet specific requirements may need to be considered.

Classroom space

Classroom space is also essential so that the students can freely move around without too many obstacles. Some students, despite being seated in front of the room, may need to go up to the board or other presentation areas to access information. The change in the table layout may need to be considered to clear the path to the distance information.

Location

The location of the adaptive equipment may also affect the choices. The student with low vision may be seated in front of the room, which means that a CCTV could be in the visual path of other students sitting behind him/her.

Visual access of classroom presentations

Large-group presentations and board work might be inaccessible for students with visual impairments without specially designed access tools. Students may require desktop copies. In some cases a different type of board may increase the student's visual access.

Type of light and level of illumination

Type of light and level of illumination will also determine where the student can be seated. Some students may require dimmed light, while other will need higher brightness level. If students need to individually adjust the light level, they may need a table light; their table or desk should be positioned near a power outlet.

Type of learning medium

Access to power outlet(s) will also be necessary when students work with different electronic tools. Many modern devices have rechargeable batteries but their operation time usually does not exceed two to three hours. Therefore students will have to plug in their devices once or twice a day in to recharge the batteries. Some of the new computers do have longer battery life but the trade-off is that the screen may not be bright enough for a student with visual impairments to see.

External noises

Since students with visual impairments, especially those with severe low vision or blindness, rely on their hearing to gather information during the classes, it is important to ensure that any unnecessary external noises are eliminated or reduced.

Assistive Technology: past and present

What assistive technology (AT) has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist such as computer conflicts, lack of training, lack of interest, or other reasons. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference. If the student is currently using assistive technology note the AT used, location,

level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Be certain to list low and high tech AT supports.

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment the student will be in.

Tasks

As a team, discuss and write on chart paper the curricular and extra-curricular tasks that the student needs to do.

One of the most important questions when assessing a student's need for assistive technology is: what tasks must be accomplished by the student in order to fully participate in a given curriculum? The following questions may provide guidance as teams begin to assess students' assistive technology needs:

- Is this student currently reading? Is there evidence of difficulty with textbooks, worksheets, math, or chapter books?
- Is this student currently writing? Is the student able to compose sentences, fill out forms, and complete worksheets?
- Is this student currently taking notes? Does the student have a functional system or efficient medium?
- Can this student independently access distance presentations such as board work, posters, multimedia presentations, document camera presentations?
- Is this student accessing visual activities related to science experiments, graphing, etc.?
- Can this student do computer-based tasks? Is the student able to use word processing programs, visual presentation programs, e-mail and/or online research?
- Can this student prepare accessible text to match their reading medium?
- Is this student participating in gym activities? Can they see the ball? Can they direct the ball to the target? Can they run without a guide?
- Is this student taking part in extra-curricular activities?

Narrowing the Focus

As a team, identify the tasks that are priorities and will be most beneficial for the student to access the curriculum. You may circle or highlight them.

After the team has generated a list of tasks that the student needs to do, refine the list to limit the tasks that the team (including the student) will focus on. Too many tasks can overwhelm the team. Introduction of too many factors and tools may reduce your ability to determine effectiveness. Maintain your original list of tasks and review it later. Some tasks may already be effectively addressed with the new tools/strategies that you are using. The tasks that remain can become your new focus at a later date.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the continuum for vision. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

The continuum of assistive technology for vision is broken down into several areas. Students will use a variety of tools, depending on the task. For example, some students with low vision will read short passages visually, but because of visual fatigue, may require either audio or tactile format for longer readings. Low-tech solutions may be sufficient for some types of tasks, while higher-end technology may be needed to complete other tasks.

The following chart includes continuums of options to support students with visual impairments in the standard curriculum tasks. These suggestions are divided into the three areas of identified visual impairments: low vision; functional blindness; and cortical visual impairment.



Computer Access	Technology for Academic Areas			Expanded Core Curriculum		
Computer access	Reading	Writing	Math	Pictorial Information	Note-Taking	Mobility
Color scheme ↓ Large operating system features ↓ Built-in Magnification ↓ Fully featured magnification ↓ Magnification with screen reader ↓ Screen reader ↓ Screen reader with Braille device	Glasses ↓ Color filter ↓ Slantboard ↓ Large print ↓ Optical magnifier ↓ Electronic magnifier ↓ CCTV ↓ Monocular ↓ CCTV with distance camera ↓ Audio text ↓ Computer based reading software ↓ Electronic Braille notetaker	High contrast pen ↓ Portable word processing device ↓ Typing with audio support ↓ Braillewriter ↓ Typing with Braille support ↓ Electronic Braille notetaker ↓ Voice Recognition	Large print measuring tools (rulers, protractors) ↓ Large key calculator ↓ Tactile measuring devices ↓ Abacus ↓ Talking calculator ↓ Models or 2D & 3D geometric shapes ↓ Tiger embossed, PIAF Tactile representation	Enlarged format ↓ CCTV ↓ Models or objects ↓ Tactile graphics ↓ Tactile-audio graphics	Slate and stylus ↓ Tape or digital recording device ↓ Computer-based recording software ↓ Electronic Braille notetaker	Cane ↓ Monocular ↓ Braille/talking compass ↓ Electronic Travel Device ↓ GPS Device

Classification of Educational Technology

Assistive Technology for Academic Areas

Low vision:

- Magnification-there are four types of magnification: relative-size (large format, bigger manipulatives), relative-distance (material presented closer to the student), angular (lens-based magnifiers), and projection (camera-based electronic magnifying devices).
- Specialized lighting-lamps and lights with various types of illumination may enhance the visibility of the working surface.
- Material positioning devices-page holders, book holders, or book stands, and slant boards enable better positioning of the material to decrease distance, angle or glare.
- Audio support-software or hardware that gives information through auditory channel in addition to the primary channel whether it be visual or tactile.
- Text-to-Speech- software that converts digital text into audio. It is implemented in talking programs, like word processors, or is part of read aloud imported text.
- Portable reading devices- Hardware that supports various formats of audio text. Information may be stored either as audio files on media cards, or as soundtracks on CDs.
- Large key calculators-oversized numbers to accommodate vision needs.
- Audio graphic calculator- software or hardware they give students with visual impairments visual and auditory access to graphing capability
- Large print keyboard stickers – in order to make the keyboard labels more visible stickers with large print characters can be used. They come in two color versions – white on black, or black on white.
- Built-in magnifier (PC), Zoom (Mac) – computer operating systems come with magnification accessibility features.
- Third party magnification software – a full-fledged application that increases the size of screen content.
- High contrast (20/20) pen- simple writing tool that makes letters more visible due to the high contrast ink.
- Third party combo magnification and screen reading software – combines features of screen magnifying software and speech output software giving dual-mode access to computer information.
- Hardware screen magnifiers – monitor-mounted screens with magnifying screen, used less than software magnification

Blindness:

- Braille keyboard stickers – in order to make keyboard labels tactually accessible stickers with Brailled characters can be used.
- Power Chord Braille Keyboard – computer keyboard based on 6 Braille keys with additional function keys.
- SIXIN – computer software that turns six home row keys into Braille keys allowing a student who is not proficient with QWERTY keyboard to type on the computer.

- Narrator (PC), VoiceOver (Mac) – computer operating systems come with built-in voice output applications to support access.
- Third party screen reading software – full-fledged speech output program that gives full access to computer systems and menu-driven programs and applications.
- Talking Web browsers – self-voiced browsers that give access to many Websites through auditory channel.
- Braille display – hardware devices that show up to one computer line at a time in Braille. As the user moves around the computer screen, tiny solenoid pins on the display raise and lower to form the Braille character of each computer screen character.
- BrailleWriter-a special typewriter that produces immediate text in Braille as it is being typed. It is the most common mid-tech device used for typing in Braille.
- Electronic Braille note-taker -a device with numerous functionalities used to input, store, and output text either in Braille or print. Depending on the model, note takers may have Braille or QWERTY keyboard, speech only output, or speech and Braille output. The newest devices store various types of files using internal drives or memory cards. They also have Internet capabilities.
- Electronic Braille typewriters- a tool that is a combination of BrailleWriter and electronic note-taker. It produces an immediate hardcopy of Braille, allowing prior insertion and proofreading of text.
- Tactile images-graphical information created and tactile format that is accessible for blind people. There are a number of methods to create tactile images. Some may require specialized equipment, while others can use low-tech materials.
- Tactile-audio - overlays and devices link to a computer to output audio information assigned to a specific area in the overly that is put over a touch sensitive board.

Cortical (Cerebral) Visual Impairment (CVI):

- Large or color-coded keys keyboard – modified keyboard giving better access because of the bigger size of the characters, and various colors assigned to specific groups of keys.
- Portable word processing device – a stand-alone tool for typing; its functionalities are usually much simpler than those of a computer system; it is also smaller and easier to handle than desktop or laptop computer.

Assistive Technology for Regular and Expanded Core Curriculum

Low vision:

- Long Cane- a walking tool used to support independent travel or to identify for others that a person is visually impaired or blind.
- Monocular-an optical device used for close-ups of distant objects. It may be used in classroom to read more for or presentation projected on large screens.
- Digital talking compass-a directional device that announces the directions through an audio output.

- Manipulatives- toys, shapes, models and other objects to support the learning process. Real objects should be used whenever possible. They may complement and/or replace pictures they might not be clear or meaningful.
- Adapted games- for computer games specially designed to accommodate vision loss.
- Typoscope-a rectangular cutout used to provide borders which outline the area for one to write their signature.
- Voice output measuring and household devices-various kinds adapt. Appliances with speech output and/or tactile markings.
- High contrast or large numbered watches and clocks.
- Magnification - there are four types of magnification: relative-size (large format, bigger manipulatives), relative-distance (material presented closer to student), angular (lens-based magnifiers), and projection (camera-based electronic magnifying devices).
- Specialized lighting – lamps and lights with various types of illumination may enhance the visibility of the working surface.
- Material positioning devices – simple page holders, foldable book holders, or more sturdy book stands, and slantboards enable better positioning of the material to decrease distance, angle, or glare.
- Audio support – software or hardware that gives information through auditory channel in addition to the primary channel whether it be visual, or tactual.
- Text-to-speech – software that converts digital text into audio. It is implemented in talking programs, like word processors, or is part of read aloud imported text.
- Portable reading devices – hardware that supports various formats of audio text. Information may be stored either as audio files on media cards, or as sound tracks on CDs.
- Large key calculators – oversized tool to accommodate vision needs.
- Audio graphic calculator – software or hardware that gives students with visual impairments visual and auditory access to graphing.
- High contrast (20/20) pen – simple writing tool that makes letters more visible due to high contrast ink..
- Money management software-programs to assist in managing financial activities like balance checkbooks, etc.
- Large print or magnified screen typing instruction software/programs to assist in keyboard instruction.
- brightly colored/high contrast balls.
- lightbox-a device that provides a lighted working surface to give higher contrast or attract visual attention.

Blindness:

- Long Cane (see above)
- Braille – a special typewriter that produces immediate text in Braille as it is being typed. It is the most common mid-tech device used for typing in Braille.

- Electronic Braille note-taker – a device with numerous functionalities used to input, store, and output text either in Braille or print. Depending on the model, note takers may have Braille or QWERTY keyboard, speech only output, or speech and Braille output. The newest devices store various types of files using internal drives or memory cards. They also have Internet capabilities.
- Electronic Braille typewriters – a tool that is a combination of Braillewriter and electronic note-taker. It produces an immediate hard copy of Braille, allowing prior insertion and proofreading of text.
- Tactile images – graphical information created in tactile format that is accessible for blind people. There are a number of methods to create tactual images. Some may require specialized equipment, while others can use low-tech materials.
- Tactile-audio presentations – overlays and devices linked to a computer to output auditory information assigned to a specific area in the overlay that is put over a touch sensitive board.
- Portable reading devices - portable players that play back different types of audio that is stored on CDs or removable media cards.
- Talking software or hardware calculators – math support with speech output functionalities.
- Braille calculator – math support device with Braille display.
- Audio graphic calculator – software or hardware that gives students with visual impairments visual and auditory access to graphing.
- Math tiles – a set of Braille tiles with a magnetic board to help blind students understand different math concepts.
- Text-to-audio conversion software – programs that allow converting digital text into audio formats.
- Abacus – low-tech tool for calculation tasks.
- Math support software – programs to give access and explain math concepts.
- Audio support – software or hardware that gives information through the auditory channel in addition to the primary channel, whether it is visual, or tactual.
- Text-to-speech – software that converts digital text into audio. It is implemented in talking programs like word processors, or is part of read-aloud imported text.
- Audio graphic calculator – software or hardware that gives students with visual impairments visual and auditory access to graphing.
- Adapted cane- modified tool that enhances safety in traveling. It is used with people who have other concerns in addition to blindness.
- Electronic Travel Devices (ETDs) electronic devices that are a secondary tool used in addition to obtain or adapted cane.
- Braille compass-I directional device with a priest arrow; braille characters indicate the four directions of the world
- Talking GPS-positioning tools separately informed person about the current position and route
- Manipulatives-extra objects should be used whenever possible, shapes, models, and other objects to support learning process.
- Sign maker-a device that helps create Braille labels to be used for marking all kinds of objects

- Talking watches, clocks-timepieces with speech output
- Talking Typing Instruction Software-programs to assist in keyboarding instruction
- Beeper balls or other acoustic balls-assist with ball interaction to sound generating components.
- Adapted games-Board or computer games specially designed to accommodate vision loss.
- Swing cell-a tool that assists instruction in Braille.
- Images-tactile, graphic, audio description or real object.
- Braille blocks- plastic box with Braille characters to assist instruction in Braille.
- Beeper Ball or other acoustic balls- balls with sound generating elements
- Voice output measuring and household devices-various kinds of adapted appliances with speech output and/or tactile markings, talking management software.

Cortical (Cerebral) Visual Impairment (CVI):

Students with CVI may not read at grade level. These suggestions may increase their access to text.

- Modified reading format – print is converted into a digital format as e-text and read by text-to-speech software or hardware.
- Changed letter kerning – increased space between characters in words, or images presented at one time.
- Reading guides – low-tech cutouts that leave one line visible at a time making the reading process easier
- Acetate filters – color transparent sheets that change the color of the page with text concurrently reducing glare and altering contrast.
- Text-to-speech software – programs that recognize digital text and provide auditory output. Some of them have a variety of features that help to follow the text as it is being read.
- Slant-board or other material positioning devices – simple constructions that reposition reading material at different angles.
- Highlighter tapes – transparent tape that easily sticks to and peels off paper to emphasize important fragments or words in text.
- Highlighters – bright color markers use to emphasize important facts or words in text.
- Talking typing instruction software - programs to assist in keyboarding instruction
- Money management software-programs to assist in functional financial activities.
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- Lightbox-a device that provides lighted working surface to give higher contrast or visual attention.
- Adapted Phy Ed tools- balls, baskets, etc. modified with extra bright colors to increase their visibility or auditory cues to assist in locating them.
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***All of these strategies may be helpful for students with low vision as well.

Assistive Technology for Expanded Core Curriculum

Low vision:

- Monocular – an optical device used for close-ups of distance objects. It may be used in classroom to read board work or presentations projected on large screens
- Digital talking compass – a directional device that announces the directions through an audio output.
- Manipulatives – toys, shapes, models, and other objects to support the learning process. They may complement and/or replace pictures that might not be clear or meaningful.
- Adapted games – board or computer games specially design to accommodate vision loss.
- Typoscope – a rectangular cutout used to provide borders which outline the area for one to write their signature.
- Voice output measuring and household devices – various kinds of adapted appliances with speech output and/or tactual markings.
- Talking watches, clocks – timepieces with speech output.
- Talking typing instruction software – programs to assist in keyboarding instruction.
- Money management software – programs to assist in managing financial activities like balancing checks, etc.
- Beeper ball or other acoustic balls – play balls with sound-generating components.
- Light box – a device that provides lighted working surface to give higher contrast or attract visual attention.
- Signmaker – a device that helps create Braille labels to be used for marking all kinds of objects.

Functional Blindness/Blindness:

- Cane – a walking tool used for safe and independent traveling.
- Adapted cane – modified tool that enhances safety in traveling. It is used with people who have other concerns in addition to blindness.
- Electronic Travel Devices (ETDs) - electronic devices that are a secondary tool used in addition to cane or adapted cane.
- Braille compass – a directional device with a raised arrow; Braille characters indicate the four directions of the world.
- Talking GPS – positioning tools that verbally inform a person about the current position and the route.
- Manipulatives - toys, shapes, models, and other objects to support learning process. They may be used as a replacement for images.
- Adapted games - board or computer games specially design to accommodate vision loss.
- Swing cell – a tool that assists instruction in Braille.

- Braille blocks – plastic blocks with Braille characters to assist instruction in Braille.
- Beeper ball or other acoustic ball - play balls with sound-generating elements.
- Voice output measuring and household devices – various kinds of adapted appliances with speech output and/or tactual markings, talking management software

***All of these strategies may be helpful for students with low vision or CVI.

Cortical (Cerebral) Visual Impairment (CVI):

- Talking typing instruction software - programs to assist in keyboarding instruction
- Money management software - programs to assist in managing financial activities like balancing checks, etc.
- Highlighter tapes – transparent tape that easily sticks to and peels off paper to emphasize important fragments or words in text.
- Highlighters – bright color markers used to emphasize important fragments or words in text.
- Light box – a device that provides lighted working surface to give higher contrast or attract visual attention.
- Adapted gym instruments– balls, baskets, etc. modified with extra bright colors to increase their visibility or auditory cues to assist in locating them.

Assistive Technology for Additional Support

Low vision:

- Talking dictionary/large print – hardware or software tools to assist in language-related tasks.
- Word-prediction software – programs that support composition of sentences.
- Organization tools – software or hardware to facilitate organization and learning material management.
- Tactile-audio systems – haptic devices that enhance tactile exploration.
- 3-D images for concept development – tactual images to complement or supplement textual information.

Functional Blindness/Blindness:

- Talking dictionary – hardware or software tools to assist in language-related tasks.
- Talking test software – software that reads out the content of the test entered by the teacher or another person that administers the test.
- Word-prediction software – programs that support composition of sentences.
- Organization tools – software or hardware to facilitate organization and learning material management.
- Tactile-audio systems – haptic devices that enhance tactile exploration.
- Image simplifying software – programs that convert images from visual to textual by simplifying their content.
- 3-D images for concept development – tactual images to complement or supplement textual information.

Cortical (Cerebral) Visual Impairment:

- Talking dictionary – hardware or software tools to assist in language-related tasks.
- Word-prediction software – programs that support composition of sentences.
- Organization tools – software or hardware to facilitate organization and learning material management (like color coding, binders, bright color or tactual markings).
- Tactile-audio systems – haptic devices that enhance tactile exploration.
- Models – real objects are typically more appealing and meaningful than pictures and should be used when possible.

Many of the tools mentioned above recur in different groups, meaning they can be used for various purposes. It is often the case that a variety of tools and support services will be used contingent upon the student's visual impairment, skills, abilities, and needs. Tasks will also determine the selection of one or more accommodations. For example, if a communication skills activity requires writing, particular writing tools will be involved to accommodate a specific student performing this activity. Talking dictionaries may appear useful both for reading and writing as well as for other classes where new terminology is introduced.

Students with cortical visual impairment often require some accommodations. Tools that are described in the Reading, Writing, or Organization chapters may be effective and efficient. Students with CVI may present decreased acuity, while others will not experience significant loss in the vision sharpness. An excellent resource that includes instructional strategies for students with CVI is the article *Strategies for Working with Children with Cortical Visual Impairment* by Jeanne Gardier. This article is available online as a .pdf file at www.pattan.k12.pa.us/files/db/cvi.pdf.

Tools for Transition

AT solutions that students may need once they leave school, such as portable text reading or ADL equipment, should be explored **during** the school years and used in context in the work/home environments. This helps the students prepare for their post-school lives, careers and experiences. Other information the graduating students should know about include accessibility options for PDAs, cell phones or household appliances. Please see the resource section for further information on these resources.

Tools for Teachers

Adaptation and conversion of learning material to make it accessible may be time-consuming. It also requires knowledge and planning to ensure quality and correctness. There are various ways and methods of preparing material. Some things can be done using low-tech materials, while others will require specialized software and hardware. Below is a list of possible devices that are needed to provide academic services to students with visual impairments:

- Text-to-Braille translation software – programs that translate print to Braille
- Embosser – aka Braille printer, a device used to emboss text in Braille
- Braille instruction support tools.
- Scanner with Optical Character Recognition (OCR) software – device used to convert paper text into digital format. Optical Character Recognition OCR is software that converts the image of the text on pages that are being scanned and turns it into e-text.
- Image simplifying software – programs that convert images from visual to textual by simplifying their content.
- Image embossing devices – hardware that makes flat print images tactually accessible.
- Color copier with enlarge function – a device that allows enlargement of print material.
- Text-to-audio software – programs that convert electronic text into an audio format. Some programs also save files as portable audio files like .mp3 or .wav.
- Voice recording software – programs that allow digital voicing recording and editing. Files can be saved in various formats and subsequently either listened to on the computer, or transferred to portable media players.

In addition to the above solutions, various simple tools and materials can complete the inventory of adaptive material. A comprehensive list would be too long to include in this chapter. Teachers may use a variety of textures, models, shapes, foods, ingredients, etc. to either replace visual material, or supplement it. It is recommended that a combination of simple, self-made material and ready-made commercially produced teaching aids be utilized. To cover all curricular areas a teacher may use a mixture of low-tech to high-tech solutions.

Accommodations

Accommodations that do not include specialized equipment may be sufficient to support students with visual impairments. In rare cases, students' academic needs may be met without them. However, accommodations are only part of complete curricular support. The following list gives the most common strategies for accommodating students who are blind or have low vision in educational settings.

- Large print materials
- Modified print text: amount per line, kerning, letter size, letter and background color
- Bold-line paper
- Raised-line paper
- Braille materials
- Braille paper
- Braille transcriber
- Personal copy of chalkboard materials
- Personal copy of overhead materials

- Peer note-taker
- Reader
- Scribe
- Special seating
- Special lighting
- Time for individual/small group instruction/test taking
- Minimizing visual distraction
- Monitoring and make adjustments for visual fatigue
- Minimizing auditory distraction
- Modification of length of assignments, tests, exams
- Extended time for assignments, tests, exams
- Take tests and exams with TVI (Teacher of Visually Impaired)
- Test items explained or paraphrased as needed
- Access to notes/text/learning materials such as tactiles/manipulatives during tests, exams

Assessments

Before you thrill your students with the news about cool equipment they are going to work with, make sure you know the level of their technological advancement. You would not want to overwhelm them with a learning tool that is far too complex. The initial excitement might quickly turn into frustration. Several publicly available informal assessments will be helpful in determining how much your students know, and how much they still need to learn. A few have been included here as examples.

The following are checklists and instruments available online that may assist you in the assessment process:

- VI Technology Assessment – www.tsbvi.edu/technology/tech-assess.htm - A variety of assessments and checklists broken down into various categories. Unlike many other assessment lists, this set is designed for assessing students who are blind or have low vision.
- Vision Assessment Toolkit – www.gpat.org – AT for students with low vision.
- Assistive Technology Assessment Tool – www.e-advisor.us/workshop/tmaggiorePPT/vieval.pdf - another comprehensive tool by Georgia Project for Assistive Technology.

Profiles

The following are real-life profiles of students who are blind or have low vision and use various types of assistive technology. Their names have been changed to respect their privacy. As indicated throughout this chapter, students who are blind or have low vision constitute a heterogeneous group. Each student will require a different set of instructional and adaptive tools that will offer support in academic and extra-curricular activities. The

examples below show how students can benefit from different learning media and corresponding technology.

Fernando, 8 years old, blind

Fernando is only beginning his adventure with assistive technology. He is a proficient Braille reader who has been using a Braille writer for writing. He has also learned touch typing, allowing him to produce some of his schoolwork in print. Because he has no vision he uses a screen reading program to give access to the computer system. He is only beginning to master his computer skills, so he relies mostly on the lower tech devices, including an abacus for math.

Britney, 14 years old, low vision

Although, Britney has only some residual vision in one eye, she is a visual learner. She tends to access learning material visually with a minimal addition of touch. She uses three different learning media, with print being the primary. Britney is an avid reader both in print and braille. Large print has been determined to be impractical due to its physical dimensions. She is a proficient user of a portable electronic magnifier for shorter readings. She uses this device to access her print textbooks and worksheets. This method is not for longer readings due to eye fatigue. Braille appears to be a logical solution here. What is difficult for her is handling large braille books. An electronic note-taker or laptop with braille display would solve most of the issues in her case.

Marquee, 15 years old, low vision, Asperger Syndrome

Marquee is a high school student with retinopathy of prematurity. He has some residual vision in one eye only. He has been learning Braille for many years, but has not been able to master it, thus it is not a viable learning medium at this time. He likes using CCTV, especially for short reading or writing. He has excellent computer and auditory skills. So although he can access written material visually, audio versions work best for him. His comprehension soars when he listens to his learning material. Because his handwriting is rather poor he uses computer for longer papers. Marquee also occasionally records his answers as he finds written composition difficult.

Amelia, 11 years old, cortical (cerebral) visual impairment

Amelia's condition affects the brain's ability to interpret visual information. Although she can see print, she is not able to identify the characters. She uses Braille as her primary learning medium. She can distinguish some details in pictorial information, so simple graphical presentations are functional for her. She has been learning to use a screen reader to access text information on the computer. She enjoys using the mouse to start programs from the desktop. Her enjoyment of the mouse led to the use of software that reads information under the mouse pointer, providing her with auditory support.

Bruno, 6 years old, low vision

As a young child, Bruno is only beginning to familiarize himself with various pieces of technology. His condition allows him to access slightly enlarged material on his desk. However, he needs support for classroom presentation. To access whiteboard and posters on the walls, he uses a CCTV system with a camera that can be tilted and swiveled to

point at distant objects. Additionally, this camera also sends the signal to a TV set showing the teacher what the student sees on his monitor. Thanks to this system the teacher can position the material she holds in her hands appropriately. Bruno also uses the CCTV to explore details in pictorial information.

Built-in accessibilities in Mac, Windows, and Linux computers

Universal Design for Learning (UDL) recommends that products should be designed for diverse users, meaning accessibility features should be implemented at the onset of development. Computer operating systems are not entirely accessible for some users with visual impairments who need to install specialized third party software to operate their computers. However, both Mac and Windows platforms offer a variety of accessibility features that allow users with visual impairments to customize the screens and to access them.

Both manufacturers of the above mentioned operating systems inform their clients about accessibility features on their respective Websites:

Windows (98, 2000, ME, XP, Vista)

<http://www.microsoft.com/enable/guides/vision.aspx>

Mac (OS X Leopard)

<http://www.apple.com/accessibility/macosx/vision.html>

Windows has a very comprehensive set of online tutorials broken down by the version of the operating system. Even users who may still be working on Windows 95 computers will find extensive information about available accessibility features. Users who are blind or visually disabled and those with low vision will be directed to the respective sections to learn what the best possible alterations are there to enhance access to the operating system.

Apple's Website also has a section on universal access for users with visual impairments. The Mac users will find an overview of accessibility features specific for persons with visual impairments. Those users that need speech output can expand their knowledge of screen reading feature following the VoiceOver link.

This section would not be complete without mentioning the Linux operating system. Although it is the least popular of the three, there may be users with visual impairments who work with this system. Currently Linux does not have many built-in accessibility options. Users who have vision disabilities and use this system should find Orca screen reader included in the most recent Solaris and Linux releases. A number of free special software available for download from different providers can be found online. The Linux Documentation Project <http://tldp.org/HOWTO/Accessibility-HOWTO/visual.html> page discusses options for people with vision concerns.

The following table compares accessibility features available in Mac OS X and Windows XP and Vista. Notice that both systems have made progress in adding accessibility features to help people with visual impairments.

Area	Windows Operating System	Mac Operating System
<u>Vision</u>	Magnifier Zoom Option in IE 7.0 and up Text size in IE, Firefox High contrast Cursor width and blink rate Cursor size and color Pointer Speed and Acceleration SnapTo Visibility-Pointer trails Hide the pointer while typing Show location of pointer Scroll bar width Narrator Desktop Icons size X Keyboard shortcuts Sound Notification when turning an accessibility features on or off X Audio Descriptions Vista (when available)	Zoom X Text size in Safari, Firefox High contrast X Cursor size X X X X X X VoiceOver X Dock icons size Keyboard shortcuts X CoverFlow OS Leopard (folder magnification) Audio Description (QuickTime)

X – indicates that the features is not available

Free Resources

Built-in accessibilities can be a great start in assessing a student's need to access computer systems. However, some of the features present in the operating systems may turn out not to be sufficient. Users of the Windows system may find open sources solutions that will satisfy their needs. Although the majority of free solutions are not as robust as the commercial products (the quality and features may not be comparable to commercial versions), it may be worth trying them out before spending money. Nonetheless, users will have an opportunity to explore the most significant options required to operate a computer system. These experiences will make it easier for the user to understand what skills they may need to use an enlarged screen or a keyboard controlled system environment.

When working with a student who is blind audio or tactile output of information is needed. If a student with low vision is having difficulties operating a computer, it is necessary to assess which mode will work best for them. Magnification may appear to be the best solution, but the student may find it difficult to navigate and control the enlarged screen area. The screen reading option may occur to be more functional even though the student may have sufficient vision to access the system visually. The students depicted in

the Profiles section show that individual solutions need to be prescribed to accommodate their educational needs.

There are a number of online resources that offer open source solutions for users who are blind or have low vision with access software free to download and free to use. Some need verification that the user is visually impaired, while others have no restrictions. The examples below present different types of access software ranging in the number of features and functionalities. It is advised that service providers get familiar with them prior to proposing them to their students.

Magnification:

- Desktop Zoom – A free screen-magnifying program with full screen or magnifying glass options.
- Virtual Magnifying Glass 3.3.1 - A free open source screen magnifier for Windows, Linux, FreeBSD and Mac OS X.
- iZoom Web by Issist – A web-based magnifier. The computer has to be connected to the Internet to run this program.

Screen Reader:

- NVDA – A free screen reading program that can be either installed on the hard drive or on a USB pen drive to go.
- Thunder by Sensory Software – Another free screen reader.
- System Access – a free version is available for K-12 students upon verification.
- SAtoGo – a Web-based version of System Access free to use by anyone whose computer is connected to the Internet.

Internet Access:

- LowBrowse by Lighthouse - A new way for those with low vision to access web documents, embodied in a Firefox extension (Windows, Mac, Linux).
- pwWebSpeak – a free version of a talking Internet browser.
- WebAnywhere – a Web-based browser that does not require any installation.

A more extensive chart with both commercial and free open source screen reading software for various platforms is available at

http://en.wikipedia.org/wiki/List_of_screen_readers.

Products for Low Vision and Blindness

The table below is a comprehensive list of products for people who are blind or have low vision. By no means is this list complete. More detailed information of the products can be found on the companies' websites. The manufacturers' sites will also have the most updated inventory of their products. Many offer free 30 day trials of their software. American Foundation for the Blind is another informative resource; they offer a huge searchable database of products. You can browse by category, manufacturer, or task. On the Home page – www.afb.org - click Product Search and then method by which you want to locate desired products.

	Type	Product	Company
Low Vision	Magnifying software	ZoomText	AiSquared
		BigShot	AiSquared
		Dual with Solo	Claro
		Lunar	Dolphin
		SuperNova	Dolphin
		MAGic	FreedomScientific
		iZoom 1.2, iZoom2Go	Issist
		VisioVoice (Mac)	Origin Instruments
		Lighting	Sensory Software
		Product	Company
	Magnifying hardware	QuickLook	Ash Technologies
		Fusion	Ash Technologies
		Liberty	Ash Technologies
		OPTi Verso (distance)	Ash Technologies
		Prisma	Ash Technologies
		Optic magnifiers	Bausch & Lomb; Eschenbach
		Clarity Series (distance), i-vu	Clarity
		Acrobat, Amigo, Flipper, Jordy, Max	Enhanced Vision Systems
		Topaz	FreedomScientific
		Opal	FreedomScientific
		SenseView	GWMicro
		MyReader	HumanWare
		SmartView	HumanWare
		MagniLinkS OCR (distance, scanning)	LVI
		Compact	Optelec
		ClearView	Optelec
		Traveller	Optelec
		ClearNote (distance)	Optelec
		Optron, I-stick (distance)	Optron
		MonoMouse, ColorMouse	Sensory Software
		Shoppa, BigReader	Sensory Software
		View series (distance)	Vision Technology

	Type	Product	Company
Blindness	Braille writers/PDAs	PacMate, Type Lite	FreedomScientific
		Braille Lite, Braille'n'Speak	FreedomScientific
		BrailleSense	GW Micro
		Small-Talk	GW Micro
		Braillino	Handy Tech
		BrailleNote	HumanWare
		VoiceNote	HumanWare
		Maestro	HumanWare
		EasyLink	Optelec
		Mountbattern Brailier	Quantum Technology
		TatraPoint	Bronislav Mamojka
		Perkins Brailier	Howe Press (Perkins)
	Screen Readers	Product	Company
		Hall	Dolphin
		Jaws	FreedomScientific
		Window-Eyes	GW Micro
		Thunder-RJ	RJ Cooper
		Lifestyle, the System Access Mobile Network	Serotek
	Refreshable Braille Displays	Product	Company
		Vario	BAUM
		Focus	FreedomScientific
		Braille Star	Handy Tech
		Handitech	Handy Tech
		Braille Wave	Handy Tech
		Brailliant	HumanWare
		Alva	Optelec
		Delphi	Optelec
		Voyager	Optelec
		Elba	Papenmeier
		BRILLEX	Papenmeier
	Braille printers (embossers)	Product	Company
		Braille BookMaker, Marathon	Enabling Technologies
		Braille Express	Enabling Technologies
		BraillePlace	Enabling Technologies
		Juliet, ET, Romeo	Enabling Technologies
		Triple Impressions	Enabling Technologies
		Braille Blazer	FreedomScientific
		Basic S/D, 4x4 Pro, Everest	Index Braille

Blindness		Product	Company
		Gemini embosser (Braille+print)	Nippon Telesoft
		Versa Point	TeleSensory Corporation
		Emprint (Braille+print), ViewPlus Pro, Cub, Max	ViewPlus
	Audio tactile	Product	Company
		InteliKeys	Cambium Learning Technologies
		Talking Tactile Tablet	Touch Graphics
		IVEO	ViewPlus
	Electronic text readers	Product	Company
		BookPort (discontinued)	APH
		ScannaR	Baum Retec
		Milestone 311/312	Bones
		Cybook	Bookeen
		Cicero	Dolphin
		Sara	FreedomScientific
		MobilEyes	Guerilla Technologies
		Bookworm	HandyTech
		Victor Reader, Vibe, ClassicX, Stream	HumanWare
		K-NFB Reader	Kurzweil – NFB
		Plectalk Series	Plector
		BookCourier	Springer Design
	Reading/scanning software	Product	Company
		EasyReader	Dolphin
		EasyProducer	Dolphin
		OpenBook	FreedomScientific
		FSReader	FreedomScientific
		Kurzweil 1000	Kurzweil Educational Systems
		TextAloud	NextUp
		Text-to-Audio, ScanPro	Premier Assistive Technology
		INFORM	Sensory Software
	GPS	Product	Company
		StreetTalk	FreedomScientific
		Trekker / Breeze GPS	HumanWare
		BrailleNote GPS	HumanWare
		Mukana	Slashphone
		Wayfinder Access	Wayfinder

	Type	Product	Company
	Text-to-Braille translation software	Braille Maker	Cragside AccessABILITY Ltd
		Braille Music Translator suite	Dancing Dots
		Duxbury, Perky Duck	DuxburySystems
		MegaDots	DuxburySystems
		WinBraille	Index Braille
		iBraille for Mac	Index Braille
		OpusDots Lite	Opus Technologies
		Monty	Quantum Technology
		Braille Master	Robotron
		KWIKBRL	Sensory Software
CVI	Type	Product	Company
	Port. Writers	Alphasmart, Neo	Alphasmart
		Fusion, Writer	Advanced Keyboard Technologies, Inc.
		Product	Company
	E-text reader	ClassMate Reader	HumanWare

Solution Selection Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the educational tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, those that can be done in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

After tools have been selected and prioritized, identify any trials or services that are needed including: procurement of trial materials; team member(s) responsibilities; start date and length of trial; training needed; and any other student/staff specific issues. Be certain to identify learning objectives and criteria of performance to determine the effectiveness of the trials.

Assessment

As the team completes the SETT process, questions may arise about the student's ability to perform certain educational tasks. Various informal assessments (see Assessments section) or teacher observations may answer those questions, however, adapted, specialized or alternative assessments may be needed.

Testimonials

- <http://www.freedomscientific.com/profiles/garrison/kolby-garrison.asp>
- <http://www.freedomscientific.com/profiles/folloa/alex-follo.asp>
- http://www.humanware.com/en-usa/products/user_stories/Braillenote_user_stories
- http://www.humanware.com/en-canada/products/user_stories/trekker_user_stories
- <http://www.dolphinuk.co.uk/dolphin.asp?id=23>
- http://www.mountbattenBrailier.com/mb_stories/parents_kids.htm

Useful resources

- www.aph.org/webfeat/index.html - Web accessibility
- www.aph.org – Catalogs with a large collection of assistive technology for different areas
- http://www.nfb.org/nfb/Products_and_Technology.asp?SnID=1380394662 – NFB Products and Technology
- <http://www.afb.org/aw/main.asp> - AccessWorld is an assistive technology journal with up-to-date articles related to technological breakthroughs in the area of visual impairments.
- http://www.rnib.co.uk/xpedio/groups/public/documents/code/public_rnib001974.hcsp - RNIB Technology
- <http://www.disabilityworld.org/June-July2000/access/Science.html> - Making Science Accessible to Blind Students
- www.wcbvi.k12.wi.us – Wisconsin Center for the Blind and Visually Impaired
- www.badgerassoc.org - Badger Association Of The Blind And Visually Impaired
- www.able.org – Services that prepare text in alternative formats like Braille or audio
- For information on supports for Deaf/Blind severe disabilities, see Chapter 14 – Assistive Technology for Students with Multiple Challenges

Formats

There are many different formats in which data is saved and stored. Some, like TXT or ASCII are open, meaning many programs are able to recognize it. There are also some that are proprietary meaning that only specific software can handle them, e.g. KESI, WYNN, etc.

- Open vs. Proprietary formats <http://www.openformats.org/en1>
- DAISY <http://www.bookshare.org/web/SupportDaisy.html>
- BRF <http://www.bookshare.org/web/AboutFormats.html>
- PDF <http://winplanet.webopedia.com/TERM/P/PDF.html>
- TXT http://en.wikipedia.org/wiki/Text_file
- ASCII <http://www.webopedia.com/TERM/A/ASCII.html>
- RTF http://en.wikipedia.org/wiki/Rich_Text_Format

Chapter 13 – Assistive Technology for Students who are Deaf or Hard of Hearing

Introduction	1
Decision Making Guide	3
SETT Process	4
Continuum of Considerations	7
Chart with Examples for the Continuum	8
Continuum Expanded	9
References and Resources	17

ASSISTIVE TECHNOLOGY FOR INDIVIDUALS WHO ARE DEAF OR HARD OF HEARING

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Individuals who are deaf or hard of hearing utilize a variety of assistive technologies that provide them with improved accessibility in numerous environments. Most devices either provide amplified sound or alternate ways to access information through vision and/or vibration. These technologies can be grouped into three general categories: hearing technology; alerting devices; and communication supports. Within each main category there may be subcategories based on different purposes or intended audiences when utilizing the technology. The overall goal of all of these devices is improved accessibility to information most people gain through their hearing. The following descriptions related to these tools are intended to provide the reader with a better understanding of their purpose and when and how they might be utilized. Depending on their needs in specific situations, deaf and hard of hearing individuals may require assistive technologies. At times these assistive technologies may be used simultaneously. Many devices developed for use by deaf or hard of hearing individuals may also be beneficial to others without hearing loss; however, this information would be beyond the scope of this chapter. The information provided is considered to be comprehensive for the purpose of assisting the reader with a general understanding of assistive technology typically utilized by deaf or hard of hearing individuals. Every device, manufacturer and resource, however, cannot be realistically listed, due to ever changing technology and websites.

The description of a person's hearing loss is often based on their level of hearing at different frequencies as measured by an audiologist. Hearing loss levels are often broadly described as mild, moderate, severe and profound. Generalizations based on these single word descriptors often do not accurately predict an individual's skills across a variety of tasks such as speech, language, listening, communication mode, etc. The terminology "deaf" and "hard of hearing" used to describe individuals with hearing loss is based on a medical model and definition of hearing loss levels. How an individual views him/herself, however, can depend on self-identity and cultural values related to or separate from the status of their hearing. For example, a person who has a level of hearing that may be medically described as hard of hearing (a person diagnosed with a "moderate" or "severe" hearing loss) may actually identify him/herself as Deaf based on their preferred communication mode, cultural values, and self-identity. Regardless of definition, many deaf and hard of hearing people do not support the use of negative descriptors such as hearing loss, impairment, or disability. A basic description that attempts to address both medical and cultural perspectives of the differences between deaf and hard of hearing will be provided. It is not the purpose of this chapter to define these various points of view in-depth, but rather to describe assistive technology that supports deaf and hard of hearing individuals across a variety of environments. The WI Department of Public Instruction provides a general description of the differences between deaf and hard of hearing within their publication "Students who are Deaf or Hard of Hearing: Eligibility Criteria Guidelines (2003)" as follows:

Deaf: In the adult community, the term Deaf does not connote nor describe the degree of hearing impairment but rather an affiliation with the community of people who are deaf and use American Sign Language (ASL) to communicate. Deaf students may demonstrate the ability to speak or speech-read well in certain situations.

Deafness: This term indicates a hearing loss so severe that processing of linguistic information through hearing alone, with or without hearing aids, is severely limited. Students with cochlear implants are considered physically deaf even though they may function as hard of hearing. Deafness is not solely dependent on ability to speak or need to use sign language.

Hard of Hearing: This term describes a degree of hearing loss that allows the student to process acoustic information necessary for auditory-verbal communication, with the assistance of hearing aids or assistive listening devices (ALD) when needed. Yet the amount of hearing loss is not an accurate predictor of how one functions auditorally. The audiologic evaluation does not reliably predict the student's ability to hear with comprehension. Some hard of hearing students function very well with hearing aids and ALDs while some may require sign language to understand classroom instruction or conversation, especially in noisy situations.

WATI Assistive Technology Decision Making Guide

Area of Concern: Hearing

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to accessing auditory information? • Benefit of assistive listening devices/personal amplification • Teacher/peers/announcements • Access to alarms/warnings • Telephone • Programs/Movies/DVDs • Person to Person • Group Activities • Note-taking	What environmental considerations impact the area of concern? • Noise • Room Acoustics • Distance • Visual Access • Lighting • Available Technology	What task(s) do you want the student to do? The premise is always to access the same information as hearing students in all environments. Break it into measurable tasks: • Complete and deliver report in social studies. • Identify key points in story (plot, characters) • Organize daily assignments
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts this area of concern? (i.e., visual, auditory, tactile)		i.e. Identify specific task(s) for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming only No decisions yet Review the area continuum	Use a feature match process to discuss and select ideas(s) from Solution Generation	AT Trials/Services Needed: Date Length Person responsible Formulate objectives/criteria to determine success of trial/AT
		Follow-Up Plan
		Who & When Set specific date/s now

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student Abilities and Difficulties

Each deaf or hard of hearing student performs differently in regards to how they utilize their residual hearing, are affected by different environments, and benefit from technology. As a team, discuss the student's abilities and difficulties related to accessing different types of information across different environments, tasks and situations. Some questions to consider may include:

- How does the student utilize their residual hearing?
- What type/s of hearing technology is the student using or has been used in the past?
- Do they use sign language and/or an interpreter?
- Can they access what the teacher says at the front of the room, while the teacher walks around, or with their back turned to the class while writing on the board?
- Can they access what their peers say during class discussions or group activities or while in challenging environments?
- Do they have access to fire/tornado alarms? Announcements?
- Do they have a way to contact home in an emergency? Community supports?
- Are movies/videos shown in class? Do the student, family and staff know how to access captioning?
- How do they communicate with others – family, peers, and community?
- Is the student able to take notes and watch the teacher/interpreter effectively?
- How do they access information during group activities – lectures, programs, or events?

Environmental Considerations

Happenings in the environment can have a significant impact on a deaf or hard of hearing student's ability to access information. One of the greatest challenges can be that extraneous factors are constantly changing from moment to moment, and from classroom to classroom; and most often are beyond the control of the student. A few areas to consider include:

Noise

What is the level of background noise from students, equipment like computers and overheads, and heating/cooling systems? Are there extraneous noises from neighboring classrooms, streets, playgrounds or hallways? Noise is present in every classroom to some extent and varies constantly. Background noise affects everyone's ability to hear and understand what is said. Noise has even greater impact on deaf and hard of hearing students because it tends to mask or cover over speech.

Room acoustics

What do the physical spaces the student spends time in look like? Surfaces (walls, windows, tile) and objects within every room interact to produce reverberation in response to sound. Reverberation refers to how much sound echoes in a given space and causes sound to become smeared or unclear. Every room has some amount of reverberation, but gymnasiums, cafeterias, auditoriums and music rooms tend to be more challenging listening environments. Smaller spaces and sound absorbing surfaces like carpet and acoustic ceiling tiles tend to have lower reverberations effects.

Distance

How far is the student seated from the teacher, interpreter, other students or alternate sound sources like televisions and announcements? Often deaf or hard of hearing students are seated in the front seat of a classroom, typically known as preferential seating. However, most teachers move about their classrooms while lecturing, so that the distance between them and the students varies. The farther a student is from the speaker or sound source, the softer the sound they receive. Sometimes, deaf or hard of hearing students can access spoken messages when they are close to the speaker, but they may not be able to do the same for peers located across the room.

Visual access

How well can the student see everything that is happening in different locations? Are there visual alarms? How is the student provided with access to announcements? Deaf or hard of hearing students often rely on their vision to provide information they may not have access to through their hearing. As previously mentioned, preferential seating typically involves the student sitting in the first seat. In reality, moving a student to a second or third seat provides them with more visual access to happenings within the class. They can see what some of the other students are doing without having to turn around. Arranging seats in a “U” shape or circle provides the greatest visual access. If a student relies on lip reading, they often need to physically turn in their seat to determine who is speaking and see what is being said. When a teacher turns to write on the board and continues to lecture, the deaf or hard of hearing student cannot continue to visually access what is being said. The same applies for note taking; every time a student looks to their paper, they lose visual contact with the speaker or interpreter. For many deaf or hard of hearing students, visual alarms are necessary for them to know when there is a fire or tornado drill. In addition, public address systems may have reduced sound quality that makes it difficult for deaf or hard of hearing students to access daily school updates. A written copy of announcements insures that deaf or hard of hearing students receive the same information as their peers.

Lighting

What type of lighting is available? Fluorescent lights are present in most school environments. These lights often emit additional background noise. Inadequate lighting or large banks of windows can be challenging for deaf or hard of hearing students because they cannot see the speakers face well or an interpreter may be located in shadows. Arranging seating accordingly can help minimize these effects.

Available Technology

Many schools have implemented technology that improves access for all students. Technology such as computers, televised announcements, sound field amplification systems, and interactive white boards can have positive impacts for all students, but especially those that are deaf or hard of hearing.

Sensory Considerations

In addition to being deaf or hard of hearing, these students may have the same kinds of sensory challenges that other students face. Any additional challenges need to be addressed accordingly, but are beyond the scope of this chapter. See Chapter 14 - Assistive Technology for Students with Multiple Challenges for information on students who may be deaf blind and have cognitive disabilities.

Tasks

The goal of this chapter is to increase awareness of the challenges faced by deaf or hard of hearing students to access information to the same extent as other students. Each team needs to be knowledgeable about how a given student uses their residual hearing, vision and other senses to access information in different environments. Be specific when outlining the tasks that need to be supported. Rather than stating “participate in class”, state “give class presentation” or “participate in small group discussions.”

Narrowing the Focus

As mentioned in other chapters and based on the Assistive Technology Decision Making Guide, the team should generate a list of tasks or activities and the associated challenges with accessing information. This will allow the team to identify the greatest challenges and prioritize what can be done to support the student. The goal is to provide the deaf or hard of hearing student access to all of the information others access through their hearing, and a way to demonstrate their understanding.

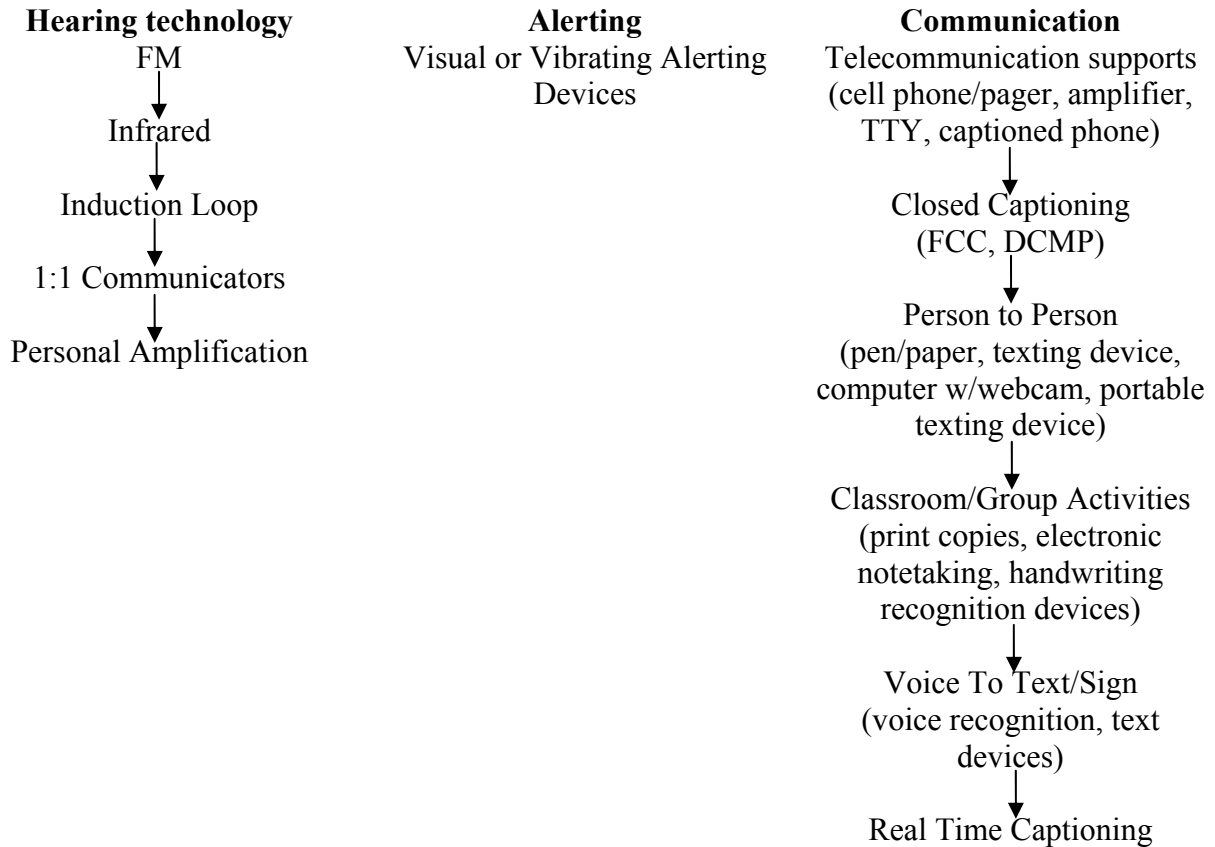
Solution Generation-Tools and Strategies

Often there are multiple solutions and outlining them through brainstorming and using a feature match process can help determine which have the greatest impact across the most environments. Readers are reminded that each deaf or hard of hearing student will access information differently and what works for one may not necessarily work equally as well for another. Assistive technology for deaf or hard of hearing students often has profound impact on their ability to access information and be part of a community, both for school and home. Some devices are more appropriate for school environments while others are more home and community based. This chapter has attempted to introduce the reader to general categories of devices as well as a few specific tools. It is important for the team to remember that accessibility needs are highly variable and may require different technologies over time, within different environments and even among students. Support from a teacher of the deaf and hard of hearing and/or educational audiologist will help the team identify strengths and challenges for each individual student.

Classifications Of Technology

Assistive technology for the deaf or hard of hearing can be grouped into three general categories: Hearing technology; alerting devices; and communication supports. Within each category, there are numerous manufacturers and a multitude of models that are updated and improved frequently. Due to the large number of devices and ever changing technology, general explanations of each type will be given and the reader will be directed to the Resource section to obtain a sampling of manufacturer websites for additional information or to resource locations that provide demonstrations or lending of multiple products. Related to deaf and hard of hearing technology, it is often difficult to maintain a hierarchy of “low to high” technology. Most often, the decision for one type over another is based on particular needs related to specific features and may vary over time or for different environments or situations. To the extent possible, technologies will be explained in a “low to high” order.

A Continuum of Considerations for Assistive Technology for Individuals who are Deaf or Hard of Hearing



A Chart with Examples For the Continuum Of Considerations For Assistive Technology For Individuals Who Are Deaf Or Hard Of Hearing

Hearing Technology	Alerting Devices	Communication Supports
Assistive Listening Device: • FM • Infrared • Induction Loop • 1:1 Communicators	• Baby Monitor • Clock / Watch • Computer • Door Bell / Knock • Fire / Carbon Monoxide Detector • Telephone / Cell Phone • Weather	Telecommunication: • Cell Phone / Pager / Text Device • Amplified Phone / Amplifier • TTY/TDD • Captioned Telephone • Telecommunication Relay Service • Computer/ Web Camera • Internet Protocol Relay • Video Phone • Video Relay Service Closed Captioning: • FCC • DCMP
Personal Amplification: • Hearing Aid		Person to Person: • Pen / Paper • Cell Phone / Pager / Text Device • Computer / Web Camera • Commercial Devices - o UbiDuo
		Group Activities: Note taking: • Copies • Computer-assisted note taking • Handwriting recognition Devices: - o Digital Pen - o White Board Voice to Text/Sign: • Caption Mic • Dragon Naturally Speaking • iCommunicator • Video Remote Interpreter Real Time Captioning: • CART • CPrint • Remote Captioning

Hearing Technology

Hearing Technology can broadly be defined as any device utilized for improving the level of sound available to a listener. Hearing technology can further be divided into two general subcategories of assistive listening devices (ALD) or personal amplification. Assistive listening devices can be utilized by individuals or large groups of people and can typically be accessed without the support of specific personnel. Personal amplification is chosen specific to the needs of an individual based on their level of hearing and requires the support of an audiologist to determine candidacy for different devices and appropriately fit and adjust the chosen device.

Assistive Listening Devices

These devices typically are used to improve the signal-to-noise ratio in any given situation. In addition to increased volume, ALDs provide the listener with a direct connection to the sound source and help minimize the effects of background noise, distance and room acoustics. There are both individual ALDs and public or large group ALDs. All ALDs utilize a transmitter that sends a person's voice or other sound source to a receiver that distributes the sound evenly throughout a room such as in theaters and churches or directly to an individual. Sound is transmitted in four primary ways: Frequency Modulation (FM); Infrared (light); Induction Loop (electromagnetic); or through a direct connection. Some hearing aids have a special connection option called Direct Audio Input (DAI) that allows the user to connect directly to an FM system or Induction Loop receiver. In many instances, one can even connect directly to other devices such as a computer, TV, MP3, iPod, or radio.

FM: With FM or Frequency Modulation systems, the sound is transmitted on a specific frequency or channel similar to a radio. The Federal Communications Commission (FCC) has designated specific frequencies for these types of systems. FM systems can be used for whole rooms or by individuals. Large areas can be set up with single or multiple speakers depending on the size of the room. These systems can be permanently installed in a given location or there are also several versions that are portable. Individual systems typically have a receiver that looks like a Walkman or MP3 player and uses different styles of earphones or headsets and may be useful for 1:1 communication, car rides, and watching TV. With miniaturization, there are now small receivers that can be connected directly to a person's hearing aids through Direct Audio Input (DAI). Any time an FM system is coupled to a hearing aid, special settings and connections are required from an audiologist. Sometimes when several FM based systems are used in the same building, there can be problems with cross over between rooms and channels.

Infrared: These systems utilize light waves to transmit sound from the transmitter to a special light sensitive receiver. The signal can be broadcast to a whole room through speakers or a person can wear an individual receiver. There must be a clear line of connection between the transmitter and receiver so that the light signal is not interrupted. The benefit of infrared systems is that they only work in the room where the transmitter and receiver are located resulting in significantly fewer issues with cross-over. These systems can be sensitive to external light sources or interfering objects.

Induction Loop: Induction loop systems utilize electromagnetic energy to transmit the signal. These systems can cover a small area with a loop placed under a rug or may be

permanently installed within the walls or ceiling of larger areas like theaters, auditoriums or churches. For individuals to access this type of technology, they must have a Telecoil (t-coil) within their hearing aids.

One-to-one communicators: These types of systems tend to require that the listener and sound source are close together because the transmitter and receiver are connected by a wire or cord that transmits the sound. The person using the system can adjust the volume as needed to hear conversation from another person, listen to TV, or while riding in the car.

Personal Amplification

These devices are designed to provide an individual with increased access to sound across all environments. They are chosen based on an individual's preferences, degree and configuration of hearing loss, and special features. Devices in this category must be obtained and fitted through an audiologist. Although many sources do not consider personal amplification as assistive technology, assistive listening devices and other auditory-based devices (MP3, TV, computer) may be connected through these systems, so they will be explained briefly. Also, some funding sources provide resources for personal amplification under the category of assistive technology.

Hearing Aid: There are numerous manufacturers of hearing aids, but all have the same basic components and purpose of amplifying sound. Styles of hearing aids include behind-the-ear (BTE); in-the-ear (ITE); and in-the-canal (ITC). They vary based primarily on size and features. In the past, most hearing aids had analog circuits that processed sound in a linear fashion so that what came in was made louder in equal amounts. Today with improvements in technology, most hearing aids are digital and programmable which allows them to be set very specifically based on each individual's hearing level at different frequencies. Many have special processing capabilities that help improve speech recognition, noise reduction, and overall performance. Many hearing aids include a telecoil (t-coil) or telephone switch that allows the user to access the electromagnetic energy in telephones as well as many publicly available assistive listening devices (ALDs). There is also the option of having a hearing aid integrated with an FM system that does not require direct audio input (DAI) or connection to other devices.

The following two devices are not assistive technology as defined by law (IDEA I.). School personnel may need to understand them in order to appropriately use compatible assistive listening devices.

Cochlear Implant: A cochlear implant (CI) is a surgically-implanted device that converts sound energy into electrical stimuli that can be processed by the auditory nerve. There are specific criteria that must be met in order for a person to be a CI candidate. There are three CI manufacturers: Advanced Bionics; Cochlear Americas; and Med-El. Readers are referred to their websites within the Resources section for additional information. Most offer multiple options including body worn and ear level processors. Most have the ability to connect to assistive listening devices (ALDs) and other external devices.

BAHA™ – Bone Anchored Hearing Aid: The BAHA is another surgically implanted device available through Cochlear Americas that is most often utilized in cases of severe conductive hearing loss related to anatomical malformations, chronic middle ear problems or Single Sided Deafness™. There is a soft headband option that can be utilized until surgery can be completed at approximately five years of age. This device is also compatible with ALDs.

Alerting Devices

Alerting devices typically provide an amplified and/or visual signal or vibration used to get the attention of the deaf or hard of hearing individual. They can be used for public emergency alerts like fire alarms and tornados or for every day situations like the telephone ringing or a baby crying. Many offer both household and travel sized versions. For alerting devices, there are numerous clearinghouses for purchasing devices as well as lending libraries or demonstration centers. The reader is referred to the Resource section for additional information. Devices that can be utilized with alerting technology include the following:

- Baby Monitor
- Clock / Watch
- Computer
- Door Bell / Knock
- Fire / Carbon Monoxide Detector
- Telephone / Cell Phone
- Weather

Communication Supports

Within Communication, assistive technology devices have been divided into three subcategories: telecommunication services; person-to-person interactions; and group activities. As before, general explanations will be given with additional contact information provided within the Resources section.

Telecommunication:

Cell Phone / Pager / Text Device: Many commercially available devices can be used by deaf and hard of hearing consumers without modifications. Cell phones may list that they are hearing aid compatible, supporting the use of telecoil/telephone switches to utilize the electromagnetic energy within the phone itself. In addition, any pager or cell phone that has text capabilities can now be used for sending text messages, instant messages, or email.

Amplified Phone / Phone Amplifier: A phone may have a built in amplifier or may be connected to an external amplifier. Regardless if the amplification is internal or external, it allows the user to increase the overall volume to their comfort level. This feature is available to some extent in regular phones and cell phones, but there are also specialized

phones or external attachments designed specifically for hard of hearing users that provide even greater output levels.

TDD/TTY: Telecommunication Device for the Deaf (TDD), previously known as teletype machine (TTY), allows the user to place phone calls using text through a regular phone line. Each TDD has a keyboard with a text screen. A user either needs to connect with another person that has a TDD or use a relay service that can convert the text into voice for the hearing listener receiving the call. Models range from basic to high-end with additional options such as printers, answering machines, and memory to save text or messages. With improvements in technology for phones, pagers, text devices and computer services, the use of the TDD is declining.

Captioned / Text Telephones: Similar to the specialized amplified phones or TDD, captioned telephones allow the user to see text of their telephone conversation as well as access relay services.

Telecommunications / Telephone Relay Service: When placing a call to another party without a TDD, the deaf or hard of hearing consumer dials into the relay service and provides the phone number they wish to call. The relay operator dials the number and explains the relay service and how to use it. Once the two parties are connected, the operator will voice all of the text messages for the hearing person and convert all of their verbal replies into text for the deaf or hard of hearing caller. This process also works in reverse when a hearing person wants to contact a deaf or hard of hearing person.

Telecommunications / Telephone Relay with Voice Carry Over (VCO): Another component of using the relay service is for deaf or hard of hearing callers who can voice for themselves, but cannot hear on the phone. They can utilize the relay service to have what is said by the hearing person they called typed for them to read and they can speak for themselves.

Computer / Web Camera: Many individuals utilize the combination of a web camera and computer Internet service to be able to visually connect with others. This readily available technology has been used increasingly by deaf and hard of hearing individuals to expand their communication options. This set-up can be utilized to access an IP relay service using sign language instead of text.

Internet Protocol Relay (IP): The increasing use of computers has resulted in additional telecommunication services for deaf or hard of hearing individuals. Callers can now use their computers to place phone calls through a relay service rather than their phone and TDD. The concept is the same; the deaf or hard of hearing person uses their computer to connect with an IP relay service. The operator places the call, identifies themselves and the relay service, and facilitates the exchange of information through text and voicing.

Video Phone: One of the newest telecommunication devices available for deaf or hard of hearing callers that communicate through sign language is a video phone. A small

camera and TV display is needed as well as high speed internet service. The deaf or hard of hearing person is able to sign for themselves in direct communication with other video phone users.

Video Relay Service: In the same fashion as telephone relay, video relay service can be accessed to allow the sign language user to call other hearing people with the assistance of an operator. As with other relay services, the operator identifies themselves and the relay call process. They then proceed to voice interpret the signed message from the caller. They are also able to convert the voice message into sign language for the deaf or hard of hearing person.

Closed Captioning:

FCC: The Federal Communication Commission (FCC) has developed regulations related to the provision of closed captioning within public programming. Closed captioning allows for a text display of the spoken dialogue contained within television programs and movies. As of 1993 all televisions with screens larger than 13 inches must have built in captioning. In 2002, the FCC expanded the rule to include all digital television receivers. There are also closed captioning decoders that can access captioning when not available within a television or projection system. Closed captioning encoders allow for captions to be added to live broadcasts or existing materials. In addition, many commercially available movies include captioning within their language or subtitle set-up features. For additional information regarding closed captioning, the reader is referred to the FCC website listed in the Resources section.

DCMP: The Described and Captioned Media Program is a FREE LOAN service that has thousands of educational titles to ‘stream’ and view on a computer immediately or DVD’s for order that can be sent to home or school.

Person to Person: Options available for a deaf or hard of hearing person to communicate directly with a hearing person have exploded with the increased use of cell phones with text capabilities, computers with internet service and overall public awareness.

Pen / Paper: The most basic communication tool that can be used between a deaf or hard of hearing person is a pen and paper. Writing notes back and forth can be time consuming, yet effective.

Cell Phone / Pager / Text Device: Numerous texting options are now available through computers, pagers or cell phones for sending text messages, instant messages and email.

Computer / Web Camera: Web cameras combined with high speed internet service have also become more widely used to help deaf or hard of hearing individuals communicate with others.

Commercial Devices: Several devices have been developed to allow deaf or hard of hearing individuals to communicate directly with hearing people by allowing individuals the means to exchange type written messages that can be considerably faster than writing.

Example:

UbiDuo Face to Face Communicator™: This device consists of two portable battery operated keyboards with displays that have a wireless connection that allow the deaf or hard of hearing person to communicate with a hearing person instantly through type written messages.

Group Activities: Communicating and accessing information within group environments such as lectures, discussions, programs and community events can be especially challenging for deaf or hard of hearing individuals. There are several types of assistive technology that can assist in providing the information through a visual means such as text or sign language. Because there are fewer options and manufacturers for this type of technology, specific examples will be provided within the text as well as websites within the Resources section.

Note taking: Often times, deaf or hard of hearing individuals find it difficult to watch the speaker or interpreter and take notes at the same time. Each time they look to their paper, they miss the information that continues to be presented. There are several options for assisting with note taking.

Copies – teacher / participant notes: Copies of the teacher's or another participant's notes can be provided. Duplication paper can still be obtained or most facilities now have copy machines available.

Electronic note taking: An individual can be trained and/or paid to take notes using a computer or portable word processor to provide a written summary of lectures, meetings and discussions.

Handwriting recognition devices: There are commercially available products that convert hand written materials into computer-generated text. Depending on the device, the information can be saved and printed as written or can convert the hand written materials into printed text for easier reading similar to a voice recognition system.

Digital Pen™: This system allows the user to combine the use of pen and paper with the power of a computer. The software converts your handwritten notes into digital text. The user can modify the hand written text or convert it to text.

Interactive Whiteboards (SMART Board™): The touch-sensitive display connects to your computer and digital projector to show your computer image. The user can then control computer applications directly from the display, write notes in digital ink and save your work to share later.

Voice to Text / Sign: There are several commercially-available products that utilize voice recognition software to convert voice to printed text or computer-generated sign language. These devices are seeing increased use for a variety of situations. Sometimes the recognition is not exact and the deaf or hard of hearing consumer must be able to recognize when errors occur. The

speaker needs to work with the specific device to train it to recognize their voice. Some allow only one user, but others are beginning to recognize multiple speakers.

Caption Mic™: With minimal practice, a voice captionist repeats what was said by an instructor into a microphone that converts the information to captioning to be read by the deaf or hard of hearing individual.

Dragon Naturally Speaking™: A voice recognition software package that was developed for general public use that can be beneficial for deaf and hard of hearing individuals by creating text documents out of voice files.

iCommunicator™: Performs as a communication tool that converts the spoken word into text, instantly translating it into Sign-Language or Computer-Generated Voice, providing access to acoustic information in real-time. This software is able to convert speech to text; speech/text to video sign-language; or speech/text to computer generated voice.

Video Remote Interpreter: When an interpreter is not available to attend a function in person, video remote interpreting provides another option. Utilizing a phone or other computer devices or software, an interpreter in another location can listen to a presentation and use sign language to relay the information presented through a web camera or video phone. High-speed Internet service is required to access this type of remote interpreting. The deaf or hard of hearing consumer can view the signed information on a computer or video telephone.

Real Time Captioning: Real time captioning provides a typewritten account of all verbal information presented within a lecture, meeting, discussion or presentation. All of these systems require the skills of a trained captionist and specialized software or equipment such as a computer. They typically vary based on the amount of information represented within the visual display of information ranging from summaries to word for word transcription.

CART (Communication Access Real Time Captioning) - Provides a word-for-word transcription (similar to a court reporter) using a stenotype machine, laptop computer and real time software.

CPrint – Developed as a speech to text communication access system at the National Technical Institute for the Deaf (NTID), a college of Rochester Institute of Technology (RIT). This system condenses information using a meaning-for-meaning translation (not verbatim).

Remote Captioning: Rather than having a captionist physically present, the user can listen in using a phone, cell phone, or computer microphone which allows the captionist to transmit the text back to the consumer using a modem, internet or some other data connection.

Selection: Tools & Strategies

Use a Feature Match process to discuss and select those ideas, tools, and strategies that were generated during the solution brainstorming. Select those that best match the student, the environment and the tasks that need to be accomplished. Limit your selections to a reasonable number and prioritize them according to those that can be accomplished immediately, in a reasonable time period and those that will be considered at a later time or require additional or significant staff training.

Implementation Plan

Depending on the device/s chosen, they may be able to be purchased or loaned for such things as alerting and telecommunication devices. However, many others such as personal amplification or captioning services require specialized equipment or software and/or support personnel including audiologists, trained captionists or interpreters. Determining benefit of a particular device or service should be implemented through a trial period to make sure what was chosen is meeting the needs of the student. Input regarding improved accessibility should be obtained from the student themselves as well as the team and family.

References and Resources

Deaf and Hard of Hearing Information

American Speech Language Hearing Association www.asha.org

Hearing Loss Association of America www.hearingloss.org

National Association of the Deaf www.nad.org

Office of the Deaf and Hard of Hearing (ODHH) <http://dhs.wisconsin.gov/sensory>

WI Department of Public Instruction www.dpi.wi.gov

Students who are Deaf or Hard of Hearing: Eligibility Criteria Guidelines (2003)

Retrieved December, 2008

<http://www.dpi.wi.gov/sped/pdf/dhhguide.pdf>

WI Educational Services Program for the Deaf and Hard of Hearing (WESPDHH)

www.wesp-dhh.wi.gov

Product / Website Resources

Assistive Listening Devices

Audio Enhancement www.audioenhancement.com

LightSPEED Technologies www.lightspeed-tek.com

Lifeline www.lifelineamp.com

Oticon www.oticonus.com

Phonak www.phonak.com

Sonovation www.avrsono.com

William Sound www.williamssound.com

Captioning

Communication Access Real Time Captioning www.cartinfo.org

C-Print Rochester Institute of Technology www.ntid.rit.edu/CPrint

Described Captioned Media Program (DCMP) www.dcmp.org

Federal Communication Commission www.fcc.gov/cgb/consumerfacts/closedcaption.html

Cochlear Implants / Baha

Advanced Bionics www.bionicear.com

Cochlear Americas www.cochlear.com

Med-El www.medel.com

Hearing Aid Companies

GN Resound www.gnresound.com

Micro-Tech www.hearing-aid.com

Rexton www.rexton-online.com

Siemens www.usa.siemens.com

Starkey www.starkey.com

Unitron www.unitronhearing.com

Widex www.widexPro.com

Products

ADCO Hearing Products www.adco.com

Harris Communications www.harriscomm.com

Hear More Products for the Deaf and Hard of Hearing www.hearmore.com

Signaling Devices

HiTec Group, Inc www.hitec.com

Sonic Alert www.sonicalert.com

Ultratec Inc. www.ultratec.com

Specific Technology Related Products

Caption Mic www.captionmic.com

Digital Pen www.logitech.com

Dragon Naturally Speaking www.nuance.com/naturallyspeaking

iCommunicator www.mycommunicator.com

SMARTBoard Interactive White Boards– www.smarttech.com

UbiDuo Face-to-Face Communicator www.scommonline.com

Telecommunications Services

CSD-VRS Communication Service for the Deaf www.c-s-d.org

Hamilton Relay Inc. www.hamiltonrelay.com/states/wi.htm

Hands-On Video Relay Service (HOVRS) www.hovrs.com

Sorenson Communications www.sorenson.com

Wisconsin-based AT Demonstration Sites

Assistive Technology Resource Center www.wiatrc.org

Independence First www.independencefirst.org

Stout Vocational Rehabilitation Institute www.svri.uwstout.edu

UniversaLink www.cdhh.org

WATI Lending Library www.wati.org

Products Mentioned in Chapter 8

Product	Vendor Website
Caption Mic	www.captionmic.com
Digital Pen	www.logitech.com
Dragon Naturally Speaking	www.nuance.com/naturallyspeaking
iCommunicator	www.mycommunicator.com
SmartBoard Interactive White Boards	www.smarttech.com
UbiDuo Face to Face Communicator	www.scommonline.com

Chapter 14 – Assistive Technology for Students with Multiple Challenges

Introduction.....	1
Introduction to Functional Academics.....	3
Using the SETT Process	6
Decision Making Guide	7
SETT Process	8
Toolbox for Academic Support for Students with Multiple Challenges.....	11
Communication for Students with Multiple Challenges	13
Using the SETT Process-Communication	15
Decision Making Guide-Communication	17
SETT Process - Communication.....	18
Tool Box for Communication for Students with Multiple Challenges.....	23
Power Mobility for Students with Multiple Challenges	24
Using the SETT Process – Power Mobility	25
Decision Making Guide – Power Mobility.....	26
SETT Process – Power Mobility	27
Tool Box for Students with Multiple Challenges – Mobility Resources	30
Resources	31

Assistive Technology for Students with Multiple Challenges

Jill Gierach MSE ATP, Shelly Weingarten M.Ed, OTR, Mary Beth Werner OTR

Introduction

Students with Multiple Challenges: Who are they?

Students who experience these multiple challenges often require assistive tools and services that are responsive and flexible to the medical, sensory, physical and cognitive challenge they experience daily. By definition of the heterogeneous nature of this population, each child may have fluctuations of attending that make it imperative that teachers are capable of adjusting instruction as well as skilled in utilizing a variety of tools to maximize the instructional moment.

“It is imperative that any set of disability-specific needs not serve to stereotype a student, to lower expectations for a student, or to contribute to negative self-fulfilling prophecies for a student. So-called unique or disability-specific needs should be taken only as possible areas of risk for IEP teams to investigate, not inevitable features automatically conjoined to a specific disability in question”. (Jackson, R., 2005).

The students within this group represent about 1% of the school population. It is suggested by some that we think of this group not in terms of the type of disability label; instead, we recognize that by using the response to instruction (RtI) model’s definition that without specific individualized supports, students will not be able to participate independently at the universal level, or at the targeted level to address their instructional needs. The greatest part of a student’s day will need individual supports provided at the top tier for the instruction to be responsive to their needs. This does not mean to suggest that these students cannot participate in general education environments. It does mean that schools must systematically utilize multiple initiatives to guarantee lasting support and meaningful students outcomes (Coyne, Simonsen, Fraggella-Luby, 2008). These are the students who will require some level of support twenty-four hours a day; these students will require assistive technology to engage in nearly all activities. Often they will require outside assistance to utilize this technology.

We further identify this group of students in the following way: these individuals will depend on significant levels of caregiver support throughout their lifespan. These students are typically not independent in communication, mobility, self-care, or decision-making areas. They have difficulty transitioning from one task to another and from one environment to another. They often have difficulty generalizing skills or applying learning across environments. Their sensory systems are not integrated systems. They may express behaviors that interfere with instruction. They may be categorized as deaf blind and also have other disabilities.

According to IDEA '97:

Multiple disabilities means concomitant impairments (such as mental retardation-blindness, mental retardation-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in special education programs solely for one of the impairments. The term does not include deaf-blindness. Authority: 20 U.S.C. 1401(3)(A) and (B); 1401(26)

According to IDEA '97:

Deaf-blindness means concomitant hearing and visual impairments, the combination of which causes such severe communication and other developmental and educational needs that cannot be accommodated in special education programs solely for children with deafness or children with blindness. Authority: 20 U.S.C. 1401(3)(A) and (B); 1401(26)

Purpose

This chapter's purpose is to augment the content in the other ASNAT chapters by providing some guidance to the ASNAT teams when they are considering assistive technology to support students with multiple, significant and profound disabilities. The original ASNAT process can work for helping teams sort through the options of support for these students with additional questions. These questions clarify how each disability area influences the target task and impacts assistive technology service and tool selection. Often the questions ASNAT team members uncover will require additional information to be gathered with other assessment tools. The tools we include we have found useful in our work. They are not an exhaustive list, but are presented as a starting point to assistive teams to better identify the needs of students. It is also noted that teacher beliefs influence how children succeed. This is so important when dealing with students that require ongoing instructional support and for whom skill attainment requires consistent and thoughtful interventions. To this purpose we have developed what we term "core beliefs" that are intrinsic to teachers' abilities to adopt high-learning expectations for this diverse group of students. These beliefs often affect the assessment team's approach to assistive technology and out-come expectations for this population. They will reappear in each section.

Core Beliefs

1. Movement

1. Every child has the right to move more independently and our job is to make them safe.
2. Each child must be honored in the process.
3. Positioning is dynamic and there is no "one" position.
4. Positioning is task-specific.
5. Movement is the foundation for all learning.
6. Transitions are the richest movement of all.

B. Communication

1. Every child deserves to communicate in multiple ways.
2. Communication is the key to engagement in all environments.
3. Every child has a story to tell and we must find a way to help them tell it.
4. Receptive language develops before expressive.

C. Functional academics

1. Every student should be provided with curriculum that is engaging and meets their needs.
2. There is the expectation there is measurable change in goal attainment.
3. There needs to be a balance between learning outcomes (observable change in the student's behavior) and general supports provided by the staff.

This chapter will also have a Decision Making Guide. We will follow the guide with a Tool box. This departs from the continuums in the other chapters. We encourage you to look at those chapters to see if they provide you with ideas of tools to try with your target student's task. If you need something else look to the tool box. These are examples of possible supports and do not follow a progression. Resources can be found at the end of this chapter. We also suggest for each category/task the reader look to the main chapters in this manual for further information on specific tasks and the continuum of tools. This chapter is meant to augment the other chapters, not replace them. This is not a chapter on specific teaching techniques. We encourage you to consult the resource section for a more extensive reference list.

Introduction to Functional Academics

Core Beliefs:

1. Every student should be provided with curriculum that is engaging and meets their needs.
2. There is the expectation there is measurable change in goal attainment.
3. There needs to be a balance between learning outcomes (observable change in the student's behavior) and general supports provided by the staff.

Research

Because of the low incidence and heterogeneous nature of this population, research is not as readily available to support implementation of assistive technology or best instructional practices. One of the chief advocacy groups for this population brings two questions to light that need to be considered as we develop environments that support students with significant disabilities.

It is important that teachers have expectations for the students with significant disabilities. This is often a foundation upon which the assessment for assistive technology supports is built. All staff must expect that the technology will provide a student with access to engaged and participatory learning. Research has been done on the affect of teacher attitude on student achievement. For more information, look to the study by:

Jussim, Lee, Kent D., Harber (2005). Teacher expectations and self-fulfilling prophecies: knowns and unknowns, resolved and unresolved controversies. *Personality and Social Psychology Review*, 9. Retrieved 5/26/09, from <http://psr.sagepub.com/cgi/content/abst>

To further state the situation TASH (The Association for Persons with Severe Handicaps) presented testimony to the Interagency Committee on Disability Research Stakeholder Meeting in Washington on August 13, 2008. Targeting research design for this population:

In addition to the small numbers of, and high degree of variance across, individuals with low-incidence disabilities, exerting experimental controls in inclusive settings

using traditional large-n approaches at worst is impossible, and at best is both extremely difficult and intrusive to the natural dynamic and relationships present in those settings. A number of applicable research methodologies that are less intrusive (e.g., participant observation, case studies, single subject designs) are available that may be necessary either to collect any data related to low incidence populations (e.g., individuals with intensive support needs, dual sensory impairments, or multiple disabilities) or to avoid endangering individual relationships and opportunities for the collection of meaningful data in inclusive settings. These methodologies potentially provide a high level of both reliability and validity and inform practitioners, parents, and educators about effective and scientifically-based practices.

Thought Point: As we assess individual students for their assistive technology needs it benefits not only the student but also our field of practice if we develop replicable implementation and data collection methodologies.

TASH also expressed concern about

The passage of the No Child Left Behind (NCLB) Act has dramatically extended research in general education curriculum and instruction, but has lead to a steadily decreasing investment in educational research for individuals with the most significant disabilities, including individuals with intensive support needs, dual sensory impairments, or multiple disabilities.

Thought Point: How does this affect students as we implement universal design for learning (UDL) principals? Does UDL include all students? How do we make certain the needs of our most involved students are also considered?

For more information on UDL and low incidence students see: Jackson, R. (2005). *Curriculum Access for Students with Low-Incidence Disabilities: The Promise of Universal Design for Learning*. Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved May 23, 2009 from http://www.cast.org/publications/ncac/ncac_lowinc.html.

Specific research on functional academics is limited. With the reauthorization of IDEA '04 and NCLB there is a new accountability built into programming and assessment. In the past goals for this population may have been along the lines of:

- Will match one out of two colors given a set of two.
- Will hit a switch.
- Will pick up an object and put it into a container.
- Will indicate yes, no.
- Will sit quietly during story.
- Will greet a peer.

Many of these goals did not lend themselves to real learning or measureable outcomes. Switch use can be a tool but to do what activity or to participate in what task? In Wisconsin, the Department of Public Instruction has responded by creating the Wisconsin Extended Grade Band Standards <http://dpi.wi.gov/sped/assmt-extstd.html>.

The State of Wisconsin has established Extended Grade Band Standards in Reading, Mathematics, and Science to guide instruction and curriculum planning for students with significant cognitive disabilities. The extended standards indicate what students with significant cognitive disabilities are expected to know and be able to do academically. The extended standards are used as the basis for the [Wisconsin Alternate Assessment](#) for Students with Disabilities (WAA-SwD).

This support assists teachers in developing IEPs that reflect a standards-based approach. This will then further assist them to identify tasks the student needs to accomplish and identify the AT tools that may support them.

At the web site goals look like this:

READING – Extended Grade Band Instructional Examples: 3-4

Model Academic Standard A: Reading

Objective 1: Determine the Meaning of Words and Phrases in Context EXTENDED GRADE BAND OBJECTIVE 1A: Match Words to Pictures			
Instructional Achievement Descriptors			
Advanced	Proficient	Basic	Minimal
<i>Use words or pictures to determine meaning</i>	<i>Match words to pictures</i>	<i>Identify correct object when given two word choices</i>	<i>Identify one picture or object from a set of two</i>
Take pictures of various places in the school (office, gym, music room, restrooms, etc.). Introduce pictures and words to student. Describe an activity that takes place in a specific place. Have student identify the correct picture and corresponding word card.	Take pictures of various places in the school (office, gym, music room, restrooms, etc.) Prepare word cards for each room. Introduce pictures and words to student. Have student match the name of the place to the picture of the place. Repeat activity with community locations and rooms in the home.	Take pictures of various places in the school (office, gym, music room, restrooms, etc.) Prepare word cards for each room. Introduce pictures and words to students. Hold up one picture and have the student identify the correct name of the place from a choice of two word choices.	Take pictures of various places in the school (office, gym, music room, restrooms, etc.) Introduce pictures to student. Have student identify picture of the requested place from a choice of two.

With this as a guide, we have movement and skill development. A student begins at minimal or basic, and then moves to proficient or advanced. The activity of matching is connected to a real activity in their environment. It begins with a low technology solution, such as photos, and then moves to picture or word cards. As we probe this example we may need to add more support depending on the student's involving and understanding. We may need to look at which communication symbol best represents the activity (see communication section in this chapter as well as the Chapter 3-Assistive Technology for Communication within this manual).

Functional academics will provide students with skills that allow them to make choices about their care and preferences. This includes engaging in communication that is understood and honored. The communication section of this chapter provides the reader with more information on the importance communication and how this impacts all aspects of this population's quality of life.

Other supports:

COACH: Choosing Outcomes and Accommodations for Children (2005).

Every Move Counts, Clicks and Chats (2008).

Using the SETT process and Decision Making Guide

Important: It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory under Student and Environment for Sensory Considerations. Additional categories include Narrowing the Focus to help identify a specific task in order to select appropriate assistive technology, a category for Implementation Plan to assign trials, dates, responsibilities, data collection and also a Follow-Up Plan to set a date for the team to reconvene. Again, this is intended as a guide; during the actual assessment each topic should be written in large print where everyone can see, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

The questions posed are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology for their students.

WATI Assistive Technology Decision Making Guide

Area of Concern: Multiple Challenges- Functional Academics

Statement about individuals who are unable to perform tasks due to cognitive limitations or because of severe physical involvement, or both.

PROBLEM IDENTIFICATION		
Student's Abilities/Difficulties	Environmental Considerations	Tasks
- Medical conditions - Severe physical challenges - Cognitive challenges (Memory) (recognition ,strategic, limbic systems)(ability to generalize information) - Sensory challenges - Or combination - Motivating activities - Movement - Variability on abilities from day to day or hour to hour - Challenging behaviors - Communication abilities - Other concerns	What environmental considerations impact the area of concern? - Are there multiple way representing content? - Are multiple means of expressing what the students know supported? - Are there multiple approaches to student engagement accepted. - Are there areas without visual clutter? - How flexibility is the scheduling or classroom schedule? - How much adult support is in the room?	What task(s) do you want the student to do that relate to the area of concern? - Ex. Reacts to objects, activities or interactions by displaying an observable change in behavior. - Directs and sustains attention to activity - Uses objects for intended purposes Check DPI resource Wisconsin Adaptive Skills Resource Guide http://dpi.wi.gov/sped/adaptskills.html
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts ? (i.e., visual, auditory, tactile) response level, self regulation recovery time, transition issues		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision Review Continuum	Use a Feature Match Process to Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: - Objectives to determine effectiveness of trial - Training needed - Date - Length - Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to communication.

Medical Considerations

Does the child receive medications that might affect their learning or recognition systems? Does their level of awareness change in response to when they receive their medications? If so, we need to take this into consideration when developing instructional programs.

Severe Physical Challenges

Often with significant cognitive involvement there will also be significant physical disability. It is critical that the student's position be assessed for active engagement in an activity to occur. We also need to determine how accessing the AT is going to be accomplished. If the student does not have hand movement, we may need to consider providing access at the head, or eye gaze. Please see position section of this chapter for further information, as well as Chapter 2 – Assistive Technology for Seating and Positioning.

Cognitive (memory, recognition, strategic and limbic systems, generalizing learning)

As we learn more about how the brain processes information we make better instructional decisions. How does the student respond to a novel tool or environment or person? How many exposures does it take for the student to retrieve or remember that information? Does this recognition only occur in the setting in which the information was learned or can the student apply this learning to unfamiliar settings? How does the student demonstrate they know or recognize information? How does the student feel about school? Are there certain activities they like more than others? How do they demonstrate this? How long does it take to learn new information? How often does the student require repeated practice? Does this change with content?

Sensory Challenges

Most students have a preferred sensory system. This can assist in finding the assistive technology that will support the chosen task. How does their sensory system impact learning? Which is their primary system? Which system affects them negatively? Does this change throughout the day?

A Combination of Sensory and Cognitive Challenges

It will often be the case that there will be both sensory and cognitive challenges. It is important that the assessment team assesses how to approach the implementation of AT with this in mind. Supports such as Every Move Counts, Clicks and Chats can assist in determining sensory influences.

Variability of Abilities from Day to Day or Hour to Hour

Variability of abilities is often a characteristic observed in some students in this category. Teachers will often remark, "The student knew how to do that last week." There is more than one reason for this. It could have been a skill taught in isolation and not generalized. It may be something that met criteria on one day and was not returned to. There may be some organic issues that are affecting retention, or the task has little meaning to the student. Students can be fully engaged at different times of day. Teachers will need to look at what happens prior to an optimal learning state. Was there: a preceding vestibular activity, a change in position, a long bus ride, or too much noise in the classroom? Many factors can affect these children that other children without these significant disabilities can screen out so they can focus and recall.

Challenging Behaviors

What do they look like? Can you predict when they occur? How do you deal with them? We find that when we can address the sensory and communications needs of these students challenging behaviors decrease.

Other Concerns

List other items that are particular to this student and affect their ability to perform the task.

Environmental Considerations

As a team discuss and write on chart paper any environmental considerations that might impact the student's communication in the classroom, number of different settings or any other environmental impacts.

There may be concerns about the transition from one activity to another within the classroom or across the school environment. Is there an opportunity to slow the transition time down for those students who process differently? Does the student have ready access to a variety of materials (manipulative, picture or tactile supports, real objects, music, e-text, computers, other access materials and supports) that would help them to understand and process content? Can they move around the environment? How is the lighting, sound? Is there a quiet place to work? Is there room for the student to be in a work group with peers? Does the teacher include materials in the lesson that meet the unique learning style of this student? Does the program time respond to the student processing need or does the student need to adjust to a predetermined schedule? What are barriers to this child's active participation?

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment in which the student will be communicating

Assistive Technology: past and present

What assistive technology has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist or can be changed such as computer conflicts, lack of training, not transferring to a new building/staff, lack of interest, or other reasons that are no longer present. If the student is currently using assistive technology, note the locations, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference.

Task(s)

As a team discuss and write on chart paper the tasks that the student needs to do related to the tasks.

We may start with tasks identified in the general education setting. Wisconsin Adaptive Skills Resource Guide (www.dpi.wi.gov/sped/adaptskills.html) is aligned with the Wisconsin Knowledge Content Standards. Many of the students this chapter supports will utilize the Pre-Requisite Concepts beginning on page 6 of the guide. Here is a math example:

I. Pre-Requisite Concepts

Wisconsin Content Standard for Math, Language Arts, and Social Studies: Students in Wisconsin will draw on a broad body of mathematical knowledge and apply a variety of mathematical skills and strategies, including reasoning, oral and written communication, and the use of appropriate technology, when solving mathematical, real-world and non-routine problems. Wisconsin Content Standard: Students in Wisconsin will listen to, understand, and will speak clearly and effectively for diverse purposes. Rationale: These skills lay the foundation for academic subjects. Basic skills & general knowledge concepts are broken down into steps that are more easily managed by the child with special needs. Pre-Requisite concepts include very basic skills needed to be able to move into the other academic sub-components.			
Performance Standard:	Sample Alternate Performance Indicators:	Sample Performance Tasks:	Instructional Tools:
Math A.4.1 Use reasoning abilities to: - Perceive patterns - Identify relationships - Formulate questions for further exploration - Justify strategies - Test the reasonableness of results	A. Demonstrate visual discrimination B. Use receptive/expressive language C. Recognize similarities and differences	Color 1.a. Use sensory input to match colors 1.b. Sequence colors to follow a given pattern 1.c. Point to requested color 1.d. Name/sign basic colors as requested 1.e. Sort by color 1.f. Sort by attribute (same/different)	- flash cards for matching - coloring books - manipulatives (i.e., vehicles, fruits, animals) - bean bags - commercial games - crayons - paints - markers - music/songs about colors

The Tools list will present additional assistive technology tools and supports that will expand what is generally listed as an Instructional tool in the Adaptive Skills Resource guide.

Narrowing the Focus

As a team, identify by circling or other means those few tasks the student needs to do in whatever curriculum area has been chosen that will have the most impact. In our experience the goals usually chosen are communication. But they may be asked to communicate about a function curriculum task. So we will be utilizing two applications of assistive technology and possibility three if the positioning issue also needs attention.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies and/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The tools and strategies discussed below follow the general continuum for reading. The continuum is generally organized from low to high Assistive Technology. It is not intended to be used as a step-by-step protocol for using AT tools with a student, but rather an organizational continuum of types of Assistive Technology.

Each ASNAT chapter has a list of tools or strategies that may need some adaptation to meet the needs of students with multiple disabilities. See the continuum in each targeted academic area.

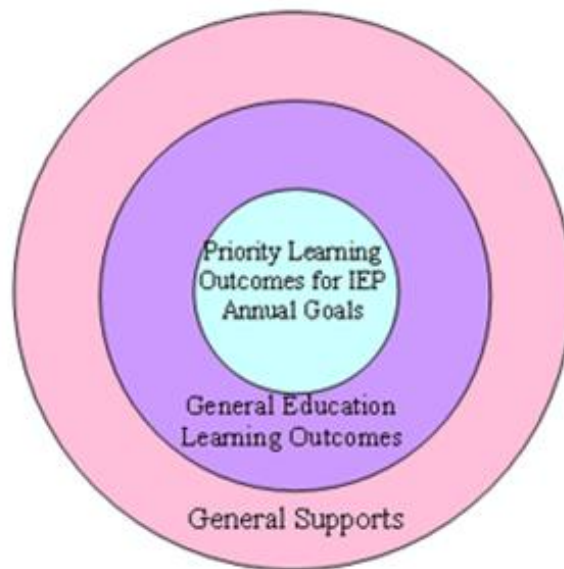
For additional information on instruction, look at the supports in our Toolbox for Academics.

Tool Box for Academic Support for students with Multiple Challenges

1. **Program development: COACH: Choosing Outcomes and Accommodations for Children**

Support for developing individual education programs in integrated setting.

Giangreco, Cloninger, & Iverson, Michael F., Chigee J., & Virginia S. (2005). *COACH: Choosing Outcomes and Accommodations for Children*. Baltimore, Maryland: Brookes. This tool assists IEP team members in understanding the relationship between functional and academic skills that are part of the general education curriculum. The COACH includes a set of questionnaires and forms to guide users through a series of interviews and a problem-solving process of divergent and convergent decision-making that results in a list of prioritized objectives that reflect valued life outcomes for individual students. The overall model can be viewed below. In the bull's eye are those priority IEP objectives these priorities are identified as a result of the planning process and includes general learning outcomes (in the second concentric circle) that are expected for all students. IEP teams use COACH to identify the subset of outcomes targeted for instruction and the general supports (in the third circle) that can be used to enable students to meet the prioritized outcomes. Other content can be considered to be part of the student's curriculum enhancement but not a priority-the third circle. Assistive technology can be used at any level.



The COACH Model

- #### 2. **MAPS (Making Action Plans)** is a widely used approach to person-centered planning. MAPS helps bring together the key people in someone's life to develop a support plan developed by Marsha Forest and Jack Pearpoint at the Marsha Forest Center, 24 Thorne Crescent, Toronto, Ontario, Canada M6H 2S5(416) 658-5363 or FAX 658-5067. This is not a curriculum but

rather a team tool to look at the student and develop the IEP after they answer six key questions that end with **“What would an ideal day at school be like for the student?”**

3. **Information on Literacy, reading and writing**--look to Copeland, & Keefe, Susan, & Elizabeth (2007). *Effective Literacy Instruction: for students with moderate or severe disabilities*. Baltimore, Maryland: Brookes
4. **Information on effective instruction practices for teaching students who may not understand spoken language**--look to Downing, June,E. (2008). *Including Students with Severe and Multiple Disabilities in Typical Classrooms*. Baltimore, Maryland: Brookes.
5. **Stages Framework** - “Stages is a seven-level developmental framework that describes a learner's cognitive and language abilities. Stages helps schools comply with alternate assessment mandates by providing an accessible way to assess learners with special needs. Stages also serves as a selection guide for curriculum activities (including both software and off-computer activities). The sequence of seven Stages is based on the work of Madalaine Pugliese, a nationally recognized authority in the fields of assistive and instructional technologies. Stages is a seven-level developmental framework that describes a learner's cognitive and language abilities. Stages helps schools comply with alternate assessment mandates by providing an accessible way to assess learners with special needs. Stages also serves as a selection guide for curriculum activities (including both software and off-computer activities).”
<http://store.cambiumlearning.com/ProgramPage.aspx?parentId=074004184&functionID=009000008&site=itc> (retrieved June 17, 2009)

This software assists teachers to look at students needs in the following areas:

1. Cause and Effect
2. Language Readiness
3. Emerging language
4. Early Concepts
5. Advanced Concepts and Communication
6. Functional Learning
7. Written expressions

As the team focuses in on the specific academic needs for a student, it has been our experience that when using the ASNAT process the team realizes that for the student to succeed it is less about the tools used and more about supporting communication and positioning for task performance. We also find the team needs support in identifying appropriate IEP goals and consistent teaching strategies. It is for these reasons that we added sections to this chapter on communication and how powered mobility might be addressed.

Communication for Students with Multiple Challenges

Introduction

Communication is a major functional skill.

- Every child deserves to communicate in multiple ways.
- Communication is the key to engagement in all environments.
- Receptive language develops before expressive.
- Every child has a story to tell and we must find away to help them tell it.

When an individual cannot communicate, often their communication partners assist with prompts and interpretations. Given this situation, it is not possible to determine if the message source is truly the individual with the disability or the communication partners.

Individuals with severe disabilities often depend upon communication partners to send messages. In some cases, partners play "20 questions" to determine wants, needs, and desires. Examples include:

"Do you want juice or cookies?"

"You want a cookie?"

"Do you want chocolate chip or peanut butter?"

"Oh, you don't want a cookie, do you want chips?"

Other times, partners prompt the individual to convey specific messages. For example:

"Tell Mrs. Ice you want the front seat."

"Say thank you!"

Communication partners translate information to third parties, and also to themselves. For example:

"When he makes that face, I know he wants more."

When these experiences happen again and again a child is being taught to be a passive communicative partner which in turn leads to learned helplessness.

Learned helplessness occurs when a student does not attempt to ask for or do things for themselves due to repeated experiences in which the child has not been able to have an effect on other people or the environment. This is likely the result for a child who is unable to act or behave in expected or conventional ways or is helplessness due to a disability. Because family members are not able to interpret or respond to the child's communicative attempts, the child does not discern a relationship between his or her own actions and a response from people or the environment. Learned helplessness is associated with excessive dependence and lowered self-esteem. Children with severe disabilities are at risk for learned helplessness due to:

- Motor, sensory or cognitive impairments that impede their ability to effectively act the environment, or to understand the results of their actions.
- Lack of opportunity to make choices or otherwise be able to determine one's own life.
- Communication impairments that prevent them from being understood by others.

To prevent learned helplessness, the child needs to be able to exert some control over other people and the environment. This can be done by providing the child with instruction and adaptations that increase his or her ability to reliably and effectively influence others and the environment, such as Alternative Augmentative Communication (AAC) devices. In addition, the child can also be given the ability to exercise this control through increased sensitivity and responsiveness from partners, and ample opportunity to make choices. (Reichle, York, & Sigafos, as cited in Ballinger, 1999, sec.2)

Research related to communication for children with multiple disabilities is limited due to the low incidence of this population, and the heterogeneous nature of their make-up. We can look for the research in the area of deaf blind populations. This group often has other considerations including cognitive, sensory, or motor issues that impact their communication.

Research

Research tells us that we all communicate.

- Research on the development of communication in infants without disabilities has shown that parents and infants communicate with each other soon after the infant is born. This knowledge has helped to understand that speech is not the only way we communicate and that we can teach individuals with severe communication disorders to communicate using a variety of means. (Rowland & Schweigert 1990, 1996)
- Contemporary assessment procedures can best be characterized as fitting the Participation Model, which holds that all persons with severe disabilities can achieve enhanced communication ability. This makes it a strength model, a departure from previous deficit-based models (Kroth & Bolson, 1996)
- Perhaps the greatest change in augmentative and alternative communication has been the near-universal abandonment of prerequisites for AAC services. This has occurred largely because of the lack of compelling empirical research supporting the requirement that certain cognitive prerequisites be present prior to beginning effective augmentative communication services (Kangas & Lloyd, 1988)

We must change how we (the communication partner) interact with the students.

vanDijk's (2006) research suggests:

- Teachers and parents can improve the quality of interactions with children who are deaf-blind by learning new skills.
- Video analysis is a powerful tool in training.
- When parents and teachers change their own attitudes and behavior, children use more positive interactive behaviors in response.

Mirenda (1993) noted, "Communication is not something that has to be learned. It is inevitability because people cannot not communicate." The success of an interaction with a child with complex communication needs depends heavily on the interaction skills of the communication partner.

Blackstone (2002) research looks at some behaviors of communication partners:

- Dominate communicative interactions.
- Ask yes/no questions.
- Take the majority of conversational turns.
- Provide few opportunities for individuals using AAC to initiate conversations or to respond during conversations.
- Frequently interrupt the utterances of individuals using AAC or his or her message

At the same time, individuals using AAC have been noted to:

- Play passive roles (e.g., initiate few interactions, respond only in obligatory contexts)
- Produce a limited range of communicative functions; and
- use restricted words

There is clear evidence that many communication partners need to learn how to successfully interact with individuals who use AAC.

Karlan (1989) developed a program called Environmental Communication Teaching (ECT). ECT is a research-based communication intervention approach that uses incidental teaching episodes that are directed toward functional communication. The goal of this training program is to facilitate an increase in augmentative communication use in target students. One day of the training is looking at how partners can act to facilitate, rather than inhibit, the student's communication skills.

We must start where the child is at for them to advance. Sometimes we have to take a step back to kick it up a notch.

Rowland and Schweigert (2000), show that most individuals who do not have pre-symbolic means of communication are not successful in acquiring any sort of symbolic means of communication. Through their research they demonstrated that once individuals learn to communicate pre-symbolically, it is a fairly straightforward matter to teach students to use some sort of symbol system to communicate (assuming that you have identified the type of symbol that makes sense to that child). (Rowland & Schweigert, 2000)

Prior to children understanding that symbols represent an activity is a level of pre-symbolic communication. At this level children use body and limb movements, gestures and vocalizations as a way of intentionally communicating.

Tangible Symbols have proved useful for a wide variety of individuals of all ages. *Tangible Symbols Systems*™ is not just a mode of communication, but a systematic instructional sequence. A recent study (Rowland & Schweigert, 2000) demonstrated the following findings:

- Tangible symbols may serve as a bridge to other symbol systems, including abstract symbol systems such as speech or manual sign language.
- Learning to use tangible symbols does not interfere with the acquisition of speech.
- Tangible symbols may be a useful means of communication for some children with autism spectrum disorders.
- Individuals who are already able to communicate effectively using gestures or vocalizations are more readily able to learn to use tangible symbols than are those who do not have intentional pre-symbolic communication skills.

Using the SETT process and Decision Making Guide-Communication

Important: It is intended that you use this as a guide. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory under Student and Environment for Sensory Considerations. Additional categories include Narrowing the Focus to help identify a specific task in order to select appropriate assistive technology, a category for Implementation Plan to assign trials, dates, responsibilities, data collection and also a Follow-Up Plan to set a date for the team to reconvene. Again, this is intended as a guide; during the actual assessment each topic should be written in large print where everyone can see, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

The questions posed are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology for their students.

It is important to remember for students with multiple challenges we need to focus on the interaction and communication- not the technology. Sensory Considerations play a significant role with children with multiple challenges.

The next section will go through the Student, the Environment and the Tasks on the Decision Making Guide. Typically you would also talk about brainstorming Tools and Strategies, Selection of Tools and Strategies and the Implementation Plan.

The purpose of this section is to help teams to identify where the student currently is with their communication skills. The resources listed in the toolbox provide frameworks to systematically approach student assessment all the way to developing an implementation plan. It is critical that teams spend time on assessing the student's current functioning.

WATI Assistive Technology Decision Making Guide

Area of Concern: Multiple Challenges-Communications

PROBLEM IDENTIFICATION		
Student's Abilities/Difficulties	Environmental Considerations	Tasks
What are the student's abilities & difficulties related to the area of communication? Review Student Information Guide, Chapter 1 - Current Mode of communication (reliable and predictable motor movement) - Motivating activities - Readiness to use symbols - Visual Concerns - Hearing Concerns - Medical conditions - Other concerns	What are the staff doing/ what does the environment look like? Type of classroom - Self contained - Resource - Full inclusion - Team approach - Communication opportunities - Transitions - Assistive Technology: past and present	What skill does the student need to develop prior to utilizing A.T.? - Communication intent - Reliable motor response - Identify motivating activities - Symbol set What tasks do we want the student to do that assistive technology would enhance? - Refuse - Make choices - Social Participation - Make comments
Sensory Considerations		Narrowing the Focus
What sensory preference/ sensitivities does the student have that impacts Communication (i.e., visual, auditory, tactile)		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision	Use a Feature Match Process to Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Communication Objectives to determine effectiveness of trial: - Training needed - Date - Length - Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to communication. In looking at beginning communicators it is critical to ask the following questions:

Mode of communication

How does the student demonstrate intent to communicate? Does the student use change in affect, gestures, vocalizations, facial expressions, or eye gaze to tell you something? Does the student have a reliable motor response? When looking for a reliable movement, reflexes and tone can interfere in reliability, so you must be careful in choosing a movement for communication. It must be reliable, not reflex-induced or position-dependent. You want to strive for optimal positioning for the student. If a student can only use a movement in one position that will make communicating at all times difficult.

One needs to be acutely aware of the continuum-of-communication intent to ensure that one does not miss a potential response by the student. For example, you may be watching for the student to extend their hand to point, while they have gazed at the object several times. It is common for each team member to have communication interactions based on different communication responses. It is significant that you determine whether the student has intent in their communication responses. The key to keep in mind is for everyone to understand the student's communication (familiar communication partners as well as unfamiliar communication partners) and we want the student to be able to say what he/she wants to say.

Motivating activities

What are motivating (enjoyable) activities? How often do they occur during the day? It is important to keep in mind when teaching communication skills that you must start with what the communicator finds enjoyable, and it must occur often for them to learn the connection between the message (the topic, what the communicator is communicating about) and their means of communication (behavior used to communicate the message). Only when communication is recognized and consistently reinforced will those with severe differences find the effort to communicate worthwhile.

Readiness to use symbols to communicate

Does the student understand that concrete symbols (symbolic gestures and vocalizations, three-dimensional objects, two-dimensional pictures) represent an activity (event or person)?

The work of Charity Rowland and Phillip Schweigert have demonstrated that tangible symbols may serve as bridge to other symbol systems (such as speech or manual sign language), and that learning to use tangible symbols does not interfere with the acquisition of speech.

Rowland, C. & Schweigert, P. (1990, 1996). *Tangible Symbol Systems*. is one resource for teachers if the student is ready for Tangible Symbols. This resource explains tangible symbols for expressive communication, receptive communication, and levels of representation. The book includes a Tangible Symbol pretest, a comprehension check and progress monitoring tools. It is available on the Design to Learn website through the authors and online at http://osepideasthatwork.org/toolkit/InstPract_tan_sym.asp .

Vision / Hearing

It is important to consider vision and hearing. Below are three common visual and or hearing deficits often found in children with multiple challenges. This is not a complete list, but is meant to provide a basic understanding and lists of common behaviors.

Deaf-Blindness

Students that are considered severe/profound may also have dual sensory impairments. The nature and extent of deaf-blindness in children is often misunderstood. Although the term deaf-blindness implies a complete absence of hearing and sight, in reality, it refers to children with varying degrees of vision and hearing loss. The core feature of deaf-blindness is that the combination of losses limits access to auditory and visual information. When both vision and hearing are affected, especially from birth or early in life, natural opportunities to learn and communicate can be severely limited.

The National Consortium On Deaf-Blindness November 2007 newsletter reported on the findings of the National Deaf-Blind Child Count. Key points were identified as:

- Deaf-blindness is varied and complex.
- Children with deaf-blindness are as diverse as the number of children reported.
- Early identification and intervention are critical.

Children and youth who are deaf-blind often have other disabilities. In fact, more than 90% of children who are deaf-blind have one or more additional disabilities or health problems and some may be identified as having multiple disabilities rather than deaf-blindness. In these cases, the impact of combined hearing and vision loss may not be recognized or addressed.

Training and support are available through federally-funded technical assistance projects in each state. <http://www.nationaldb.org>

For a student with deaf-blindness, the combined effects of the vision and hearing loss create a barrier that significantly impedes the ability to gather information from the environment. This causes chronic difficulties with incidental learning and concept development. Students cannot learn what they do not detect, and they may be unaware of what they are missing. Access to information is a primary issue for all students with deaf blindness, and should be addressed in each IEP.

(From *IEP Quality Indicators for Students with Deaf-blindness* -
<<http://www.tsbvi.edu/Outreach/deafblind/indicators.htm>>)

Cortical Visual Impairment

http://ohiolionseverresearch.com/cortical_visual_impairment.htm

Cortical visual impairment (CVI) is a complex and heterogeneous condition in which the eyes and optic nerves appear healthy; yet, the patient does not have normal vision or normal visual perception. Indeed, as the name implies, CVI is not an eye condition but rather a brain condition. Previously, many eye doctors referred to such patients as "cortically blind" but it is now generally believed that many of these patients have useable, albeit abnormal, vision.

CVI results from a number of conditions that affect the brain and particularly the surface of the brain called the cortex. Intracranial bleeding, head trauma, birth defects, strokes, or seizures can result in CVI. Typically diagnosed during infancy, CVI is also associated with premature or more

accurately complications due to premature birth, such as intracranial bleeding. Typical visual behaviors of an infant or child with CVI include:

- Momentary fixation – the child will look (fixate) on things only briefly, say about a second or less
- Variable vision – the child with CVI will seem to "see" at certain times and not at other times
- Selective attention – the child may look at some things that may be rather hard to see (e.g., small toy) but act unaware with very salient objects (e.g., faces)
- Avoidance – some children with CVI will actively avoid (e.g., look away from) salient visual objects
- Prefer certain colors – some children with CVI will attend to colored objects (e.g., yellow) but ignore black-white objects
- Moving objects – some children with CVI will track or watch an object when it is moving (e.g., a small ball rolling across the floor) but ignore or exhibit "blind" behavior (using hands to locate a nearby object) to the same object when it is stationary
- Act blind but respond to objects – some children with CVI will act as though they're not able to see or identify an object but, at the same time, are able to locate and grab or actively avoid the object.
- Hemianopsia – some children with CVI will be missing parts of their visual field and may prefer to fixate on objects by looking to the left or right of the object.

Central Auditory Processing

Auditory processing is a term used to describe what happens when your brain recognizes and interprets the sounds around you. Humans hear when energy that we recognize as sound travels through the ear and is changed into electrical information that can be interpreted by the brain. The "disorder" part of auditory processing disorder (APD) means that something is adversely affecting the processing or interpretation of the information.

Children with APD often do not recognize subtle differences between sounds in words, even though the sounds themselves are loud and clear. For example, the request "Tell me how a chair and a couch are alike" may sound to a child with APD like "Tell me how a couch and a chair are alike." It can even be understood by the child as "Tell me how a cow and a hair are alike." These kinds of problems are more likely to occur when a person with APD is in a noisy environment or when he or she is listening to complex information.

APD goes by many other names. Sometimes it is referred to as central auditory processing disorder (CAPD). Other common names are auditory perception problem, auditory comprehension deficit, central auditory dysfunction, central deafness, and so-called "word deafness." More information is available at:

<http://www.nidcd.nih.gov/health/voice/auditory.asp>

National Institute on Deafness and Other Communication Disorders

National Institutes of Health

31 Center Drive, MSC 2320

Bethesda, MD USA 20892-2320

Sensory Considerations

What does the environment look like?

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment in which the student will be communicating. It is imperative that we consider the sensory needs of children with multiple challenges.

- What sensory input is calming to the student?
- What sensory experiences are over-arousing to the student?
- Does the student have a sensory diet?

Environmental Considerations

As a team discuss and write on chart paper any environmental considerations that might impact the student's communication in the classroom, number of different settings or any other environmental impacts.

Type of classroom: self contained, resource or full inclusion?

Least restrictive does not mean full inclusion; it means that they are in the classroom that provides them with the best meaningful educational benefit. With the differences in needs and interests among students with disabilities, there is no single definition of what a least restrictive environment (LRE) will be for all students.

Multiple classrooms or environments create additional challenges. How will the student access the necessary assistive technology tools? Will there need to be multiple sets of tools in each environment? How will staff and other children in these multiple environments support the student using the assistive technology tools? One approach is to provide a dictionary of the student's communication system, and directions on how support staff should use them.

Team approach

Do you use a team approach in the classroom? How many support staff are in the room? Do they rotate between students? Where does therapy take place?

Communication opportunities

What communication opportunities are happening throughout the day?

Bukelman & Mirenda (1998) stated that the primary emphasis of communication intervention has shifted to the acquisitions of functional communication skills within natural environments. Although structural approaches are still utilized, best practices today emphasize functional language skills within natural daily routines and natural environments.

“Naturalistic teaching procedures typically incorporate the following:

- Instruction that is based on the child's interest and that follows the child's lead
- Frequent models of appropriate communication within natural routines
- Open, unambiguous prompting of child communication
- Use of natural consequences
- Ongoing interaction between the child and the interventionist.” (Warren & Richele, 1992)

Transitions

Is the student involved in the transitions to an activity throughout the day?

List times when the student is involved in the transition from one activity to another.

Kangas, (2009) noted:

Transition prepares a child for control. Intention develops when a child understands the beginning, the middle and the end of a task. What happens is we control the beginning, extend the middle too long and we control the end. Instead we should repeat the frequency of the activity not the duration. When the child can anticipate the beginning and the middle then they can control the duration.

Assistive Technology: past and present

What assistive technology has been employed in the past or is currently used with the student?

List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist or can be changed such as computer conflicts, lack of training, not transferring to a new building/staff, lack of interest, or other reasons that are no longer present. If the student is currently using assistive technology, note the locations, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference.

Tasks

As a team discuss and write on chart paper the tasks that the student needs to do related to communication:

What skill does the student need to develop prior to utilizing A.T.?

- Communication intent
- Reliable motor response

What symbol set will the student use for communication?

- Objects, partial objects, pictures, line drawings, symbols, touch cues/ partner assisted scanning, signs. Voice output (see chapter for ideas).

What tasks do we want the student to do that assistive technology would enhance?

- Refuse
- Make choices
- Social Participation
- Make comments

Narrowing the Focus

As a team, identify by circling or other means those tasks the student needs to do for communicating that will have the most impact.

Below you will find a Tool Box of Resources for Students with Multiple Challenges that will help you developmentally and systematically move your students to their highest potential.

Tool Box for Students with Multiple Challenges: Communication

every move counts clicks and chats (emc³) is a systematic sensory based assessment and implementation resource that supports and encourages communication. The power of this program is that it takes the student through a communication matrix that is based on where the student is currently functioning. emc³ helps identify, refine and expand responses into a more functional communication system. Assistive technology from switches to voice output are included. Available at: <http://www.everymovecounts.net/>

Design to Learn Package Includes the following resources. They can be purchased as a package or purchased individually. Available at <http://www.designtolearn.com>

- First Things First book provides practical strategies for encouraging early communication in children who have no or minimal intentional communication. First Things First describes instructional strategies for children who are not yet ready to use symbols to communicate.
- Tangible Symbol Systems manual helps teach individuals to communicate using objects or pictures that represent items, people, and events in their daily lives. These products describe and illustrate alternative communication options and instructional strategies for a broad range of learners of all ages who are unable to communicate using speech, manual sign language, or other systems that involve abstract symbols.
- Communication Matrix The Communication Matrix (©1996, 2004 Charity Rowland) is a communication skills assessment instrument.
 - available in three formats:
 - * the ORIGINAL version designed for professionals
 - * a "user-friendly" version designed Especially for Parents –
Now available in Spanish
 - * an ONLINE version using the parent-friendly format, but available as a
FREE service to parents and professionals
- Design to Learn The Design to Learn environmental inventory is used to track the opportunities to learn communication and object interaction skills that are provided in classroom activities for a specific student. The inventory was developed especially for children with pervasive developmental disorders (including autism) and it is applicable to nonverbal children with wide a range of disabilities.
- Hands-On Learning The Hands-On Learning materials address a wide range of object interaction skills, including the use of objects in symbolic play and in social interactions. They focus on the child's interaction with the physical environment and specific object interaction skills that may reflect cognitive and social skill development.
- Problem Solving Skills These materials are appropriate for nonverbal children with multiple disabilities that may include severe mental retardation or sensory impairments, including deaf-blindness. These assessment tools are used to examine a child's everyday interactions with the physical environment in order to determine cognitive ability. This information will help educators and parents to target problem solving skills that will promote cognitive development.

- [HomeTalk](#) HomeTalk is an assessment tool for parents and care providers of children who are deafblind and who have other disabilities. Its purpose is to help you participate in the planning of your child's educational program. As a parent or care provider, you have the best opportunities to make observations of your child at home and in the community. HomeTalk can provide a broad picture of your child's skills, special interests, and personality. HomeTalk was developed by a group of parents and professionals who know the importance of collaboration. Your assessment will be very helpful to members of your child's educational team, such as teachers, therapists, special instructors, and aides, who may not know your child well or have the chance to observe your child outside of the school.
- [On the Same Page](#) makes it easy for parents and teachers to compare how the child behaves in the two different environments and to discuss and generate logical new skills to target based on information from home and school. The form also includes space to evaluate the teaching environment using Design To Learn to identify environmental supports for learning within activities the team has identified as motivating to the child.

Power Mobility for Students with Multiple Challenges

Introduction

Mobility Core Beliefs

1. Every child has the right to move more independently and our job is to make them safe.
2. Each child must be honored in the process of mobility.
3. Transitions are the richest movement of all so the student must be involved in the transition.
4. Positioning is dynamic. There is no one position rather positions are task specific.
5. Self-produced movement is a foundational skill for learning.

This chapter will help guide the team working with students with multiple challenges to think about powered mobility and what resources your teams need to assess your student for powered mobility. Please read Chapter 2 - Assistive Technology for Seating, Positioning and Mobility. There are articles listed in the reference section for a more complete understanding about the components needed for seating and positioning for powered mobility. This chapter will pose questions to the team specifically about mobility for students with multiple challenges. Karen Kangas, and Lisa Rotelli from Adaptive Switch Labs, have been instrumental in the development of our approach to the content in this section. They carefully consider a functional approach to seating and positioning for powered mobility. Karen and Lisa believe that every person should be given the chance to try power mobility. It takes a willing team working diligently with a wheelchair vendor and specialized equipment to make this a reality for students with multiple disabilities.

Background information to think about:

Every child has the right to move more independently.

The following are several statements from professionals working in the field of powered mobility. Hear what they have to say:

Kangas (1997) believes that any child with a physical disability who is unable to walk independently, in all environments, with efficiency and safety is a candidate for powered mobility. She goes on to say, “Anyone who can demonstrate an understanding of starting and stopping can benefit from a powered wheelchair. The only motor control necessary is to get off the ‘go’. It is the adults’ job to make the child safe.”

Kermoian, (1997, quoted by Seiberlich), “If children need to demonstrate prerequisite cognitive and physical skills in order to receive a powered wheelchair and if these skills are usually developed with mobility, then many of children who could benefit from a means of independent mobility may not qualify for a powered wheelchair”

Self-produced movement is a foundational skill for learning.

(Seiberlich) Various cognitive, motor, perceptual and psychosocial skill developments are dependent upon and associated with the development of self-produced mobility in early childhood.

- Spatial cognition
- Emotional skills
- Self awareness
- Increased independence
- Ability to cope with environmental stresses

Tellefson (n.d.) “The effects of motor dysfunction are cumulative and incrementally disabling because motor action and mobility play such a crucial role at every stage and in virtually every aspect of a child’s continuing development. Secondary benefits include improved posture, increased attention, improved motivation and interaction and desire to communicate.”

Using the SETT process and Decision Making Guide

Important: It is intended that you use this as a guide for the process of assessing students for assistive technology. The Decision Making Guide follows the SETT (Student, Environment, Task, and Tool) format with a subcategory under Student and Environment for Sensory Considerations. Additional categories include Narrowing the Focus to help identify a specific task in order to select appropriate assistive technology, a category for Implementation Plan to assign trials, dates, responsibilities, data collection and also a Follow-Up Plan to set a date for the team to reconvene. Again, this is intended as a guide; during the actual assessment each topic should be written in large print where everyone can see, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

The questions posed are not intended to be all inclusive but rather to prompt the team to consider as many factors as possible in order to identify and ultimately try appropriate assistive technology for their students.

The resource toolbox at the end of this section will provide teams with some resources to get you started.

WATI Assistive Technology Decision Making Guide

Area of Concern: Powered Mobility

PROBLEM IDENTIFICATION

Student's Abilities/Difficulties	Environmental Considerations	Tasks
Current level of independent mobility • Age • Supervision • Pelvic stability • Seating position • Task performance position • Vision • Hearing • Other	What environmental considerations impact the area of mobility including staff? • Current or past AT used • Staff knowledge of power mobility • Need for other access • Transitions	What task(s) do you want the student to do that relate to mobility? Increase power mobility independence Safe transportation Other
Sensory Considerations		Narrowing the Focus
What sensory challenges does the student have that impacts mobility? (i.e., visual, auditory, tactile)		i.e. Specific task identified for solution generation
Solution Generation Tools & Strategies	Solution Selection Tools & Strategies	Implementation Plan
Brainstorming Only No Decision	Use a Feature Match Process to Discuss & Select Idea from Solution Generation	AT Trials/Services Needed: Objectives to determine effectiveness of trial Training needed Date Length Person(s) Responsible
		Follow-Up Plan
		Who & When Set specific date now.

Important: It is intended that you use this as a guide. Each topic should be written in large print where everyone can see them, i.e. on a flip chart or board. Information should then be transferred to paper for distribution, file, and future reference.

The following are suggested questions to ask when using the Decision Making Guide, and information that will help teams think more about the questions.

Student's Abilities and Difficulties

As a team, discuss what the student's abilities and difficulties are related to communication.

Age

How old is the student? What motor milestones have they achieved?

Hardy (2004) stated that children as young as 4-18 months of age are able to mobilize around their environment using any of a variety of means according to their physical development, typically; rolling, crawling, cruising, walking then running. They require constant supervision while they enjoy the opportunities to explore and learn about their environment. Children with disabilities who have no other means of experiencing independent movement can and should be given an opportunity to experience independence using an augmented mobility system. Young children using powered wheelchairs simply need the supervision and learning support (appropriate to their developmental level) normally provided to their ambulant peers.

Supervision

How much supervision does the student require for participation in activities?

Hardy (2004) found that children and adults with cognitive impairments deserve to experience and learn through independent movement. There are many ambulant people in society who have varying degrees of cognitive impairment. These people require varying degrees of supervision and support within their individual environments. People with cognitive impairments can use a powered wheelchair for mobility and should be provided the training, support and supervision required in specific environments.

Pelvic Stability

What is happening at the pelvic girdle when the student is sitting?

Kangas (2008) said that for isolation, and adequate use of an extremity to be used in a graded, controlled movement, pelvic stability with pelvic weight-bearing must occur and be controlled by clients themselves. This stability of the pelvis is not a position of immobility but rather a position that allows a range of self-controlled (limited, graded) pelvic mobility. In short, the body must allow muscle lengthening and controlled shortening simultaneously to allow controlled holding. Pelvic girdle stability is required for shoulder girdle mobility. This relationship is critically related to weight-bearing and movement.

The Seating Position

Is the student's seating system flexible? What kind of chest supports does the child have? Where is the shoulder girdle in relation to the pelvis? Does it change or stay the same throughout the day?

Kangas (2008) asserted that for many individuals with hypertonicity, or combined hyper and hypotonicity, chest supports are not working. The adult or child can be readily observed to be hanging on the chest supports, collapsing their trunks into the support, rather than being assisted by the support to remain upright.

Rotelli (2008) confirmed that the shoulder girdle is behind the pelvis you are using more peripheral vision. When shoulders are slightly forward in relationship to the pelvis, central vision is better and arm power is stronger.

Position for a Task Performance

Does the student have different positions for working versus safe mobility?

Kangas (2003) verified that seating for task performance is not a seated posture to be maintained all day, or for long periods of being inactive. In short, the seating has to allow a change in postures. This can best be developed with the use of a tilt-in-space function as well as less restrictive seating while the individual performs a task. With a powered system, the seating can be changed without changing the seat with which the individual is already extremely familiar.

Sensory Impairments

Does the student have vision or hearing issues?

Hardy (2004) said that children and adults with vision and hearing impairments are able to ambulate safely within in our society. These people need to compensate for their sensory impairment by using strategies such as assistive technology (vision cane, hearing aide etc.), environmental supports (Braille signs, curb indicator line, etc) and other support systems. Using similar principles, there would seem to be no real reason why people with sensory impairments can't be considered as candidates for powered wheelchair mobility. Problem solving around the issues involved may result in the development of new technologies for powered wheelchairs such as sensor.

Environment

As a team discuss and write on chart paper any environmental considerations that might impact the student's communication in the classroom, number of different settings or any other environmental impacts.

Assistive Technology: past and present

What assistive technology has been employed in the past or is currently used with the student? List all assistive technologies that have been used with the student. If some have been discontinued, make note of the reasons. Sometimes effective tools are discontinued for reasons that no longer exist or can be changed such as computer conflicts, lack of training, not transferring to a new building/staff, lack of interest, or other reasons that are no longer present. If the student is currently using assistive technology, note the locations, level of effectiveness, trained staff, and any other issues that are pertinent to the student/building. Do not discount assistive technology that was previously tried and discarded. There may have been a mismatch between the assistive technology and the student's skills at the time. Differences in skill development, maturity, a different environment or other factors may make all the difference.

If there is currently a chair but if the student is not using it effectively try this:

Check out the programming of the controls, can they be changed? If using a joystick did you consider using a head array?

Did you know: All wheelchairs are made to work with a joystick? This can be changed; some chairs are easier to add these electronics than others.

Staff knowledge

What is the staff knowledge of power mobility? Do you need more training?

What other person(s) do you need to connect with?

PT

OT

Wheelchair vendor

Seating and positioning

Other

Access to other devices

Will you want the student to do more than mobility? Do they need to access the computer, communication device, environmental controls?

Did you know? It is best at the time of ordering **to know that you will** want these extra accesses, **you do not need to know what** devices and what computer software.

Transitions

Is the student involved in transitions?

Did you know? This is something that wheelchairs currently don't do – but need to do.

Sensory Considerations

Different environments have different levels of sensory stimulation. If the team has determined that sensory impacts are influential for the student's learning, identify the sensory levels in each environment in which the student will be. What is calming and what is alerting and what is over arousing?

Tasks

As a team discuss and write on chart paper the tasks that the student needs to do related to mobility.

- Increase power mobility independence
- Safe transportation
- Other

Narrowing the Focus

As a team, identify by circling or other means those few tasks the student needs to do for communicating that will have the most impact.

Solution Generation: Tools/Strategies

As a team, brainstorm and write on chart paper any assistive technologies &/or strategies you think will assist the student in successfully completing those tasks you identified.

The team brainstorms strategies and assistive technology tools that may be of benefit for the student to complete the identified tasks in the given environments. Do not critique or otherwise

evaluate the suggestions at this time. List all suggested tools and strategies including those currently in use on chart paper for all to see. The following is a resource toolbox with some resources to get you started.

Tool Box for Students with Multiple Challenges: Mobility Resources Please also see Chapter 2: Seating, Positioning and Mobility

Power mobility for everyone	Baniec, M. (n.d). Pediatric Mobility retrieved from the internet 4-2009 http://www.invacare.co.nz/index.cfm/3,101,522/pediatricmobility.pdf Hardy, P. (2004) Examining the barriers: Powered wheelchair mobility for people with cognitive and/or sensory impairments. Retrieved March 19, 2009 from website http://www.e-bility.com/arataconf/papers/doc/hardy.doc Kangas, K., (2008) Why power? Why should children be considered candidates for powered mobility? retrieved 2-6-09 from http://www.patinsproject.com/KarenKangas/whypower.pdf
Seating	Kangas, K. (2003) Seating for Task Performance Closing the Gap Handout
Mastery of Independent Mobility	Kangas, K. (2008) Clinical Assessment and Training Strategies for the Child's Mastery of Independent Mobility Shamokin, PA. Available through the author @ kmkangas@ptd.net Kangas, K. (2006) Configuring Powered Mobility Systems for Children Closing the Gap Handout

Resources

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Websites and Links

Project IDEAL (Informing and Designing Education For All Learners)
Texas Council for Developmental Disabilities (TCDD).

www.projectidealonline.org/multipleDisabilities.php

Activity Ideas for Students with Severe/Profound/Multiple Disabilities

PALAESTRA: Forum of Sport, Physical Education & Recreation For Those With Disabilities

<http://www.palaestra.com/featurestory.html>

Nevada Dual Sensory Impairment project

Best educational practices for students with severe and multiple disabilities

Many informational sheet to download and low tech assistive technology ideas

www.unr.edu/educ/ndsip/factsht.html

Short outline of strategies for students with multiple challenges

http://www.lburkhart.com/learned_helplessness.pdf

Hold Everything! Twenty Stay-Put Play Spaces for Infants, Preschoolers, and Developmentally Young Children with Sensory Impairments and Other Special Needs by Kay L. Clarke This 48 page manual is available for download through The Ohio Center for Deafblind Education

www.sscsco.org/ocdbe/products.html

Switch and touch screen “videos” can be downloaded all are available in PC format but not all in Mac version. They include cause effect activities and interactive talking books. This resource also includes lesson plans and teaching ideas.

<http://www.priorywoods.middlesbrough.sch.uk/>

Short outline of strategies for students with multiple challenges

http://www.lburkhart.com/learned_helplessness.pdf

Switch and touchscreen “videos” can be downloaded all are available in PC format but not all in Mac version. They include cause effect activities and interactive talking books. This resource also includes lesson plans and teaching ideas.

<http://www.priorywoods.middlesbrough.sch.uk/>

Design to Learn - This resource includes strategies and materials address the educational needs of children and adults who have severe disabilities, including multiple and "low incidence" disabilities such as deaf blindness and autism.

<http://www.designtolearn.com/>

Communication Resources

Articles on communication for severe profound and tangible symbols

<http://www.designtolearn.com/pages/articles.html>

Online book about tangible symbols

http://osepideasthatwork.org/toolkit/InstPract_tan_sym.asp

Articles on Tangible symbol

<http://www.mayer-johnson.com/ResearchArticles.aspx>

Helen Keller National Center for *Deaf-Blind* Youths and Adults ... and Cued Speech for the Student with Deafblindness by Robbie Blaha, Education Specialist, ...
www.orientationandmobility.org/deafblind.html

Cortical Visual Impairment

Here you can find Tangible Symbols book online to download.
http://ohiolionseyeresearch.com/cortical_visual_impairment.htm
http://osepideasthatwork.org/toolkit/InstPract_tan_sym.asp

Organizations and Associations

Family Connect
American Foundation of the Blind and the National Association for Parents of Children with Visual Impairments
www.familyconnect.org/parentsitehome.asp?SectionID=79

Family Center on Technology and Disability
This site is Funded by the U.S. Department of Education The Family Center on Technology and Disability provides a wide range of resources on assistive and instructional technologies,
www.fctd.info

TASH (formerly Association for Persons with Severe Handicaps)
www.tash.org

The Arc of the United States
www.thearc.org

United Cerebral Palsy Associations, Inc.
www.ucp.org

Curriculum Examples

The Learning Standards and Alternate Performance Indicators for Students with Severe Disabilities [Final Version]
<http://www.vesid.nysed.gov/specialed/publications/learnstand/lrnstdi.htm>

New Jersey adapted curriculum
<http://www.state.nj.us/education/specialed/cccsssd800.pdf>

Books

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Vendors

Vendor	Summary	Contact Information
Attainment Company	This company produces a variety of products including augmentative communication devices, software, videos, and curriculum. Programs utilize a picture-based approach for teaching low-level or non-readers the skills for active participation in their home, school and work communities. All materials are particularly appropriate for young adults.	www.attainmentcompany.com
Ability Hub	Information on adaptive equipment and alternative methods available for accessing computers.	www.abilityhub.com
Ablenet	This company develops and markets products and services to meet the needs of children and adults with severe disabilities. Products include simple technology systems and related materials that allow users to actively participate in daily activities.	www.ablenetinc.com
AblePlay	AblePlay is a website developed by National Lekotek Center which provides a unique search tool to match toys to disability categories: physical, communicative, sensory and cognitive	http://www.ableplay.org/
Clicker Crick Software	Clicker is a writing support and multimedia tool, which enables you to write with whole words, phrases or pictures. It is switch accessible.	www.cricksoft.com/us/products/clicker/
Communication Matrix	The Communication Matrix is an assessment tool designed to pinpoint exactly how a child is currently communicating and to provide a framework for determining logical communication goals	http://www.communicationmatrix.org

Vendor	Summary	Contact Information
Don Johnston Literacy Starters	Switches, computer interfaces, software from early literacy to learning disabilities, resource books.	http://www.donjohnston.com/
Dynavox Mayer-Johnson LLC Boardmaker	Mayer-Johnson, Inc. Picture Communication Symbols (PCS) used in augmentative communication. Products include educational materials, software used to make communication boards, educational materials, and overlays for different computer access devices and for speech output	www.dynavoxtech.com
Enabling devices	This company develops learning and assistive devices to help people of all ages with disabling conditions including communicators, toys and switches for the physically challenged students.	http://enablingdevices.com/catalog
Every Move Counts tm	A sensory based communication program for individuals with severe multiple differences, developmental differences and autism.	http://www.everymovecounts.net/Index2.htm
Inclusive technologies	Inclusive Technology provides special educational needs software, switches and computer access devices, simple communication aids and assistive technology for learners with a physical disability, sensory impairment or learning difficulty. Their resources include SwitchIt!, ReadIt! and Choose and Tell software series.	http://www.inclusive.co.uk click on severe and complex special needs tab
Intellitools	IntelliKeys® USB, versatile, alternative keyboards that enable users with physical, visual or cognitive disabilities to easily type, enter numbers, navigate on-screen displays, and execute menu commands.	www.intellitools.com/
Lekotek	Independent ratings of toys/play ideas for individuals with disabilities	www.lekotek.org
Rifton	Positioning and self care products	http://www.rifton.com/

Vendor	Summary	Contact Information
Sammons Preston	Positioning and self care products	www.sammonspreston.com/
SoftTouch	SoftTouch develops software for students in early childhood and students of all ages with significant disabilities. They specialize in emergent literacy and language development software with engaging use of music and animation. All software is accessible by one and two switches, touch screen, mouse and IntelliKeys keyboards.	www.ablenetinc.com/
Stages Assessment software	<i>Stages</i> is a seven-level developmental framework that describes a learner's cognitive and language abilities. Stages helps schools comply with alternate assessment mandates by providing an accessible way to assess learners with special needs. Stages also serves as a selection guide for curriculum activities (including both software and off-computer activities). The sequence of seven Stages is based on the work of Madalaine Pugliese, a nationally recognized authority in the fields of assistive and instructional technologies.	http://www.intellitools.com/