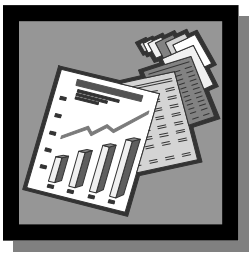


How Do You Know It? How Can You Show It?

Penny Reed
Wisconsin Assistive Technology Initiative
Gayl Bowser
Oregon Technology Access Program
Jane Korsten
Responsive Centers for Psychology and Learning

Wisconsin Assistive Technology Initiative
448 East High Street
Milton, WI 53563
Phone 800.991.5576 Fax 608.868.6740
***Visit our website at* www.wati.org**

This How Do You Know It? How Can You Show It? manual was made possible by funding from IDEA grant number 9906-23. Its content may be reprinted in whole or in part, with credit to WATI & Wisconsin DPI acknowledged. Reproduction of this manual, in whole or in part, for resale is not authorized.

Acknowledgements

The authors would like to thank all of the students, teachers, therapists and parents who continue to use assistive technology.

Special thanks to Maureen Palecek and Mary Chapin for transforming our charts, graphs and text into such an attractive and readable finished product, and to Therese Canfield and Paula Walser for their helpful suggestions.

Preface

Assistive Technology, as a field of service, has been around for over 30 years and during this time there have been many changes. Vendors have come and gone, equipment has become more sophisticated, consumers and service providers have become more knowledgeable. Initially, the focus was on products rather than on process. However, this focus is beginning to shift. Strategies to guide the decision making process have become increasingly important as more and more technology alternatives become available. IEP teams, IFSP teams, transition teams and rehabilitation teams are all charged with examining an individual's need for assistive technology. In this manual the IEP team will be referred to, but keep in mind that it could be any of these teams that need to address assistive technology. Today's service providers must be able to objectively document the impact of technology on an individual's performance before recommending long term use.

The purpose of this manual is to guide teams in developing strategies to evaluate the effectiveness of assistive technology. Rather than providing 'the' way to measure, *How Do You Know It? How Can You Show It?* presents a 'thought process' to support the development of data collection appropriate for a variety of assistive technology applications. It is intended to help service providers develop a plan for gathering data in specific situations.

Table of Contents

1

Understanding School District Responsibility

The provision of assistive technology by school districts is specifically mandated by the Individuals with Disabilities Education Act (IDEA '97). It states:

300.308 Assistive Technology

(a) 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—

(1) Special education under 300.26;
(2) Related services under 300.24; or
(3) Supplementary aids and services under 300.550(b)(2).

(b) On a case-by-case basis, the use of school-purchased assistive technology devices in a child's home or in other settings is required if the child's IEP team determines that the child needs access to those devices in order to receive FAPE.

The definitions for assistive technology devices and services are:

300.5 Assistive Technology Device

As used in this part, "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 functional capabilities of children with disabilities. 300.5 (Authority: 20 U.S.C. Section 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 of the child, in the child's customary environment;
(B) purchasing, leasing or otherwise providing for the acquisition of assistive technology devices by children with disabilities;
(C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of assistive technology devices;
(D) coordinating with 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 a disability, 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 children with disabilities. (Authority 20 U.S.C. Section 1401(2))

In addition to IDEA there are two other laws that may affect the provision of assistive technology. Both the Americans with Disabilities Act and Section 504 of the Rehabilitation Act encompass assistive technology (Golden, 1998). These laws address access to public programs for individuals including education. They both apply to a broader group of individuals with disabilities than IDEA does. For children who do not require specially designed instruction, Section 504 or the ADA may still require school districts to make assistive technology decisions. School districts may need to consider assistive technology to insure that students with disabilities have "equal access" to an appropriate education under Section 504 or are receiving the "effective communication, equal access, and consideration of consumer preference" under the ADA. Golden (1998) points out that school districts often assume that once they have provided FAPE, other standards are satisfied, because FAPE is a higher standard. However, there are students with only sensory or motor disabilities who may be entitled to "auxiliary aids and services" under the ADA (which includes assistive technology), that are clearly not required by FAPE and may not be required for "equal access."

The definitions of assistive technology devices and services raise many questions in the minds of educators, related service providers, and families. Here are some of the most frequently asked questions.

- What does it mean to "need" assistive technology?
- How do we know if assistive technology is "required" for FAPE (Free Appropriate Public Education)?
- How do we figure out if one product is better than another for a given student?
- How do we know if assistive technology is needed at home or in other settings?
- What information does the Individualized Educational Program team require to determine the need for assistive technology?
- How do we know when the assistive technology is working as planned?

When questions like these are raised, the conversation is frequently charged with emotion. For instance, when someone requests assistive technology for a child with special needs and others do not feel it is necessary, there are typically strong feelings on both sides. This is equally true whether the request comes from the family or a staff member. In other instances there may be disagreement about exactly which hardware or software is the "right" choice. Frequently there are questions about whether a "low tech" solution is as effective as a "higher tech," more expensive solution. Other questions center around whether assistive technology that has been provided is working as expected, whether the child is better able to complete critical tasks, or whether the assistive technology is necessary for the child to receive FAPE.

Some of these questions arise at the time of a formal referral for an evaluation of the need for assistive technology. Others may grow out of the consideration of the need for assistive technology that is now required as part of every Individualized Educational Program (IEP) meeting. Questions about assistive technology may surface at any time during the delivery of special education services. Bowser and Reed (1995) suggest through *Education Tech Points* that there are specific questions about assistive technology that should be addressed at every step of the special education process. The team may find a need to collect or analyze data at the point of referral, evaluation, or any time during plan development, implementation, or periodic review. Times of pending transition often require data gathering and analysis.

In this manual the IEP team will always be considered as the decision making group. IDEA '97 (and preceding laws) clearly empower the IEP team to make all decisions about a student's individualized educational program including those related to assistive technology devices and services. The IEP team may call upon additional individuals with specific expertise in the area of assistive technology to work with their team. They may also have written reports from other sources that address the need for assistive technology or even suggest specific devices or services. In any case, input from these sources are only recommendations. It is the IEP team that must gather all needed information and make necessary decisions.

It is the belief of the authors that all assistive technology questions can be answered if the IEP team:

- Frames the question in a way that allows it to be answered.
- Identifies the information that will be needed to arrive at an answer.
- Collects and analyzes the specific data and general information.
- Uses that collected data and information to formulate an answer to the question.

In this manual a variety of scenarios will be explored and used to identify information that might be useful in answering the underlying question. Then ways to collect and record that information and data will be discussed. Many simple forms that support the recording, analyzing, and understanding of the data are included. Full copies of these forms are included in the appendix for your use. However, it is important to understand that there is no universal data collection form. These are simply examples. Even though it may appear that the question for your student is the same as one of the examples, each student's needs are unique. Your team needs to think about the specific questions and what information or data is needed to answer those questions. Then a form can be developed to collect that specific data.

Summary

IDEA, Section 504, and the ADA require schools to consider the need for assistive technology for students with disabilities. The IEP team is required by law to make all decisions about the program for a student who requires specially designed instruction. Teams can make good decisions about assistive technology if they collect and use appropriate data.

2

Framing Assistive Technology Questions

What does it mean to "Frame the Question?" It means to adjust the original request or question until a question is articulated that gets at the root of the issue and can be answered. One common error that IEP teams make when they begin to address a question about a child's need for assistive technology is that they may not spend enough time thinking about the actual problem they want to solve. Sometimes the questions that are asked are too broad and the team attempts to address that broad question without first breaking it down into smaller, more manageable questions.

Ryan's parents have requested a computer for Ryan who has a learning disability. The school staff members are not sure he needs a computer any more than all the other students in the class. How do we know if he "really" needs it?

Ryan's team could easily get into difficulties if they don't address the issue in more detail. They need to find out what Ryan's parents believe a computer would do for him. Assistive technology is a tool to help a child do something with which he has difficulty because of his disability. What tasks are difficult for Ryan? What is his present level of performance on those tasks? How does Ryan currently complete those tasks? Is a computer a reasonable tool to use to complete those tasks? Answering these smaller questions will help prepare the team to address the larger issues.

Errors in framing the question can occur if the team is not familiar with the results of research on the impact of assistive technology use. MacArthur (1999) found that the use of text to speech and word prediction software resulted in improved spelling and legibility for four out of five students with learning disabilities; however, no differences were found in the length of

of the text written or the rate of composing the written material. If the team expects that a student with a learning disability will write faster or write more because of the provision of this type of assistive software, they may be looking for the wrong evidence on which to base a decision about effectiveness.

Another common error teams make when trying to address the need for assistive technology is to begin with a question that is to specific.

Barbara has used a voice output communication aide for many years. Her speech therapist recently saw a new voice output device called an "Armadillo." She thinks it would be just right for Barbara. The speech therapist asked the team to find out "how we can get an Armadillo for Barbara."

Again, a question that is not appropriately framed can cause a team to experience conflict. The speech therapist's supervisor may think that an Armadillo is too expensive for Barbara and ask that a less expensive device be purchased. Barbara's mom may think that Barbara's existing voice output device works just fine and besides, she wants Barbara to "try harder" to communicate without an assistive technology device. The classroom teacher may be worried about how difficult it will be to program the Armadillo to support Barbara's ability to interact during classroom activities. Because this team has not described Barbara's performance, they are likely to take sides in an argument that does not have a solution and that is focused on equipment rather than Barbara's specific needs.

Another error occurs when individual team members rely only on their own personal opinions or personal experiences when considering the need for assistive technology. This error is most common when the team has agreed upon the nature of the task the child needs to accomplish but has not identified the specific characteristics of the child's performance or specific characteristics of the environment(s) in which the child needs to use the device. For example, the environment may be louder or quieter or more distracting than the situation they previously heard about or saw. The activity may be occurring in an auditorium or on the floor rather than at a desk. The situation may require a larger vocabulary or allow a shorter time to respond.

There are many variables that can affect how a specific assistive technology tool works for a child. What works for one child in a given situation may not be at all appropriate or even functional for another child in a different situation.

Here the team is trying to address a question based on personal experience.

Sally's mother thinks Sally should have a voice output device with dynamic display, but the speech/language pathologist wants one with semantic compaction (e.g. Minspeak) because she has worked with devices using semantic compaction for many years. Should Sally have a voice output device with dynamic display or semantic compaction?

The team is not ready to answer this question. Sally's preference for and ability to use one or the other of these devices (or possibly a totally different one) in specific situations will need to be addressed before a decision can be made.

Common Types of AT Questions Which Can Be Answered With Data

When teams ask questions about a child's use of assistive technology, the questions most often fall in into one of the following types of question.

- What is the difficulty?
- Is there a need for assistive technology to help solve the problem?
- What assistive technology is needed?
- Does the tool that has been tried make a difference? In what settings? Under what conditions? To do what?
- Which tool should be chosen?
- What is happening with the assistive technology that is in use?

It's important that everyone agree on the question or questions to be answered before efforts are made to find the answers. If one team member wants to know what the difficulty really is and another team member wants to know which device is the best one, it will be difficult to plan together to collect data and find the answers.

Well Framed Questions

Here are assistive technology questions that are more useful to a team. All of these questions can be answered. They lend themselves to the collection of specific data that can lead to an answer.

- *The occupational therapist believes Kelly is activating a switch on purpose, but the classroom teacher and assistant believe it is random. How can the team tell if Kelly's actions are purposeful or random?*
- *The speech language pathologist strongly recommends a voice output device for Jason, but his parents are not sure it is needed because they understand him at home and prefer that Jason communicate with speech. How does the team decide whether or not to use a voice output device in some environments?*
- *Kristin, who has significant motor differences, uses the computer for all written work. She is having difficulty using the standard mouse. The teachers and therapists want to know if there is an alternative that will work better for her. How can the team figure out if there is a mouse alternative that will be easier for her to use?*
- *Andrew uses talking word processing during school and his parents want it used during the state assessment. How can the team decide if he should use talking word processing during the state assessment?*
- *Samantha has made very little progress in using her voice output communication device. How does the team determine what is holding her back?*

Summary

Before you begin to think about data collection, it is important that you have a question in mind and that you really want to know the answer. Questions like those above provide enough information to allow the team to focus on a specific problem or issue, and the team has not prematurely predicted what the answer will be.

3

Answering the Questions

Questions related to the use of assistive technology can only be answered appropriately if specific information about student performance is collected and analyzed. How should this information be collected? When should it be gathered? How long should a child's performance be evaluated before a decision is made? The purpose of this manual is to provide suggestions and strategies that will be useful to teams as they strive to collect measurable and observable information on the need for assistive technology and the results of its use by students with disabilities. This kind of specific, measurable information is called data.

What Is "Data" and Why Is It Needed

Humans have a great gift. It is called "memory." People can observe something one day and recall it many days, months, or years later. Unfortunately, the accuracy of memories varies greatly. As a person tries to remember many separate events, memory can become less accurate. In addition, different team members may perceive things differently or remember events differently after time has passed. Writing down, or recording, what took place, so that it can be reviewed at a later date is the best way to have an accurate and usable memory of what actually took place. This recording of an event or series of events creates specific ***data***. For instance, if a team wanted to know whether a student was pressing a switch on purpose and data already showed that she liked music, the team might use a switch connected to a tape recorder. Research shows that if a behavior is in response to a particular event, it will occur within three to five seconds of that event (Brinker, R. & Lewis, M., 1982). With this arrangement, they could record how often the student pressed the switch within three to five seconds after

the music stopped playing. The team could compare that to how often the student activated the switch when no music played. If there is a difference in the frequency with which the student activates the switch, data will show that the student is purposefully activating the switch.

Another way to think about data is that it is a very specific type of information. One description of data is ***the recording of observable and measurable performance.*** Collecting data can be as simple as recording the number of times an event occurred or the time of day that it occurred. It can be how loud or long or accurate that event was when it occurred. Both specific data and other less specific information such as what types of assistive technology are available for a given task, who has experience with that assistive technology, and where to get the assistive technology are important. But general information alone is not sufficient to answer typical assistive technology questions. Past experience also may suggest what might work, but past experience alone is not enough to determine what will work best for a given child in a given setting. That is why data is needed. Data adds a different "voice," telling that the child has shown a preference for that tool, understands that concept, or has mastered that step and is ready to move on (Lehman & Klaw, 2001).

When a team needs to decide whether or not assistive technology will enhance student performance on a particular task, comparing student performance with and without the technology could provide the answer. For example, if it was important to know if a computer was more effective than a portable word processor for a student who needed to complete written assignments, the student might be trained on each, then alternate their use each week for a month and compare written assignments. If the team wanted to know whether a student has a preference for one type of symbol over another, they might record the accuracy with which a student communicated using each set of symbols for a short time. If the question was whether a particular computer access mode such as voice recognition was more or less effective than an alternative keyboard or the regular keyboard, samples could be completed using each of these tools. Comparing those samples would help answer the question.

The first step in data collection is to clearly and accurately define the problem or question that needs to be addressed. Discussions about the real question and how to answer it need to involve participation of the entire team. The team always includes the family and the child. The amount and type of participation by the child depends on the child's interest and ability to understand and contribute. Remember that this is the IEP team, with any additional members needed to help answer specific questions. The team needs to work together to formulate and answer questions about assistive technology. The process would look something like this.

1. The team members identify the difficulties the student is experiencing and discuss what may be causing those difficulties. Team members review existing information and data. During this review, the team decides what else they need to know in order to make an informed decision about the need for assistive technology.

2. The team members gather new (baseline) data if the existing data did not provide all needed information.

3. The team reviews the problem that is now clearly identified, generates possible solutions, and develops a plan to try the potential solutions.

4. During the next few days, weeks, or months, depending upon the specific situation, each solution is tried and data collected.

5. The team analyzes that data and makes decisions about longer term use or permanent acquisition of one or more assistive technology tools.

6. If specific assistive technology was identified as being needed, it is then written in the IEP.

Apparent in this suggested process is the need for the team to work collaboratively in order to complete activities and make appropriate decisions.

When Is Data Needed?

Here is this process in action.

At the time that his IEP team first began to consider the need for assistive technology, Christoper was 3 years old and attending an Early Childhood Special Education (ECSE) class. The IEP team consisted of his parents, the ECSE teacher, the speech language pathologist, the occupational therapist, and the physical therapist. They requested a district assistive technology specialist to work with them.

Team Meeting: *The team met and identified this information.*

- *Christopher was able to bring his hands together at midline to fiddle with his bib and pat his chest.*
- *He was also able to cross his legs by placing one ankle onto the other knee.*
- *These appeared to be self-stimulatory behaviors.*

His team was in agreement that they wanted Christopher to use intentional gestures to make requests and to use his hands to play. They felt that assistive technology, used in conjunction with the movements he could already do, might be the key. They felt they had a lot of existing data but that they needed to know what was reinforcing for Christopher.

Gathering More Baseline Data: *The team used the "Every Move Counts Assessment" (Korsten, Dunn, Foss, & Franke, 1993) to gather that data. From this data, it became apparent that Christopher found lights, music, and vibration to be pleasurable activities. The team now knew what to use to motivate and reinforce Christopher's movements.*

The team met again to discuss the next steps and to plan the intervention. Following that meeting, Christopher's environment was structured to provide switch use opportunities; his team wanted to know at what point purposeful switch use would emerge.

Over the next few weeks at designated times each day, Christopher was positioned so that his self-stimulatory behaviors would activate a switch. They used a small, round, 1" diameter switch, on a Velcro band around his knee, that would be activated when his ankle was crossed over the knee. They used a slightly larger, round switch, about 2" in diameter, placed on his bib, that would be activated when his hands were brought together at midline.

Beginning Data Collection: *It was agreed that data about the effectiveness of the plan would be collected by periodic video taping of Christopher in his classroom with the switches in place. Staff would video tape Christopher and send the tape to the AT consultant, who would view the tape and record the number of switch activations observed. The first, baseline tape captured three switch activations during a 20 minute period.*

Further Decisions: *This team felt that they needed to meet weekly until they were sure they were on the right track. At the next meeting it was reported that Christopher had activated the switch three times in 20 minutes. The team set a goal for Christopher to activate a switch on an average of seven times in three minutes. The next tape revealed that Christopher had met the goal with an average of nine switch activations per three minute time block. Upon viewing the tape, however, the team agreed that the increase in switch activations was actually due to increased ability on the part of the staff to position switches and make them more easily accessible.*

The team responded to this data by revising Christopher's plan and introducing a switch latch timer. The goal then became for Christopher to reactivate an activity within 5 seconds of shut off. Christopher was provided with daily switch use time and video taped on a monthly schedule. The tape was sent to the AT team members for review and summary. Data was summarized on the following format.

NAME: Christopher
DATE: October 3, 2000

Consequence Stops	Consequence On-going
Reactivated within 5 seconds *5*	
Reactivated beyond 5 seconds *2, 7, 8, 9, 10 , 12, 13, 14, 15*	Activated while consequence is occurring *1, 3, 4, 6, 11*

Comment: Each number indicates the sequence of the movement. The first switch activation is 1, the second is 2, the third is 3, and so forth.

Analysis: October – Pattern appears random, only 6% are within five seconds while 33% occur while activity is ongoing.

NAME: Christopher
DATE: February 1, 2001

Consequence Stops	Consequence On-going
Reactivated within 5 seconds *3, 4, 6, 7, 8*	
Reactivated beyond 5 seconds *1, 2, 5, 9*	Activated while consequence is occurring *10*

February – Pattern appears to be becoming purposeful, 50% within 5 seconds with only 10% while activity is ongoing. The pattern of responses is changing

Ongoing Data Collection: *Each time Christopher activated the switch, the number of the activation was entered in the appropriate cell. In this way, it was not only possible to tell whether the desired activations (those within 5 seconds) increased, but also whether the desired activations decreased as the activity went on. In other words, if it were noted that the actual numbers of desired activations (those within 5 seconds) did not increase, but the pattern shifted from random to predictable, then the intent would be met. The intent was that Christopher understand switch use. If his activations within 5 seconds were high when the activity was new and lower as the activity went on, then it might indicate that he understood switch use and was declining to use the switch as he became tired of the activity.*

Data collected in this way provided not just a number count, but also a way to look at the pattern of Christopher's responses. In this example 100% is not a desired goal. The desired outcome is that Christopher understand switch use. This would be better reflected by a pattern of using the switch when the activity was new and declining to use it as the activity went on. Looking only at percentage of hits would not provide this level of information.

Summarizing: *This team decided that the switch use was purposeful and that Christopher was well on his way to meeting the IEP goal of using intentional gestures to make choices.*

Other Examples

It's important to know that there are many instances when data may need to be collected. The first instance is to help clarify the nature of the problem by collecting initial data.

So sometimes we collect data to help define the problem. When doing so, we sometimes discover that assistive technology is not the answer.

David, a seventh grade student with severe cerebral palsy, wasn't turning in his homework. The special education teacher thought writing was too difficult for David and that was why he was not turning in assignments. After collecting data for two weeks, it was obvious that he just didn't turn in assignments, even when they were completely and appropriately done. Focusing on finding another way to complete the written assignments would not have solved the problem. Instead, he needed a behavior management program designed to help him turn in assignments.

Another instance when collecting data might be useful is to be able to analyze the impact of the use of assistive technology. This may be to make a choice about a specific product or type of product, or to determine if the assistive technology does indeed increase, maintain, or improve a specific functional capability for the child.

Amanda was having trouble in math. Her teacher gave her a number line to help her do math assignments. Then one day Amanda asked if she could use a calculator when she worked on word problems. Amanda and her teacher agreed that she could use a calculator for two weeks, and then they would compare her work to assignments she had done with the number line. That way they could see if the use of the calculator helped improve Amanda's ability to complete math word problems. If the calculator improves the functional capability of completing math word problems, then it may be assistive technology for Amanda.

STUDENT: Amanda

	TOOL USED			
Date	**Calculator**	**Number Line**	**% Correct**	**Comments**
11/04		X	70%	Baseline
11/05		X	76%	Baseline
11/06		X	72%	Self selected tool
11/07		X	65%	Self selected tool
11/11	X		80%	Self selected tool
11/12		X	75%	Self selected tool
11/13	X		90%	Teacher directed her to use calculator
11/14	X		88%	Self selected tool

A third instance when data collection may be useful is to help identify specific difficulties with the use of assistive technology.

Patrick recently got a new voice output device, and he doesn't seem to be using all of the available messages. The team needs to know what is actually happening. Is he unable to reach some of them? Are they too difficult to activate? Does he not understand the messages? In order to understand why he is not using these messages, very specific observation of Patrick's use of the device will need to take place.

What if the Team Doesn't Know Where to Start?

Sometimes, when faced with questions about assistive technology, the IEP team may not know where to start. This is especially true if the question is in the form of a request for an evaluation of a child's need for assistive technology. Two statewide technical assistance programs, The Georgia Project for Assistive Technology (www.gpat.org) and the Wisconsin Asssitive Technology Initiative (www.wati.org) have developed assistive technology assessment tools that can be downloaded from their respective websites. These tools are free and can help guide the teams through the process of defining the problem, framing the question, and planning for gathering necessary data.

In addition, if the team needs to know more about assistive technology, they might begin by downloading *A Resource Guide for Teachers and Administrators About Assistive Technology* (Reed, 2004) from http:// www.wati.org. This simple guide offers an introduction to a range of assistive technology tools. For more in-depth information on assistive technology, another resource is *Assessing Students Needs for Assistive Technology* (Reed, 2000).

Summary

Questions about assistive technology can only be answered with accurate information and appropriate data. Data adds a different "voice" that cannot be obtained from any other source. Data should be collected to answer a specific question. There are assistive technology assessment tools that can guide the team and suggest the questions that need to be asked.

4

Gathering Information

Decisions are made daily based on both general information and specific data. The decisions about which products to buy at the grocery store are generally based on data. That data might be about family members' stated preferences or how long a product lasted, how well it worked, or how easy it was to use. Different data is considered when selecting paper towels than when choosing spaghetti sauce. Sometimes the cost is the most important factor, but in other situations experience has shown that the cheapest product doesn't meet the family's needs. On the other hand, when there is no data, people may find themselves bewildered when they stand before a display of several dozen similar products. They may also find themselves making purchases that do not meet their needs!

When trying to answer a question about a student and assistive technology, it is important to have both general information and specific data. General information includes things such as the types of assistive technology that exist, the major vendors for various types of assistive technology, what assistive technology the district already owns, who is knowledgeable about specific tools, what has been tried in the past, useful web sites to get more information on assistive technology, etc. Data is more specific than general information.

One piece of information that we need is the goal for the use of the technology. This is necessary in order to determine the best strategy for evaluating the effectiveness of the technology. For example, if the team wants to "try technology to see if a student's writing will improve," they have information but not data. The goal is too general to guide selection of appropriate technology. What constitutes "improved writing?" Is it the quality of the writing or the amount or both? Is it really a spelling problem or letter formation problem? If, on the other hand, the teacher states his concern that the student's written products are an appropriate length, appear to include critical facts, but are so illegible that the teacher cannot read them, then the team knows that a tool to replace handwriting may be useful. If they also have data that tells them that keyboarding has been taught but is not a viable option, then they know that they may want to explore an alternative keyboard or voice recognition software.

When approaching the task of gathering information about the use of assistive technology, there are a series of questions to ask.

1. What is it the student needs to do with the assistive technology?
2. What kind of change could there be in the way the student completes the particular task?
3. What aspect of the student's performance will change?
4. What is the best way to gather data to show that change?

Identifying the tasks is always first. When thinking about the expected change in the way a student completes a particular task, there are some considerations. Is the expectation that the technology will allow the student to do more of what he already does (quantity) or do better at what he already does (quality)? Changing the quantity suggests that the data will involve counting amounts of something with and without the use of technology. Changing quality suggests that effectiveness will be best evaluated by comparing samples of something done with and without the technology, or observing the student as he or she works to collect data about how the student performs the task.

When thinking of what aspect of the student's performance might change as a result of the technology use, consider all possibilities. It may include changes in speed, accuracy, spontaneity, frequency, or duration. In other words, will the student be able to make his needs known more quickly, more often, to more listeners, or with less prompting? Will the technology allow the student to write more words per minute, use more age appropriate language, have fewer illegible words, or experience less fatigue when writing?

In thinking about how you expect the performance to change, it is important to remember that, while technology can be a very effective tool for students with disabilities, technology alone is rarely sufficient. Because students frequently struggle with multiple aspects of a task such as writing, technology alone rarely addresses all of the students' writing needs (Fennema-Jansen, 2001). To fully meet a student's needs, instruction in the use of technology must usually be combined with instruction in the use of strategies. Collecting data on the use of any technology that was provided without adequate training or without the teaching of appropriate strategies may lead a team to believe the technology was not useful.

Another thing to remember at this point is that it is important to know what types of change are realistic. Research on the impact of assistive technology use can help a team have reasonable expectations. For example, MacArthur (1999) found that the use of text to speech and word prediction software resulted in improved spelling and legibility for four out of five students with learning disabilities. However, he found no difference in the length of the written material or the rate of composition. Therefore, setting a goal for increased length of written output using assistive technology may not be realistic for a student with a learning disability. However use of word prediction by a student with a motor impairment might result in a change in both production speed and length of written products, because it reduces the number of keystrokes needed.

When thinking about what type of data may be needed, the focus is on how the expected changes will best be seen. Data should be collected in the easiest but also the most effective manner.

There are four basic ways to gather information or data:

- Interviewing the student
- Reviewing finished products created by the student
- Observing the student's performance completing the task
- Video taping the student while doing the task

Summary

As we prepare to gather useful data, we must ask a series of questions about what it is the student needs to be able to do and what aspect of change in performance we may expect. We then design a plan to collect data that will demonstrate that change. There are four basic ways to obtain the information: interview, review finished products, observe, or video tape.

In the following pages, each of these will be discussed, pointing out some pros and cons of each method and suggesting the most appropriate times to use it. It is important to remember that you may need to gather data in more than one way to answer your question.

5

Interviewing the Student

When the student is able to answer questions about his or her needs or preferences, interviewing may be the simplest way to gather necessary information. Giving the student the opportunity to try two different software programs and then asking which one he preferred and the reasons he preferred it is a fast and efficient way to gather information when the student can accurately and reliably provide that information. Because the student's feelings and opinions about a specific solution are very important in determining whether he will use that solution in the long run, they are also extremely important in making decisions about assistive technology. Interviewing is the most suitable data collection method if you want to understand the experiences of the student and the meaning that student makes from those experiences (Siedman, 1991).

> **Caution: While student's feelings about a particular assistive technology solution are important, they are not the only thing that the team should consider.**

Some students would prefer to use a computer when a portable word processor is sufficient. Other students may not want to wear hearing aids because they look different, but without them they will not be able to receive adequate instruction. While important, student preference may be only one of several significant factors.

A student interview may also be helpful in determining what features of the assistive technology are the most appealing or utilitarian for the student. For example, if a student tries two different portable word processors and prefers one more than the other, he may be able to tell you the reason.

The keys may be easier to activate on the one he prefers; he may like the fact that he gets more support for his hand on the preferred device; or he may like the auditory feedback from the slight click when each key is depressed. This information can be helpful in both present and future decision making. These facts are not easily learned through any of the other methods of data collection.

Interviewing is most helpful when it can provide information quickly or information that is not easily learned through other methods of data collection. For instance, a device may offer all of the features that we have determined are needed, but the student appears to dislike the device and avoid using it. If the student can tell us that she doesn't like the texture of the surface she needs to touch to activate it, then we can change that surface rather than discarding the idea of utilizing that device.

Shannon is a high school student with arthritis and mild learning disabilities who had been experiencing increasing pain in her thumb and forearm for several months. She and her mother had discussed it and were worried about the possibility of carpal tunnel syndrome. They decided that, before going to the doctor, Shannon should ask the occupational therapist (OT) if she had any suggestions. Shannon was not currently receiving OT, but she had in the past. The OT met with Shannon after school and brought along a kit with a variety of pencil grips, pens, pencils, and a soft splint. She suggested that Shannon try some of them and keep track of any differences. They agreed that Shannon would probably need to use each one for at least a week, unless she really disliked the feel. They decided that Shannon would keep a record in a small notebook that the OT provided. Shannon described the device, then wrote any comments she could think of. She planned to write something each day so she wouldn't forget. If all she could write was "no difference," that was fine. Shannon tried four of the pencil grips over a three week period. None of them seemed to make much difference. Then Shannon tried a strange looking pen in the kit. It was called a ring pen. It fit over her index finger. She wasn't sure she liked it. It felt kind of strange. That was her comment the first day.

But she remembered that she had agreed to try them for at least a week unless she really disliked the device. By the third day she realized that there was no pain. She had completed all of her written assignments and felt no pain. The same thing was true the fourth day. By Friday she had definitely decided this was a tool that made a difference. She left a note in the office for the OT. When the OT came to see her the next week, she quickly reviewed Shannon's notes and asked her some additional questions. She agreed that this was a good tool for Shannon. Shannon kept the ring pen permanently and the OT ordered another one for her "writing kit."

Although this example involved a written anecdotal record, it was essentially an interview. The focus of the data collection was the collection of information about the student's opinion. Only the student herself could determine what "felt" better and, most importantly, what tool caused the pain to stop.

Elena had a great deal of difficulty with handwriting. Improving writing was one of her IEP goals. She had been taught to keyboard last year in fifth grade and liked to use the computer. However there were only three computers in her classroom and they were located at the back of the room. They worked great for researching websites and other assignments, but weren't a good choice for taking notes and doing short assignments at her desk. Elena's teacher knew that there were portable word processors available in the school and from the district's assistive technology lending library. She and Elena talked about them and Elena agreed to try them. Elena tried three different brands of portable word processor for one week each. At the end of the three weeks, her teacher asked her what she liked about each one and why. One was clearly her favorite. It was less confusing to her than one of the others and felt "right" when she used the keyboard. It had all the features Elena needed at that time. After their discussion Elena's teacher put in a purchase order to get one for Elena to use all of the time.

Interviewing can be a useful tool to help a student begin to explore how assistive technology might help them. *Hey! Can I Try That? A Student Handbook for Choosing and Using Assistive Technology* (Bowser & Reed, 2001) provides a useful tool to help a student understand assistive technology and become more involved in making decisions about its use. The following interview questions from *Hey! Can I Try That?* can be helpful in getting started.

Assistive Technology Student Interview

1. What are the classes that are hardest for you?
2. In your classes, what are the tasks that are the hardest (like copying from the board, understanding the book, writing math problems, etc.)?
3. When you need to take a test, what is the hardest part?
4. What do you do now to help with these problems?
5. What ideas do you have about tools that might help?
6. What would make taking tests easier for you?
7. What have you already tried that did not work? Why didn't it work? What would have made it better?
8. What do you want assistive technology to do for you?
9. What assistive technology do you already use?
10. Have you seen things that other kids use or seen things that you think might help you?
11. What do you want to tell the teachers and others about your school work?
12. What do you want to tell teachers and others about things you have tried or want to try?
13. Are there any questions you want to ask?

Summary

Interviewing may be quick and easy. It is most effective when the student can understand and answer questions and when the information is not easily obtained by observation or review of finished material.

6

Reviewing Products Created by the Student

One of the most common ways to gather information about use of assistive technology is to review some type of completed product such as a spelling test, a math worksheet, or a writing assignment. This kind of information gathering takes place after the time that the child produces it.

When looking at finished products consideration may be given to either quality or quantity or both. For instance, the team may be interested in not only how many spelling words were correctly spelled, but also whether the misspelled words were the result of recognizable spelling errors (e.g. letter reversals), illegible writing, or no attempt at the word.

The main advantage of reviewing finished products is the permanence and durability of the data source. Finished product review has been used in a variety of ways related to academic tasks such as completion and accuracy of arithmetic problems (Cassell & Reid, 1996) and spelling, legibility and length of written products using text to speech, and word prediction (Mac Arthur, 1999). It is one of the most commonly used types of data gathering. It often works well for determining accuracy and frequency of specific errors.

One of the problems with **only** reviewing finished products is that we may not get all of the information we need. In other words, we may not get the information we need about the process or strategies the student is using to complete the assignment. We may not know how many actual errors the student made before getting the correct answer or be able to discern a pattern of errors that is important to correct.

Caution: Too often in the field of assistive technology, the only data used is the finished product. When this happens, the team may miss extremely important information that could be gained by observing the student as he produces that product.

In the following example, the end products provided sufficient information.

Jamie was a middle school student who received support through a Learning Center. The IEP team asked for help in completing an AT evaluation because he was "unable to produce written work of a quality commensurate with his intellectual abilities." The IEP team felt that voice recognition software would eliminate spelling errors, reducing that as a factor and allowing him to produce products at a level that better represented his ability. The team met to discuss their concerns and develop a plan. They determined that Jamie already had an IEP goal to be addressed with the technology. It was, "when completing projects on the computer, Jamie will produce products independently with no more than five spelling errors per 100 words." There were no goals about the quality or length or readability of his written work.

Baseline Data to Be Collected: *Jamie's team agreed that written samples of work would be analyzed in order to determine whether written work improved with the use of voice recognition software. The written samples allowed them to recognize and analyze more than spelling, even though that was all that was mentioned in the IEP goal.*

Plan: *Jamie provided a sample of written work done with a pencil. The Language Arts teacher keyed this sample into the computer and, using the readability feature of the word processing software, tried to determine the readability level of the sample. However, she determined that the sample was too low to register a grade level. Jamie was then provided with voice recognition software and trained to use it. He progressed independently and used the speech recognition software to create written assignments, especially composition papers. Written assignments were checked periodically with the readability tool to determine grade level and percentage of words spelled correctly.*

Within a few months his work done with the continuous voice recognition program registered an increase in spelling accuracy and a grade level of 6.9. Spelling accuracy was measured by taking the total words per document divided into the number of words highlighted or misspelled.

Discussion: *Periodic samples of Jamie's written work provided the evidence that the speech recognition software continued to improve the quality of his written work and that he was meeting the spelling goal. The team decided they needed to have an IEP meeting to add the use of voice recognition software and to add additional writing goals that better reflected his ability.*

This is a sample of the simple form that was used to track Jamie's progress.

NAME: **Jamie**

Type of Work Reviewed	Date	Tool Used	Readability	Person Reviewing
Test-timed	10/6	Pencil & paper	Too low to register	MC
Test-not timed	10/9	Pencil & paper	Too low to register	MC
Report/composition	12/13	Voice recognition	3.1	MC
Assignment w/questions to be answered	12/13	Voice recognition	3.3	TR
Test-timed	1/10	Voice recognition	3.6	MC
Report/composition	1/19	Voice recognition	3.2	TR
Report/composition	1/30	Voice recognition	4.1	MC
Test-timed	2/2	Voice recognition	5.4	MC
Report/composition	3/7	Voice recognition	6.9	MC

Juan struggled with math problems. One of the difficulties was that he could not copy the problems onto his paper correctly. The problems often were not lined up properly which caused Juan to use the wrong number when completing the math operation. So, even when he knew how to do the operation he didn't get the correct answer. Juan's teacher decided that she would try some different interventions to try to identify one that would help. She first had Juan copy problems on to graph paper. There was a little improvement, but not enough. A few days later she tried putting a darker vertical line down every fifth block on the graph paper. That helped, but she still thought there might be something that would help more. One day she tried putting Wikki Stiks (a colorful, tacky, flexible strip) on his paper. It created a ridge that Juan could feel. He lined up his problems perfectly and then removed the Wikki Stiks so that no vertical lines were on his paper. Comparing the completed math sheets showed clearly that Wikki Stiks were an inexpensive and effective solution.

Summary

Reviewing products created by the student is the most commonly used way of gathering information about the effectiveness of assistive technology. Using only review of finished products may cause the team to miss important information about **how** it was created or how easy or difficult it was to do so.

7

Observing the Student

In many instances more information is needed than is provided by a completed product. It is important to know something about **how** the finished product was produced. In that case the team will need to observe the student working on the task and note specific information about what occurs.

There are two main ways to record information that is gathered through observation:

- ***Anecdotal recording***
- ***Event recording***

Anecdotal Recording

One way to create a record of what occurred during the production of the product is to simply write an anecdotal record of what took place. Here is an example.

Mary took the spelling test with the other students. She was sitting at the front of the room near the teacher so that she could see the teacher's lips and hear what she was saying. The teacher paused to see that Mary was looking at her before she pronounced each word.

As the anecdotal record continues on the next page, it becomes apparent that hearing and understanding the directions is the key factor in Mary's success.

STUDENT: Mary
DATE: February 15

Time	Activity	Observation
10:20	**L**	Mary took the spelling test with the other students. She was sitting at the front of the room near the teacher so that she could see the teacher's lips and hear what she was saying. The teacher paused to see that Mary was looking at her before she pronounced each word.
10:25	**L**	Continued with spelling test. Mary did not raise her hand or indicate in any way that she could not understand the teacher's directions.
10:30	**D**	The class scored the spelling test as a group. Students were asked to spell one word on the test and say it in a sentence. The teacher did not call on Mary.
10:35	**D**	The class continued to score the spelling test. Mary was asked to spell a word and use it in a sentence. She misspelled the word "thankful." She used the word correctly in a sentence.
10:40	**SW**	Students were instructed to write each word they missed four times and write a sentence using each word on the test. Mary wrote each word four times. She did not write any sentences.
10:45	**T**	The teacher stopped at Mary's desk. She saw that Mary was not writing sentences for the spelling words. They discussed the assignment. The teacher stood above and behind Mary when she gave additional instructions.
10:50	**SW**	Mary continued to write each word she missed four times. She wrote sentences for each word that she missed.
10:55	**SW**	Mary continued to write words and sentences. She did not write sentences for words that she did not miss on the test.
11:00	**L**	The teacher instructed everyone to turn in their papers and gave the assignment for the following day orally. Mary did not write the assignment down.
11:05	**T**	The bell rang. As Mary left the room, the teacher stopped Mary at the door, showed her the spelling paper and told her what she had done wrong. Together they wrote out the correct way to do the assignment and the homework for the following day.

Activities: L - Lecture D - Discussion SG - Small Group
T - 1-1 with Teacher SW - Seat Work O - Other

An anecdotal record may also be useful in supplementing another type of data. The problem with anecdotal records is that we may not always remember to write down the same information each time we add to our anecdotal record. When that happens we may miss important data that we will later wish we had documented. Wright (1960) suggests the following guidelines when recording anecdotal reports.

When Benjamin was asked to demonstrate his voice output communication device for the school board, there was an audio tape made of the presentation, but the anecdotal record added important information. The anecdotal record stated:

"Benjamin was sitting in the front of the room directly in front of the ten school board members. His mother sat next to him. When asked questions about himself, he waited until his mother pointed to answers on his communication device and he then activated the appropriate answers."

1. Begin by describing the setting so that it is easy to later recall what it was. Describe the location of the student in regard to other students or the teacher, the activity that is going on, the noise level, or other significant factors, etc.

2. In the anecdotal record, include everything the student says and does, including to whom and about what.

3. Also, if there are other students or adults there, include everything they say and do to the student.

4. If impressions or interpretations are included, clearly differentiate those from the actual facts of what occurred.

5. Provide some indication of the amount of time involved. "Mary took a long time to write each spelling word" may mean very different things to different people. "Mary took 3 minutes to write each spelling word" communicates more useful information.

Event Recording

Noting each time a specific event occurs is a good way to document exactly what happened. It is one of the most accurate ways to gather information. Writing down each time the student hits the switch when attempting to play a music CD may be a very effective way to gather the information that will be helpful in deciding if using that switch is a viable option. In order to record specific events, something must be happening that can be seen. This is called a **discrete** event or behavior, meaning it has an obvious beginning and an obvious end. Event recording has been used to count and document a wide range of behaviors related to assistive technology use. These include: amount of time students with learning disabilities spent interacting with the text in electronic books (Lewis, 1998b, 2000; Lewis & Ashton, 1999), mouse clicking on correctly spelled words (Birnie-Selwyn & Guerin, 1997), using a calculator (Singh, Oswald, Ellis, & Singh, 1995), and establishing yes/no responses (Neef, Walters, & Egel, 1984).

An advantage of event recording, in addition to its accuracy, is the fact that often the teacher does not need to interrupt a lesson in order to collect it. She can easily note events as they occur by making a mark on a card on her desk or a piece of tape on her wrist, or by transferring beans from one pocket to the other, and then note the total at the end of the lesson (Alberto & Troutman, 1999). Here is an example of event recording.

Allison is provided with a voice output communication aid (VOCA) programmed with a repetitive line in a story or song. As her teacher reads the story or sings the song, Allison is supposed to activate the device at the appropriate time to deliver the line when prompted. Her teacher keeps a chart near her and records the number of correct responses and the number of opportunities to respond that occurred. She does this at the end of the story or song. It takes only a few seconds. At the end of the day she transfers the data to a chart that helps her analyze performance.

STUDENT: Allison
DEVICE: Big Mac

Date	Phrase	No. of Opportunities	No. of Correct Activations	% Correct
5/11	What do you see?	14	5	36%
5/12	What do you see?	12	5	36%
5/13	What do you see?	14	7	50%
5/14	What do you see?	14	8	57%
5/15	What do you see?	11	9	64%
5/18	What do you see?	14	7	50%
5/19	Are you my mother?	9	7	78%
5/20	Are you my mother?	9	8	89%
5/21	Are you my mother?	9	9	100%
5/22	Are you my mother?	9	7	78%

Lindy's story provides another example of event recording.

Goal for Technology: *Lindy was a middle school student with mild cerebral palsy. She was not able to speak and had been using a voice output communication aid (VOCA) for several years. The device had broken and the company was no longer in existence, so Lindy's team decided they needed to identify a new communication device. Her team consisted of her parents, Lindy herself, the SLP, the OT, the PT, the learning center teachers, and an AT Specialist with knowledge in the area of augmentative/alternative communication. Her previous device had offered both text-to-speech and pre-stored message options.*

IEP Goals to Be Addressed With the Technology: *Lindy's IEP had numerous goals for augmentative/alternative communication in social as well as academic settings.*

Question to Be Answered Through Data Collection: *Lindy's team decided that data would need to reflect changes in the quality and/or quantity of her communication using one or more replacement VOCA. They chose an approach that broke the task into two parts. First, Lindy would be provided with different VOCAs to 'test drive' until Lindy and her team felt that a good match to her need had been found. Once a potential match had been identified, data would be collected to determine whether the VOCA improved the quality of Lindy's communication.*

Plan/Phase 1: *The team selected a short list of devices that provided features similar to Lindy's previous VOCA and provided them for extended trial. The length of each trial was determined primarily by Lindy. When she felt that she would like to try something different, Lindy told one of the adults on the team. Her team then filled out a 'Device Evaluation Summary.'*

DEVICE EVALUATION SUMMARY

STUDENT: **DEVICE:**

COMPLETED BY: **DATE:**

Circle the number that best describes the ability of this tool to meet the student's needs.

	Low				High	Comments
Size of cells/keys	N/A-0	1	2	3	4	
Number of cells/keys	N/A-0	1	2	3	4	
Sensitivity of touch panel	N/A-0	1	2	3	4	
Screen visibility	N/A-0	1	2	3	4	
Voice quality	N/A-0	1	2	3	4	
Print quality	N/A-0	1	2	3	4	
Computer compatibility	N/A-0	1	2	3	4	
Ease of Programming	N/A-0	1	2	3	4	
Portability	N/A-0	1	2	3	4	
Memory	N/A-0	1	2	3	4	
Set-Up	N/A-0	1	2	3	4	
Overlay changes	N/A-0	1	2	3	4	
Level changes	N/A-0	1	2	3	4	
Overall in meeting the student's needs	N/A-0	1	2	3	4	

	Student	Teacher	Other
Who carries the device?			
Who sets up the device?			
Who programs the device?			
Who changes the overlays?			
List the daily activities for which the device is used.			
Comments:			

Shawnee Mission School District, Shawnee, Mission, KS

Discussion: *Through review of the 'Device Evaluation Summary' features important to Lindy in her current setting and with her current abilities were identified. It was found that her spelling skills did not allow her to spell words for text-to-speech messages of more than one short word; that pre-stored messages did not provide her with a means to generate the novel utterance needed in social settings; and, that her language skills did not support generation of grammatically and syntactically correct utterances of more than two words. There was a significant gap between Lindy's receptive and expressive language abilities. These discoveries led the team to consider semantic compaction for Lindy, and a device that provided both text-to-speech and generative capability via semantic compaction was presented for extended trial use.*

OBSERVATIONAL SUMMARIES

NAME: Lindy **SETTING:** Learning Center
DATE OF OBSERVATION: September 13 **ROOM ARRANGEMENT:** Device on desk

Time	Method	Message	Prompt and Environment
9:35	V	CU	S - Appeared to be trying to attract some one's attention (me?, teacher? other student?); teacher discussing quiz results; vocalization not acknowledged
	V	CU	S - Continued vocalizing
	V	CU	S - Continued vocalizing
	V	CU	S - Continued vocalizing
9:40	D	?	S - Continued vocalizing; started activating keys; device didn't speak a message
	V	CU	S - Continued vocalizing
	V	CU	NP - Teacher started referring to text; guiding them in looking for definition; asked Lindy.
	G	Answered question	S - She responded by pointing and nodding.
	D	First	NP - Teacher called on Lindy to find definition; wrong answer
	D	Second	NP - Teacher said "Try again;" wrong answer
	D	Work	P - Correct answer; teacher prompted her to use her voice
	V	CU	NA
	V&G	CU	NA
9:50			Teacher provided books and work pages; Arno started reading aloud; Lindy writing; desk space an issue; Lindy and I; problem solved
9:55	D	Yes	NP - Is this o.k. ? - silent reading continued
10:00	D D	Peeked Teacher	NP - Teacher came over; asked a question; Lindy answered using device to spell but didn't speak it; teacher requested "teacher" as a vocab. item; Lindy looked and found it - and said "teacher"; silent reading continued
	G	?	NP - Teacher returned to Lindy; asked question
	D	Yes	NP
10:10	G	3	NP - "Are you to the bottom yet?"
	G	Pointed to page	NP - Teacher went to Lindy who pointed in book and teacher said "yeah"
	G	Shame on you	S - I confessed to helping another student and Lindy shamed me.

V - Vocal D - Device G - Gesture CU - Couldn't Understand
S - Spontaneous P - Prompted to Use Device (e.g. a question) NP - Natural Prompt NA - Not Acknowledged

Total Communications: 22

DATA SUMMARY

System	No. Used	%	No. Success	Rate %	Spontaneous	Natural Prompt	Prompt	MLU
VOCA	8	36%	7/8	87%	1/8 (12%)	5/8 (62%)	2/8(25%)	1
Voice	7	31%	0/7	0%	6/7 (85%)	1/7 (14%)	0	?
Gestures	6	27%	2/6	33%	- (25%)	- (75%)	0	?
Voice & Gestures	1	4%	0/1	0%	1/1 (100%)			?

Phase II: *The team agreed that the best yardstick against which to measure the effect of semantic compaction and the selected device on Lindy's communication would be spontaneous language samples collected in the natural environment. Lindy and her team were provided with device training by the company representative. The AT specialist observed Lindy periodically in her natural environments over the next several months.*

NAME: Lindy **SETTING:** Social Skills
DATE OF OBSERVATION: April 18 **ROOM ARRANGEMENT:** Device on lap

Time	Method	Message	Prompt and Environment
7:40	D	I'm moving June 3rd.	NP - Conversation about when the family was moving to Nashville
	D	May	NP - "
	D	Yes	NP - "
	G	Yes	NP - "
	G & V	Yes	NP - "
	G & V	Yes	NP - "
	G & V	Yes	NP - "
	D	This my house is big.	NP - "
	D	No	NP - "
	G & V	Yes / No	NP - "
	G & V	Yes / No	NP - "
	G & V	Yes / No	NP - "
	G & V	Yes / No	NP - "
	G & V	Yes / No	NP - "
	G & V	Yes / No	NP - "
	D	I am sick.	NP - "
8:00	D	I go play and musical.	NP – Question, "What are your hobbies and interests?"
	G & V	Yes / No	NP
	G & V	Yes / No	NP
	G & V	Yes / No	NP -
	D	Opera	NP-

V - Vocal D - Device G - Gesture CU - Couldn't Understand
S - Spontaneous P - Prompted to Use Device (e.g. a question) NP - Natural Prompt NA - Not Acknowledged

Total Interactions: 21

System	No. Used	%	No. Success Rate	%	Spontaneous	Natural Prompt	Prompt	MLU
VOCA	8	38%	100%		100%			2.75*
Voice	0							
Gestures	1	4%	100%		100%			1
Voice & Gestures	12	57%	100%		100%			1

* *The Mean Length of Utterance (MLU) was adversely affected by use of the device to communicate yes/no on several interactions. Calculating on the basis of responses to questions that were not yes/no questions, MLU was 4.*

Discussion: *All interactions were recorded and the quality analyzed. The most dramatic change in Lindy's spontaneous communication was in the mean length of utterance when using her device. Also noted were improvements in reception of her communication, as measured by whether it was understood by the listener, and increase in her choice to use her device over oral, gestures, and written words used at some times.*

Summary

There are two ways to record information that is gathered through observation: anecdotal recording and event recording. Anecdotal recording is often less specific and is useful for activities that do not occur very often or where specificity is not critical. Event recording is useful for very specific steps and can be very accurate. It can be especially useful when a student cannot tell you what you need to know.

8

Using Video

For activities in which the technology is expected to allow a qualitative change, video taping may provide a way to evaluate the effectiveness of the intervention with more objectivity. The student may be video taped doing the activity under several conditions, one of which is with the assistive technology, or video taped periodically over time using the same assistive technology to see if there are changes in performance. Observers who are unfamiliar with the student, the task, and the technology can then be invited to view the tapes and indicate in which segment the student appears to be doing the "best." If there is consensus that the segment in which the student is using the assistive technology appears to be the "best," then a more objective conclusion can be made, such as "three out of four observers agreed that the student is better able to make a choice using eye gaze than pointing with his finger."

Caution: A video camera can be very distracting to some students, although if left in place for awhile they usually become accustomed to it. If it draws too much attention away from the activity that you want to observe, it may not be a viable option.

Video taping also allows information to be shared across environments. Glanz (1998) suggests that multimedia data is particularly strong when it is used with other valid and reliable data collection methods.

Tara, who had mild cerebral palsy, was having an extremely difficult time in fifth grade. Writing was very difficult for her. She never completed written assignments during school time and did poorly on all of the classroom tests. Her parents worked with her at home every evening and sent in her completed homework that had been done on the computer.

The teacher began to believe that the parents were actually doing the homework because there was such a discrepancy in performance between what Tara produced at school and the homework that was returned. In addition, previous psychological testing indicated that Tara might not be capable of doing the homework that was being sent to school. During a parent conference, the parents were quite insulted and frustrated by the teacher's suggestion that this may be the case. After much discussion, the parents decided to video tape Tara using the computer at home and bring it to school to share during a second parent conference. The video tape clearly showed Tara using the family's computer to complete her homework. It was slow and arduous, but it was clearly her own work. After viewing the video tape, the teacher and parents agreed to allow Tara to use a classroom computer at several times during the day and to seek an assistive technology consultation to see if there was software that might speed up the writing process for Tara. The team met with the assistive technology consultant who suggested a key guard and word prediction software as tools that might help Tara better meet the writing goals on her IEP. The consultant provided training to the staff and to Tara. She is now using both tools successfully and is completing most of her assignments at school.

Summary

Video taping, and when appropriate, audio taping can be extremely useful tools in documenting change. Video taping or audio taping a student reading in September and again in June may provide striking qualitative evidence of reading growth. Even still photographs can communicate graphic changes in posture, attention, and engagement. A picture of a child enthusiastically showing a book she just created can communicate a lot. A picture often is worth a thousand words.

9

Identifying Variables That Can Be Measured

If you are reviewing a finished product, you can measure changes in quantity and/or quality of that product. This section will discuss measuring changes that can be measured while observing the student; these include changes in speed, accuracy, spontaneity, duration and latency.

Measuring Speed

If the team's goal is to learn something about the speed of an event, it is necessary to know not only how many times the event occurred, but in what time period. If a student completed five math problems and they were all correct, that sounds very good. However, if the student spent an hour and a half completing those five problems, it probably isn't so good.

The rate or speed at which a student is able to complete a task may be very significant in answering questions about assistive technology. Therefore, the information collected needs to include both how many times something occurred and over what period of time it occurred. For example, if a student takes two hours to complete a 200 word paper using the standard keyboard but can complete the same length of paper in 40 minutes using a modified keyboard, the impact the assistive technology had on the speed can be computed by calculating words per minutes. For the student using a communication device, if a device with icon prediction shortens the time it takes her to locate the next symbol in a sequence, then it might be expected that she will be able to communicate a message more quickly with icon prediction than without it.

Jeff was a high school student with a severe reading disability. He was very bright and planned to go on to college, but he struggled with many academic tasks. He used a computer with word prediction software and text to speech software to complete his assignments and to read scanned text. He had a great deal of difficulty when he needed to complete reports that required that he obtain quotes or research from sources in the library. He and his team decided they needed to find a simple tool that would help him with this task before he finished high school. His Science teacher looked on the internet and found some small, hand held scanners that he thought might be useful. The school arranged to borrow two brands of hand held scanners. Jeff felt that the real issue was how long it took to copy a piece of information from a resource book. So they decided that over the next month Jeff would choose to either hand copy material or use either of the two scanners. He would keep track of the amount of time it took. This is what he did.

STUDENT: Jeff

Length of Text to Copy	Tool Used	Time Taken
18 words	Pencil	9 minutes
24 words	Scanner A	6 minutes
25 words	Scanner A	5 minutes
35 words	Scanner B	4 minutes
22 words	Scanner B	3 minutes
12 words	Pencil	5 minutes
48 words	Scanner B	4 minutes

Jeff continued to take data. He began to see that he was getting faster with both scanners as he got used to them. However, he found scanner B was faster and easier to use. The school agreed to buy the scanner for him to use at school because it clearly made it easier to do the task of copying material. Jeff's parents decided to buy one for him to use at home, so that he would have his own to take to college.

Measuring Accuracy

When it is important to know whether assistive technology affects the accuracy of a student's performance, it will be necessary to compare what happens with and without the technology. This may be as simple as looking at the percentage of misspelled words a student has written in an assignment. If so, this can be accomplished by reviewing a finished product. However, if it is important to know how many attempts the student had to make before getting something correct, the student will need to be observed completing the task. The number of mistakes, erasures, and overwrites that occur will need to be counted.

Accuracy may also be an issue when trying to increase the speed of a student's response. If a student recognizes errors and takes time to correct them, it will affect the overall output.

When John first used talking word processing, his overall written output went down and remained at a decreased level for more than three months. One of the reasons was that, for the first time, John recognized many of his errors and reversals and took time to correct them. At first he even "argued" with the computer. When he thought he had typed "was" and the computer spoke "saw," he would go back and do it again, then think about what happened before he could correct it and move on.

STUDENT: John

Date	Number of Errors	Number of Words Typed	Time to Completion
2/3	17	200	6 min
3/3	12	220	15 min
4/7	9	100	12 min
4/8	9	188	19 min
4/14	7	246	30 min
5/10	6	100	5 min
5/21	0	115	9 min

For a young student or a student functioning at a young age level who uses a communication board or device, accuracy may be evaluated by how often the student is unhappy with the consequence of the communication. If the student is unhappy when given what was requested, it might be that he is not accurate in pointing to words or symbols on the communication device and is attempting to make a different selection. Again, observation is the best way to collect this data.

Mailee is using a simple voice output communication device with eight messages. The staff recorded her apparent satisfaction with getting what she requested when using her device. She expressed dissatisfaction 50% of the time. The team decided they needed to further analyze her responses. The "Please play with me" was on the far right and was accidentally being activated when Mailee wanted to choose a different message. They began to plan how to change the location or placement of messages to help Mailee be more accurate.

AC VOCABULARY USE

STUDENT: Mailee DATE: 11/3
ACTIVITY: Play LOCATION: Play Area

Phrase Used	Accurate Choice? (Y/N)
Please play with me.	Y
Please play with me.	N
Please play with me.	N
Want to hear a joke?	N
Let's do water play!	Y
I like this!	Y
Please play with me.	N
Do it again!	Y

Older students or those functioning at a more advanced level who use more complex VOCAs may have access to features in the VOCA that monitor the number of self corrections they make.

Measuring Spontaneity

If initiating communication or other events is a concern, observation is the best way to collect information. For example, one goal of a communication device might be to allow a child to communicate wants and needs without prompting. Observing the events of the day will make it possible to record how many times the child initiates a conversation or makes a request as well as how many times he responds to requests. In this instance, documenting the number and types of opportunities to initiate a request that were actually available to the child will also be significant. Were materials he needed for a task out of his reach so that he would need to request them? Or did an adult automatically get all of his materials and place them within easy reach? Was there something that he wanted for a snack and needed to request? Did an adult quickly provide the snack item without waiting for him to request it? Was there a change in the amount or type of prompt required? These situations are often true for young children or children functioning at a young age.

Sasha was recently adopted from eastern Europe. He is four years old but using language at about a two year level. He is verbal but has articulation errors and is very hesitant to initiate communication. The staff is collecting data on the number of times he initiates communication when there are good opportunities to do so.

INITIATED COMMUNICATION
STUDENT: Sasha WEEK: 10/16

	Initiations	Opportunities Missed	Percentage
Monday	XX	XXXX	30%
Tuesday	XXXXX	XXXXX	50%
Wednesday	XX	XXXXX	29%
Thursday	XX	XXX	40%
Friday	XXXX	XXX	57%
Comments	Tuesday is free play time instead of group.		

INITIATED COMMUNICATION
STUDENT: Sasha **WEEK:** 10/23

	Initiations	Opportunities Missed	Percentage
Monday		XXXXX	0
Tuesday	ABSENT		-
Wednesday	XXXXX	XX	71%
Thursday	XXXX	XX	67%
Friday	XXXXXX	X	86%
Comments	I think he was coming down with something on Monday.		

Unfortunately, in an effort to be efficient, classroom staff often makes things so available that children don't have any "real" need to spontaneously request things. In addition, adults often speak rapidly and leave too short a pause for the child to "talk" with a communication board or device. Learning to pause and to use a prompt hierarchy is critical in providing opportunities for spontaneity. The data collected may need to be as much about the adult's actions as those of the student. Video taping portions of the day can be an effective way to gather data in this case.

Measuring Duration

If there is a question about a student's ability to maintain interest, attend to an event, or persevere with a task, observing may be the best way to gather that data. Observation may also provide information on what is affecting the duration of the behavior. For example, were there visual distractions or auditory distractions, did the child become fatigued, were there too many steps in the task, so that the child lost interest? Video taping is sometimes helpful in these situations because it allows the teacher or therapist to review the tape in a quiet setting after school is over and analyze his or her own actions.

Some students may be able to help monitor their own ability to attend by logging the time they start an activity and the time of day they stop. Some computer programs can track the number of tasks attempted and completed. Stop watches, timers, and other tools may be used by an observer or, when feasible, the student, to document and increase the ability to persevere or attend.

Measuring Latency

Latency is the time it takes a student to begin to perform the event or action once the opportunity is available. In gathering information about latency, it will be necessary to note when the opportunity began (e.g., the switch was placed in front of the student in an accessible location), when the action occurred, and possibly, how long it lasted. For example, it may be necessary to know how long a child waits before hitting a switch that is positioned in front of him. Again, video taping can be a useful tool in looking at latency both to provide a longer time to analyze what occurred and to compare performance over time.

LATENCY OF RESPONSE
STUDENT :

Date	Stimulus	Reinforcer	Time to Response
2/13	Switch	Car	5 sec
	Switch	Car	5 sec
	Switch	Car	9 sec
	Switch	Car	8 sec
	Switch	Car	15 sec
2/14	Switch	Car	5 sec
	Switch	Car	15 sec
	Switch	Car	17 sec
	Switch	Music	19 sec
	Switch	Music	6 sec
	Switch	Music	3 sec
	Switch	Music	2 sec
2/15	Switch	Music	2 sec
	Switch	Car	2 sec
	Switch	Car	7 sec
	Switch	Car	9 sec
	Switch	Car	11 sec

In this example the type and location of the switch were not changed. If different switches or switch placement were being tried to determine their effect on latency, then columns for documenting those factors would need to be added.

When to Collect Event Data

Questions about all aspects of event recording can be effectively addressed by collecting data that best illustrates what is happening. An additional decision that needs to be made is about the schedule for collecting that data. Is it something that must be collected every day or even every time the device is used or the event occurs? This type of data collection is continuous or ***ongoing***. If it is not necessary to record every instance, then some schedule of collecting data is sufficient. It is necessary to decide how often to collect the data. It might be once a day, every few days, once a week, at the end of the month, etc. The times when regularly scheduled or ***episodic*** data is collected are called ***probes*****.** The frequency of the probe will depend on how many opportunities there are to perform the specific action, the amount and speed of change expected, and the time available to collect it. The team will need to determine an appropriate schedule for the probes.

Summary

There are several types of variables that can be measured. This chapter addressed speed, accuracy, spontaneity, duration, and latency. In every case it is necessary to decide whether data collection will be ongoing or episodic. If it is decided to collect episodic data using probes, it is then necessary to decide how often the data must be collected.

10

Deciding What Data Is Needed

In the preceding pages a number of ways to collect data about a child's use of assistive technology were discussed. The following questions can be used to plan the best way to get the needed data about a specific student and a specific assistive technology question.

- Can the student communicate the needed information?
- Is there a finished product to review?
- Does that finished product provide all of the needed information?
- If there is no finished product or it doesn't provide enough information, can the needed information be captured with an audio or video tape?
- If observation is required in order to gather the needed information, is the target behavior numerical or time related?
- If the target behavior is numerical, is it expected to occur at a low, moderate, or high frequency? Based on that answer, will the teacher be able to collect data during instruction, or will someone else need to do it?
- If the target behavior is time related, is it important to measure the time before the child initiates the action or the time elapsed during performance of the action?
- Should data collection be ongoing, or can it be episodic? If episodic data is sufficient, how often and when does the data need to be collected?

The answers to these questions will help the team decide how and when to gather specific data to make a decision about assistive technology. They will also help them think about what type of data may be needed in order to "show" progress or change. The following chart can assist in thinking about whether it is important to know (and can tell) the number of times something happens, the percentage of time it happens, or the rate at which it happens.

Thinking About Data

Type of Information	Conditions	Potential Data
Interview	Student is able to provide needed information and/or it is not observable	Preferences, feelings, intentions, significant features
Product Review	Time and opportunities to respond are constant	Number of correct responses
	Time is constant (or not important) and opportunities vary	Percentage of correct responses
	Time varies or time and opportunities vary	Rate of correct responses
Observation		
Anecdotal	Event occurs only infrequently or specific "action" has not been identified	General information, related factors, number of occurrences
Event Recording	Time and opportunities to respond are constant	Number of occurrences
	Time is constant (or not important) and opportunities vary	Percentage of occurrences
	Time varies or time and opportunities vary	Rate of occurrences
Video or Audio Tape	Very detailed behavior needs to be analyzed or compared over time or analyzed in several different ways	Rate, type of change, subtle changes

Summary

Matching data collection to the type of information needed and the conditions affecting it increases the likelihood that the data will be useful and meaningful.

11

Recognizing Factors That Impact Data Collection

When information collection depends on human beings, there is always the possibility of error. Errors can occur when interviewing the student (the interviewer might misunderstand something he said), when reviewing finished products (someone might occasionally count an answer wrong that is right and vice versa), or when observing various behaviors. If a mistake is made in interviewing, one can go back and ask the student to explain what he said. If a mistake is made in reviewing finished products, one can look at them again and change the grade or description of the work. If a mistake is made in observing, it is more difficult to correct. There are several ways people can error in collecting observational data. The wrong type of data can be collected, it can be collected at the wrong time, or the criteria for successful performance can be poorly defined. The following are some critical factors to keep in mind as you plan to collect data.

Frequency of Data Collection

When it comes to data, generally speaking, more is better. Frequent data collection increases the chances of seeing patterns and trends in the data that can lead to more accurate decisions. Lehman and Klaw (2001) point out that if it is decided to collect data only once a week or only on specific days such as Monday, Wednesday, and Friday, important information may be missed that daily data would have shown.

Ana often came to school very tired on Mondays. Her parents let her stay up late on Friday and Saturday nights so that she would sleep in a little in the morning. Because of this, Ana had trouble going to sleep on Sunday night and was tired all day Monday. She didn't use her voice output communication aid well on Monday and frequently cried in frustration during the day. Ana spent time with the speech/language pathologist on Tuesday and Thursday afternoons and sometimes got new messages added to her voice output device. On Thursday mornings Ana had Occupational Therapy as soon as she got to school. On Thursdays she used her voice output device more frequently and more accurately. In addition, she more frequently used new messages on Thursdays than she did on any other day. The team might not have realized these things if they were not taking daily data on Ana's use of her assistive technology. In addition, Ana might be struggling much more than she is right now. As soon as they realized the significance of the data, they had a team meeting that included Ana's mother. Ana's parents are now making sure that Ana has a consistent schedule on weekends. As a result Ana is coming to school well rested on Monday morning. The team discussed what the OT was doing that might be having such a positive affect on Ana and incorporated some specific activities each morning under the direction of the OT. These actions, based on data, have caused a significant increase in Ana's successful use of her voice output communication aid.

Impact of Uncontrollable or Unexpected Factors

Sometimes the impact of external factors is not taken into account. For instance the student's performance may be affected by lack of sleep, the beginning of an illness, a change in medication, or stress due to something that has happened outside of school. If data is collected on a very infrequent basis, the impact of uncontrollable factors may not be recognized and may seriously impact decisions. It is important that team members work together to keep track of these factors and discuss their impact.

Will provides an example of the importance of communication among team members.

Will, who has cerebral palsy and uses a manual wheelchair and walker to get around school, had been doing relatively well in Math class which was scheduled immediately after lunch. But for some reason his performance in Math had dramatically decreased. He was having trouble getting his assignments done during class and got a failing grade on a Friday quiz two weeks in a row.

The team, including his parents, met to discuss this change. The physical therapist who works with Will serves several schools and couldn't attend the meeting, but the rest of the team didn't think that would be significant since this was about Math. The meeting went on for quite some time with little success in identifying the problem. Finally they decided to assign extra practice problems to be done at home to see if that would help.

It was at that point that Will's mother made the comment that it would be hard to work that into the schedule. In addition to his usual homework, he had begun practicing using his walker for longer distances. He had recently started using his walker to go to and from the lunch room each day, and it was so difficult for him that they were practicing more at home to try to increase his endurance. As they discussed it, the team members realized that the decrease in performance in math exactly coincided with the new practice of using the walker to go to lunch. They decided to have another meeting, this time with the physical therapist present. They decided to use the walker to go to lunch only two days a week and see what difference it made. Sure enough, he did well in math on the days he did not walk to lunch but had difficulty solving problems, learning new information, and taking quizzes or tests for at least 30 minutes after walking a long distance with his walker.

After reviewing that data, the team decided that Will would need to be given time to recover from the exertion any time he walked any distance using his walker.

STUDENT : Will
WEEK BEGINNING: April 3

	Number of Problems	% Correct	Completed Assignment	Comments
Monday	25	80%	Yes	
Tuesday	20	50%	Yes	Used walker
Wednesday	15	75%	Yes	
Thursday	20	40%	No	Used walker
Friday	20	75%	Yes	

Ease of Data Collection

The easier it is to collect the data, the more likely it will get collected. This is also true of forms. The easier they are to understand and use, the more likely they are to be used. They also need to be available. Placing forms on or near the AT increases the likelihood that they will be used. Parents, teachers, therapists, and assistants are all very busy. Any data they are asked to collect and any form they are asked to use to collect it must be as simple as possible. Remember Patrick from page 17? He was not using all of the available messages on his new voice output communication aid. It was critical that the data collection system be very easy to use for Patrick's teachers. Here is how the team developed a system to collect the data they needed.

Goal for Technology: *Patrick was 14 years old and in a full inclusion setting in the middle school. He had been using a voice output communication aid with eight messages arranged in two rows of four messages. Line drawings were used. Data showed that he used these eight messages spontaneously and appropriately across settings. Staff wanted to try a different device that would be lighter weight, and the device selected allowed nine messages arranged in three rows of three. Soon after the transition, staff reported that "Patrick's device wasn't working as well as the old one." The assistant reported that he was "less consistent and less accurate." They decided they needed to meet to determine what was happening.*

IEP Goal(s) to Be Addressed: *Patrick had IEP objectives that related to functional communication via voice output to support social interactions.*

Question(s) to Be Answered Through Data Collection: *What did "less consistent, less accurate" mean? It needed to be clarified and quantified in order to determine whether the changes in Patrick's communication were the result of the different device or some other variable.*

Data: *Miniature blanks of Patrick's overlay drawn on 3" x 3" Post-It notes were placed near his device where they were easily accessible. The classroom assistant recorded Patrick's interactions by marking in the cell that represented the message he used. She put a '+' if the message was appropriate for the situation and a '–' if she felt it was not appropriate. It was agreed that the team would meet again in two weeks to review and discuss the data. Below is a sample of data collected on two consecutive days.*

+ +	+ –	+ + +
+ + + + –	– + + +	+ + – + +

–	+ + –	+ +
+ – +	– + +	+ + + +

Discussion: *At the next meeting it was obvious to the team that "less consistent, less accurate" meant that Patrick was no longer using the items that had been placed in the top row. What was less obvious was "why not?" Patrick's team identified three possible reasons why Patrick might not be using this row: these items were no longer needed in his new setting; he could not reach the top row; he could not see the top row. (The device was typically placed on a flat surface in front of him.) In order to determine which of these variables might be influencing Patrick, the following changes were made one at a time.*

- *Symbols were rearranged and items that had been on the top row were moved to a lower row.*
- *The device was placed on an easel so that the top row was closer to Patrick.*
- *The laminate was changed on the overlay to reduce glare.*

With each change data was again collected in the same manner. The data continued to reveal that Patrick did not use the top row. Staff speculated that perhaps there was a visual field difficulty and referred him for an evaluation. In the meantime they provided Patrick with a device that had a more linear and less rectangular arrangement. The change was made back to his previous device and it was found that Patrick could use all eight items/messages appropriately. They then borrowed a voice output device that had four rows of eight messages across and left the top two rows blank. They gradually added additional messages on the bottom two rows until Patrick was successfully using 16 messages. They then purchased the new device for Patrick's fulltime use. Because this device had the ability to be programmed with levels, they knew they could expand Patrick's vocabulary and still use the linear arrangement he needed.

Appropriateness of Type of Data

In the previous chapter four ways to obtain data were described. The chart on *Thinking About Data* (page 54) gave examples of when it might be important to count occurrences or find the percent or rate of occurrences. Unfortunately, in education percentage is overused. It is the experience of these authors that it is the most common type of data mentioned as criteria in IEP goals and objectives. Lehman and Klaw (2001) point out serious problems that can occur when using percentage.

- If percentage is used with very frequently occurring behaviors, it is unlikely that the recorder will be able to count all of the opportunities in the day when the behavior could occur. Each time the recorder fails to note that an opportunity occurred which the student missed, the percentage becomes less accurate. When this happens the ratio of successful performance to opportunities for performance becomes inflated and the child appears to be more successful than he or she actually is.

Molly was using a switch to activate a tape recorder for Musical Chairs in the Early Childhood class. The teacher became so busy monitoring several students that she lost count of how many times Molly pressed the switch before the music had stopped. She had to guess that Molly only did that twice. If this happens very often, Molly may be credited as reaching a specific criteria when she has not actually done so. If this continues to happen, Molly will be moved on to goals for which she is not ready and then the staff will be confused about why she is so "inconsistent."

- If percentage is used with very infrequently occurring behaviors, the data may be very misleading. If the teacher offered more opportunities, percentage might be useful, but only if the opportunities don't become too frequent to count (such as in the previous example).

Percentage may be used when counting how many times Jonathon correctly responds with his voice output device in Science class. The teacher only calls on him two times that week. The possible percentage is 0%, 50%, or 100%. Those figures simply do not give enough gradations to accurately represent Jonathon's performance in any meaningful way. The huge jump between possible values does not accurately represent changes in Jonathon's ability to use his voice output device.

Observer Reliability

To be sure that observational data are correct or reliable, it is smart to have two people observe the same event or behavior and then compare data to see if they agree about what actually happened.

When comparing the data collected by two individuals simultaneously observing the same situation, the goal is ***inter-observer reliability***. This means that they would both have recorded identical or very similar data. The basic formula for calculating reliability between two observers is the number of agreements over the number of agreements plus the number of disagreements times 100.

$$\frac{\text{Agreements}}{\text{Agreements} + \text{Disagreements}} \times 100 = \text{percent of agreement}$$

This equals the percent of agreement. In the classroom it is desirable to have data from two observers agree at least 80% of the time (Alberto & Troutman, 1999). If they don't agree at least 80% of the time, then they may not be defining the behavior the same or have the same criteria for when something occurred or didn't occur. They may want to discuss what could have caused their different interpretations or experiences.

Jacob's teacher and the classroom paraprofessional collected observational data on ten interactions that Jacob had with students when using his communication system. The purpose of collecting data was to determine whether the use of the voice output device increased his spontaneity. Since their agreement was only 70%, they discussed what they were recording. The discussion revealed that "spontaneity" was not clearly defined. In this case, the paraprofessional thought that an utterance is spontaneous as long as no one asks the direct question, "What do you want?" The teacher thought that when the food was placed in front of Jason, it acted as a natural prompt that is the equivalent to "What do you want?" For the teacher, an utterance was counted as "spontaneous" only if it was initiated in the absence of any verbal ***and*** *non-verbal cues.*

	1	2	3	4	5	6	7	8	9	10
Teacher	X		X		X	X	X	X		X
Paraprofessional	X	X	X	X	X	X	X	X	X	X

Agreements 7

Agreements + Disagreements x 100 = % of agreement $\frac{7}{7+3} \times 100 = 70\%$

The teacher and paraprofessional in this example need to carefully define "spontaneous" and insure that they agree on that definition. Kazdin (1977) suggests four issues that can cause differences between observers. One is that the student may react differently for different observers. This is called ***reactivity*****.** If the observer doesn't usually spend much time working with this student, he may notice her attention and perform differently. Another is ***observer drift***. Over time an observer may slightly change her "definition" of the movement or behavior and "count" things that she didn't count a month ago. A third problem can come from ***complexity*****.** The more complex the recording system, the more the reliability is endangered. The old KISS principle, "Keep it Simple, Sweetie!" definitely applies here. The last source of bias is ***expectancy*****.** If one observer has a preconceived notion about the student and what he can do or should be able to do, it may affect her interpretation of what she is actually seeing.

Whenever there is a discrepancy in data, the team must come back together and discuss the situation to arrive at a more clearly defined action or behavior or to redesign their plan for data collection.

Summary

There are many factors that can impact the amount of data collected, its accuracy, and ultimately, its usefulness. It is important for the team to think about these factors as they plan for the collection of data related to the use of assistive technology.

12

Reviewing the Data

Reviewing the Data

"*Not everything that's countable counts and not everything that counts is countable*" (Albert Einstein).

This chapter will focus on techniques for developing individualized measurement systems by which to evaluate the effectiveness of assistive technology approaches. Collecting data will be discussed in a way that allows the analysis of errors and patterns.

Accountability is crucial when making assistive technology decisions. Good data definitely increases accountability. Unfortunately, too often data is collected without sufficient thought about the ultimate goal for the use of the technology. There is a tendency to approach data with the philosophy, "If a little is good, more is better and too much is just right." In an effort to miss nothing, everything is recorded and often it is difficult to determine what is relevant. Or, when faced with a cumbersome or overwhelming data collection system, it simply may not be collected at all.

As pointed out in the previous chapter, the frequency of data collection can be critical. However, it is not just the volume that is critical, but what that data communicates.

When developing the student's IEP, considerable thought and energy are often expended. Concerns are discussed and prioritized, goals are identified, and procedures are outlined. Unfortunately, when it comes to evaluating the outcomes of an intervention, it becomes tempting and often too easy to rely on pat phrases such as "with 85% accuracy on 5 consecutive days" or "spontaneously with 100% accuracy." A closer look at these criteria may reveal that they do not accurately measure the intent of the goal. They may not lend themselves to collection of **meaningful** data. They may not provide the information necessary to determine the modifications needed for an individual student when progress is slow or absent. Finally, they may simply be too confusing or too cumbersome to collect.

Developing a plan to collect data can be helpful in figuring out what data is needed and how to best collect and analyze it. The data collected about any individual child should be unique to that child's needs. Thinking about a plan before starting provides a means by which growth and progress can be **effectively** and **efficiently** monitored. In developing meaningful data collection systems consider the following:

1. What is the goal for the assistive technology?
2. What IEP goal(s) will be addressed through use of assistive technology?
3. What question(s) needs to be answered through data collection?
4. How can the data best be collected?
    - What can be measured and/or how can it be measured that will show not only whether criteria is achieved, but if not, why not?
5. What will it take to conclusively show that the intervention was successful and the student is ready to move on?
    - What is the minimum level of performance the child needs to display?
    - What are the possible obstacles to success of the child?

Collecting Data

Anyone present when the student is utilizing the assistive technology in question or attempting to complete a specific task can collect data. The teacher, classroom assistant, or therapist may be able to track data with colored paper clips clipped on the edge of a notebook, beans transferred from one pocket to another, or marks on Post-It notes or masking tape. In most cases it is simply a matter of writing down what is seen. In other instances, a computer may collect the data as the student completes a task using specific software. If the student's preference or perceived effect is the information needed, it might be feasible to simply ask the student which one worked better or felt better or was less fatiguing.

Video tape has the advantage of creating a permanent record that can be viewed whenever needed to reflect on what actually was happening. Often a high school or community college media class will have students who can help with video taping.

Minimum Performance

Determining the minimum performance necessary for the task at hand is critical. Even Mark McGuire doesn't have to hit a home run **every** time he steps up to bat! Too often criteria are set based on a standard that is unrelated to the goal at hand. Consider the goal that the student use a communication aid to let someone know when he is hungry "with 85% accuracy on five consecutive data days." Now consider that the data is going to be collected at a predetermined time during the day when scheduled, but when that student **may** or **may not** be hungry. Has he really achieved the desired goal if he uses the aid when instructed to do so, requests the food, and then throws the food because he was not hungry? Or has he more truly achieved the desired goal if he always eats food received as a consequence for spontaneously requesting that food? Collecting data not only on the specific performance of the task, e.g. "requesting food," but also on the student's satisfaction with the results of his request is often critical. The criteria for successful performance must be well thought out and grounded in functional goals. There is a tendency to collect data when it fits in the schedule, e.g. eating/hunger goals during snack or meal time. However this may not be when the student is hungry.

It is critical to identify what it will take to show that the student has the skill that is being taught. This is especially challenging when all responses are "multiple choice" because chance is always involved. If a student has two choices available to him (such as two pictures from which to choose or two switches to activate), then there is a 50/50 chance that the student will accidentally select the "correct" item. Statistically, making the "correct" selection anywhere between 25% and 75% of the time would fall in the range of occurrence of chance. In other words, the student could be accidentally selecting the picture or activating the switch and have an average of between 25% and 75% correct responses. To demonstrate the acquisition of a skill, the student's accuracy would need to be more than 75% (or less than 25% which would show the student was getting it wrong on purpose).

Similarly, if a student often turns his head to the right ten times in a ten minute period and a switch is placed near the right side of his head, his activation of the switch will need to be significantly more than the ten times in ten minutes in order to demonstrate that he has purposeful switch use. Ten times in ten minutes is the baseline that he does with no specific purpose. He will need to turn his head more (or less) than ten times in ten minutes to show he has developed the skill of purposely activating the switch. **The amount or rate of successful performance that is needed to insure that a child has learned the necessary skill will vary with different tasks.**

Four out of five tries is frequently used as criteria on IEPs. It may be sufficient when taking data on a child's accuracy in activating a switch. It is certainly not good enough if the child is learning to cross the street safely! The criteria or expected performance should reflect many things, including what the child was able to do before the intervention began (baseline performance), the difficulty of the task, the chance of accidental success, and the importance of the task as a building block for additional skills. Using the same criteria on every goal on a child's IEP indicates that the individuals writing the IEP are not truly thinking about the child's unique needs or the unique characteristic of the task.

Analyzing Errors

When you plant lettuce, if it does not grow well, you don't blame the lettuce. You look for reasons it is not doing well. It may need fertilizer or more water or less sun. You never blame the lettuce (from *Peace in Every Step*, Thich Nha Hanh). Yet when difficulties occur with a student learning to use assistive technology, sometimes the student is blamed. Remember, if the needed conditions are identified and provided, the skills will grow well, just as the lettuce does. Blaming has no positive effect at all, nor does trying to persuade, using reason, or arguments. Effective education means no blame, no reasoning, no argument, just understanding. That understanding can only come from careful observation and analysis of what is occurring.

It is not sufficient to just collect checkmarks and compute percentages. Meaningful data **must** provide a means by which to analyze performance or look for patterns within student responses, including specific errors. This is necessary in order to determine whether the number of responses or percentages are meaningful and/or identify what may be preventing the student from reaching the desired goal.

If a student has a communication device that offers him two choices ("yes" and "no" or "want" and "don't want"), he has a 50/50 chance of selecting the message that actually reflects his choice. It is important to look more closely at what the student is telling us in the pattern of his or her responses, not just the percent correct.

First, it is possible for the student to "not want" something and yet select "want" up to 75% of the time **by accident**. Staff may interpret a correct rate of 75% as indicating understanding of yes/no and respond to the "want" message by giving the student something that is **not** desired, such as the request for food described earlier in this chapter. Since the student selected 'want' only by accident, he may now push the item away, throw the item, or have a temper tantrum. Staff might then begin to discuss a behavior modification program to eliminate the throwing behavior, temper tantrum, etc. when, in fact, staff should be analyzing and revising the student's communication program because 75% is within the range of chance. The pushing away or throwing the item may more accurately indicate true communication!

At the same time, it is possible that 50%, although seemingly a chance response, might actually signal mastery! Consider these reasons.

- The student who is being asked to respond to four consecutive trials may become satiated with the activity after two presentations and then may purposely select the 'no' or 'not want' message on presentations #3 and #4. Although this computes to an average of only 50% "correct" responses, the pattern of the responses may show that they were purposeful.
- The student was declining the activity when he tired of it. The student who accidentally or randomly selects 'want' at a higher percentage, such as 75% with no obvious pattern, may actually be less purposeful in his choice.
- And finally, if position of the messages is being randomized, selection of a particular message 50% of the time might actually signal perseveration on that position (e.g. always hitting the switch on the right). The fact that the appropriate response is in that position 50% of the time is coincidental.

From these examples, one can see that 50% has three possible interpretations: a chance occurrence, perseveration on a position, and mastery of the skill. Each of these interpretations carries with it the need for a different program change for the student. If the data has been collected and reported as a percentage only, it is not possible to look at the patterns and determine which interpretation is correct. If, on the other hand, the data collected includes the recording of the number of the trial, or response (such as that seen in Christopher's example on page 14), as well as the response made on each trial, and the location or position of the "desired" response, it will be possible to review the data. Error patterns will be more evident and it will be possible to make a more accurate interpretation leading to appropriate program modifications.

In developing a data collection plan that will allow analysis of patterns and errors, consider what might prevent the student from reaching the goal. Then structure the data collection to identify not only whether the criteria is achieved, but if it is not, which of the obstacles might be the reason? What information will be available from the data that will support problem solving? When goals and objectives or benchmarks continue unchanged from one IEP to the next, it should be a red flag that suggests that no error analysis has been accomplished and the student is being "blamed" for the lack of progress.

Making Data Meaningful

Collecting a lot of observational data can result in piles of data sheets. So now what can be done with the piles? As mentioned, sometimes one can just look at the total numbers. Other times that is not enough.

When trying to decide which form of communication Bobby, a young child with severe speech difficulties, uses most frequently in a play group, the team can provide a communication board with appropriate picture symbols and a simple voice output communication device with equally appropriate symbols. Then one or more observers can collect data on how many times he uses his voice, how many times he uses the board, and how many times he uses the voice output device during a fifteen minute play time each day for a week. The total number of times he used each one can then be compared. That may be all that is needed. However, if another question is how well he is understood using each method of communication, this is a more complex question and it may be necessary to look at the data in another way. Another column may be added to the data collection form to note whether his request or comment was understood and responded to by the child or adult he was attempting to communicate with. After another week of daily data collection during play time, it may be possible to make some decisions about the most effective way for Bobby to communicate.

STUDENT : Bobby

Date/ Activity	Message Communicated	Method	Outcome
9/12/01	Play with cars	Card	Successful
	Paint	VOCA	Successful
	Take picture home	Voice	Three attempts before successful
9/13/01	Look at book	VOCA	Successful
	Play at sand table	VOCA	Successful
	Bigger cup	Voice	Not successful
	Other student took funnel	Voice	Not successful Bit other student
	Ready to quit	VOCA	Successful
9/14/01	Paint	VOCA	Successful
	Take picture home	VOCA	Successful
	Hungry	Voice and gestures	Successful
	Play with cars	VOCA	Successful
	Other student took his car	VOCA	Successful

Note:
As we add more relevant messages to his voice output device, he is having more success.

In order to decide how to best record and analyze data, it helps to think about the information that is being gathered and how it will best serve to answer important questions. When interviewing the student, the questions are usually about his or her needs and preferences. This information may be best recorded in an anecdotal way and may not lend itself to being charted or graphed. But other types of information may be most useful if it is transformed into a graph. The Thinking About Data chart on page 54 helps think about transforming information into useful data. Everyone can learn *when* the appropriate strategies are employed. For example, given the importance of frequent experience with a piece of technology, perhaps the first data point is not with respect to the student's production but rather to his environment. How often does the environment provide opportunities for the use of the identified technology? Does the absence of progress reflect an absence of opportunity? If so, what needs to be changed to accelerate growth? Data should provide not just a 'score,' but also the information or insights necessary to make the appropriate changes in implementation strategies.

Goal for Technology: *An example of lack of opportunity can be seen in Shawna's story. Shawna is five years old and has a diagnosis of autism. She recently moved to a new school. Her new teacher reviewed the previous IEP and was surprised to note that there were no communication goals or, in fact, any indication of expectations for Shawna to communicate. The only goal in the area of language was that she would "engage in verbal play during fine motor activities." Shawna's teacher believed that the first step was to observe Shawna, talk with her parents about what communication they observed at home, and together figure out a reasonable communication goal for Shawna.*
The IEP Goal to Be Addressed With the Technology: *The teacher was specifically concerned that they think about creating an environment that would elicit communication and reinforce communication rather than "making sounds." However, the existing goal of engaging in verbal play would serve as a starting point as they worked together to determine an appropriate communication goal.*

Questions to Be Answered Through Data Collecton: *Shawna had difficulty sitting still or participating in classroom activities. She spent most of her time running around the room, opening doors, climbing under tables, etc. The only time she would sit was when she had therapy putty that she could stretch across her face. She occasionally took the paraprofessional's hand and manipulated it toward an item to indicate, "I want something." She occasionally signed "more."*

After a week of baseline data which included video taping, the teacher was ready to schedule a new IEP meeting to plan a new intervention. At the IEP meeting, they decided to use a prompt hierarchy and descriptive feedback learned in a class on Environmental Communication Teaching (McCloskey, 2000). The prompt hierarchy involves a gradually increasing amount of assistance. The steps are as follows.

1. *Provide Environmental Cue – pause*
2. *Ask an open ended question – pause*
3. *Provide a partial physical prompt – pause*
4. *Request a verbalization – pause*
5. *Provide full model*

The pause is important because adults often do not wait long enough for the student to process information and initiate a response.

Type of Data to Be Collected: *They decided to begin with snack time for Shawna. They used a Mayer-Johnson symbol for "cracker" taped on a small sample of countertop material so that it could not be bent. They placed it in front of Shawna. The teacher held up the cracker and held out her open hand. She waited. When Shawna did not respond she*

followed the prompt hierarchy. The paraprofessional was stationed behind Shawna to assist. Shawna was very quick to throw the symbol to the ground, so the paraprofessional was very busy. In addition, Shawna continuously pushed her chair back away from the table so the chair had to be stabilized by the adults. By the end of snack, Shawna was able to hand the single picture to the teacher with a minimal prompt at her elbow from the paraprofessional. So in one day, she moved from needing all five steps to needing only the first three steps of the prompt hierarchy. During the second week of intervention they introduced other symbols but found that they could only offer one at a time. She could not discriminate and picked up multiple symbols all at once and handed them to the teacher.

Within one month Shawna was able to request, with no cues, 11 out of 12 times from an array of five pictures. Within two months she could select from 10 items. During the second month the teacher decided to try voice output. She chose a simple 16 message device and used the symbols that Shawna was accustomed to. When first presented with the device, Shawna played with it somewhat randomly but did request "milk" appropriately four times. Within four months Shawna was successfully using the voice output device in Circle Time and other daily activities. She was asking for turns and telling what comes next.

Discussion: *The chart on the next page shows the data from Snack Time on February 7th. In just a few weeks Shawna rapidly progressed from needing all five steps of the prompt hierarchy to being able to respond appropriately to an environmental cue, such as seeing the milk near the teacher and activating "milk" on the voice output device to request it. The change in Shawna's communication was dramatic. What would have happened if Shawna had stayed at the school where all they expected was that she "verbalize" during motor activities?*

COMMUNICATION TRAINING DATA
STUDENT: Shawna **DATE:** 2/7

Symbol	Prompt	Notes
Cracker	**C A PP RV (M)**	
Cracker	**C A PP RV (M)**	
Cracker	**C A PP RV (M)**	
Cracker	**C A PP RV (M)**	
Cracker	**C A PP (RV) M**	
Cracker	**C A PP (RV) M**	
Cracker	**C A (PP) RV M**	
Cracker	**C A (PP) RV M**	
Cracker	**C A (PP) RV M**	

C - Cue-pause
A - Ask open ended question-pause
PP - Partial physical prompt-pause
RV - Request verbalization-pause
M - Provide full model-pause

Summary

Technology can be challenging, exciting, rewarding, and fun **or** it can be frustrating, discouraging, disappointing, and difficult for all concerned! The direction taken from the beginning will determine the outcome. The time, thought, and systematic planning invested at the outset can lead to successful use of assistive technology.

In the past much of the research about assistive technology and other special education technology took place in laboratories or clinical settings, far from the classroom (Lewis, 2000b). That research indicated that technology is a very feasible tool to help students with disabilities. Lewis (2000b) suggests that now the task is to study application of technology within the context of the classroom. It is critical to look carefully at what is occurring and learn from it. Meaningful data appropriately analyzed is crucial to the process. When you have the data, you don't need to blame the lettuce!

13

Using Graphs to Analyze Data

When analyzing the data is critical, graphs provide a useful tool. Graphs serve at least three useful purposes. They provide a way to organize the data during data collection, so that it makes more sense. Second, a graph can provide an ongoing picture of what is happening, so that decisions can be made both along the way (formative evaluation of what is happening) and at the end of the time period set aside to collect data (summative evaluation). Finally, graphs can provide a very useful vehicle for communication between the team members including the parents, teacher, therapists, and when appropriate, the student.

Types of Graphs

There are two basic types of graphs:

- ***Line graphs***
- ***Bar graphs.***

Both are useful for helping compare and analyze information about assistive technology use. Both are easily created these days using computer programs such as Microsoft Excel or AppleWorks. These descriptions are adapted from the Journal of Applied Behavior Analysis (1997).

Line Graphs

Line graphs are generally used to look at data in a sequential manner across several days or weeks. They are easily drawn on graph paper or designed on the computer with a simple spreadsheet program. A line graph has two ***axes***, a vertical ***y*** axis (the ordinate) and a horizontal ***x*** axis (the abscissa). Historically, when the graph was completed these axes were typically drawn in a ratio of 2:3. In other words, if the y axis was 2 inches tall, then the x axis would have been 3 inches across. Today, when using a computer program these proportions are easily adjusted as needed.

To record data on the graph, small geometric forms such as circles, squares, or triangles are used. These different forms are used to represent different types of events or different students.

The data points are then connected with a line or ***data path***. A single type of geometric form is used to represent each data point on a single data path. When more than one set of data appears on a graph, each is represented by a different geometric symbol. Which symbol represents which behavior is shown at the bottom of the graph.

Bar Graphs

A bar graph is another way of displaying data to be analyzed or compared. Like a line graph, a bar graph has two axes, the abscissa and the ordinate. As its name indicates, the bar graph uses vertical bars to show performance levels rather than data points and connecting lines. Each vertical bar represents one observation or one student's performance.

Additional Graphing Information

Some traditional labels are used when discussing the data and analyzing the results. ***Conditions*** are phases of an intervention during which different approaches, techniques, or assistive technology are used. The very first data collected before beginning a specific intervention is called the ***baseline***.

For instance, if we want to know whether Isabelle can write more words using a portable word processor during language arts assignments than she can using a paper and pencil, we need to collect baseline information about the number of words she writes with the paper and pencil. That "baseline" data might consist of the number of words written each day for a week during the 20 minute writing session.

Intervention is the word used to identify that we have changed something and want to know what effect that change produces.

In Isabelle's case, the intervention is the provision of a portable word processor. Since Isabelle already knows how to keyboard, she only requires a few minutes of instruction on the use of the portable word processor. When we review her written work and count the number of words she now produces during the "intervention," we will be able to compare the baseline date with the intervention data to determine which condition is the most effective.

Transferring End Product Data to a Graph

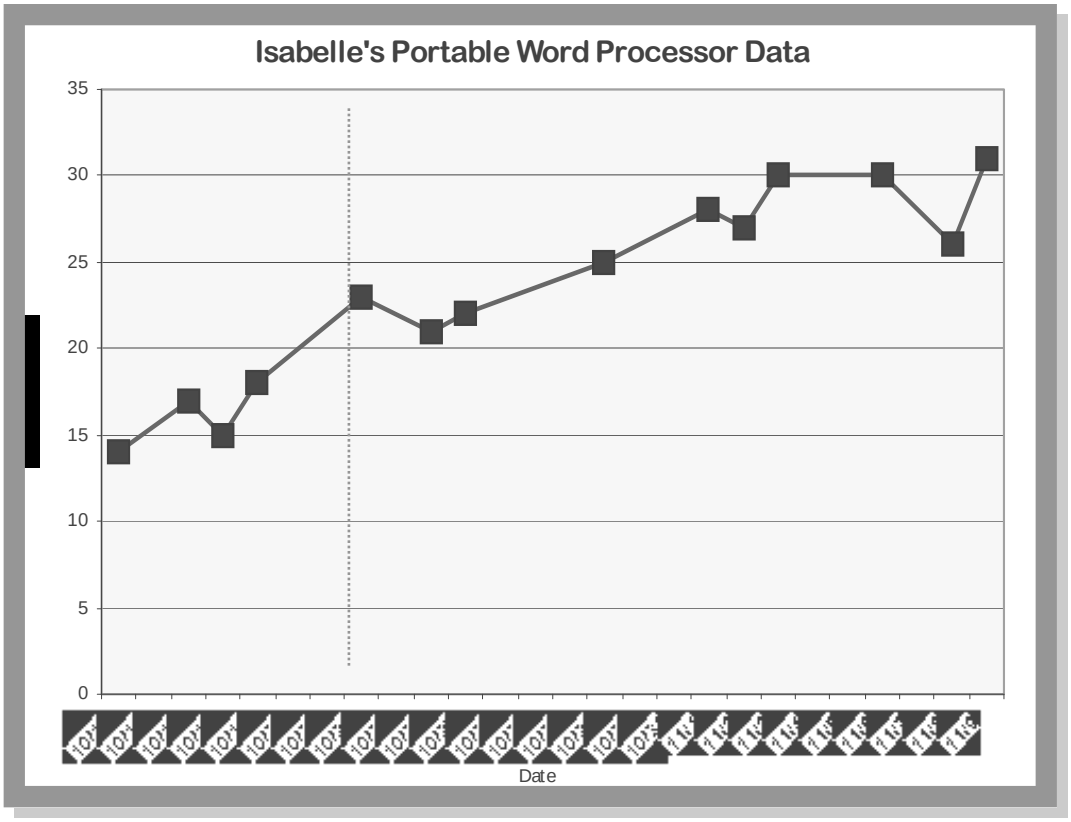
In the previous example about Isabelle, a graph can be made by recording the baseline data and the intervention.

Student: Isabelle
Task: Writing paragraphs of 30 words or more given a title and topic sentence
Baseline: Using pencil and paper

Date:	Number of Words:
10/15	14
10/17	17
10/18	15
10/19	18

Intervention: Using portable word processor

10/22	23	11/2	27
10/24	21	11/3	30
10/25	22	11/6	30
10/29	25	11/8	26
11/1	28	11/9	31



Transferring Event Data Into a Graph

Eli has difficulty responding and paying attention in Science class. His speech pathologist was only recently made aware of this problem. She wants to know whether having vocabulary prepared in advance will increase his participation in class. She obtained the planned content for each class from the teacher and provided Eli with specific vocabulary on his voice output device. To see if it was effective, she collected four days of baseline data when he had only general vocabulary on his device. Then she collected several more days of data after she started putting specific vocabulary on his device and reviewing it with him prior to the start of class. If this works well, she will train an assistant to do this task each day for Eli.

Student: Eli

Task: Responding when called on by the science teacher

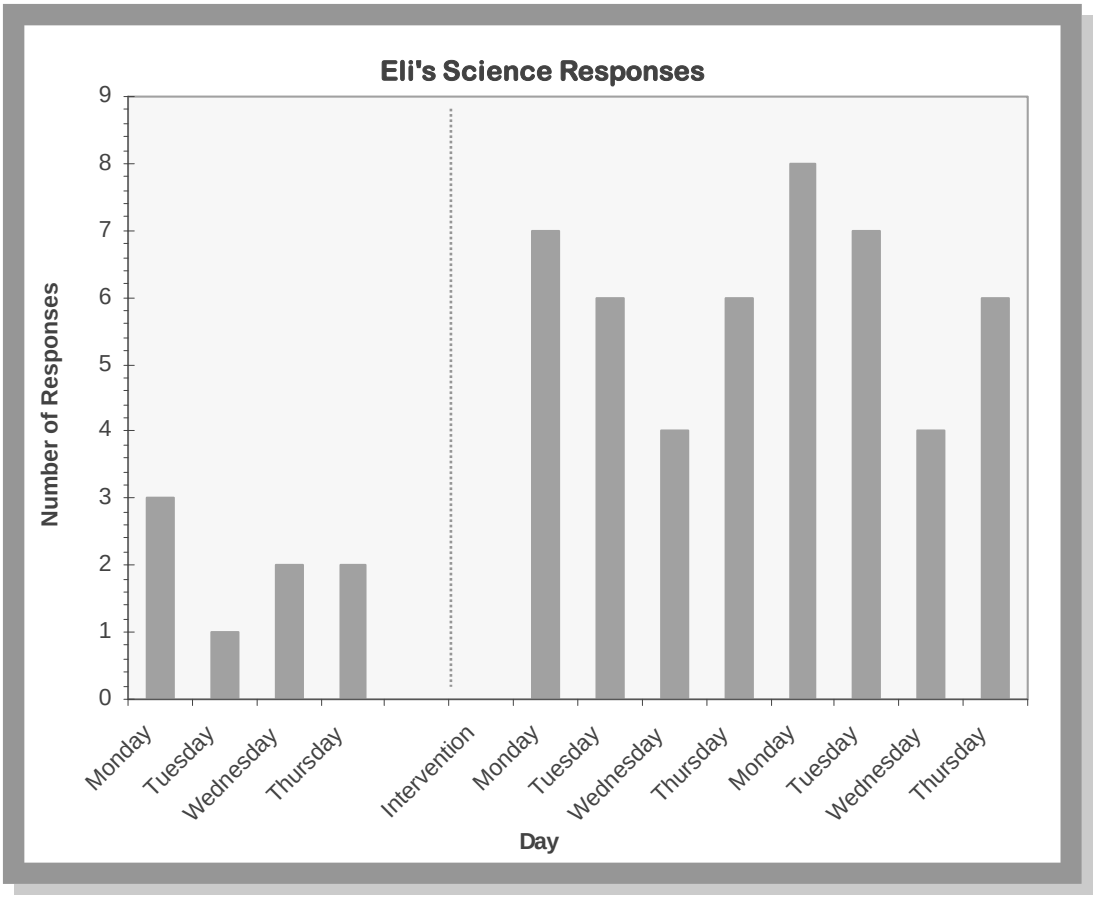
Baseline: Using general vocabulary on voice output communication device

First Week No. of Responses:

Monday	3
Tuesday	1
Wednesday	2
Thursday	2

Intervention: Specific vocabulary from teacher and reviewed before class

Second Week	Responses	Third Week	Responses
Monday	7	Monday	8
Tuesday	6	Tuesday	7
Wednesday	4	Wednesday	4
Thursday	6	Thursday	6


Eli's Science Responses
Number of Responses
0
1
2
3
4
5
6
7
8
9
Monday
Tuesday
Wednesday
Thursday
Intervention
Monday
Tuesday
Wednesday
Thursday
Monday
Tuesday
Wednesday
Thursday
Day

Transferring Rate Data to a Graph

Rate data is extremely important when there is concern with both accuracy and speed. Rate data tells more than simple totals do.

$$\frac{\text{15 problems correct}}{\text{30 minutes}} = \text{0.5 problems correct per minute}$$

$$\frac{\text{20 problems correct}}{\text{45 minutes}} = \text{0.44 problems correct per minute}$$

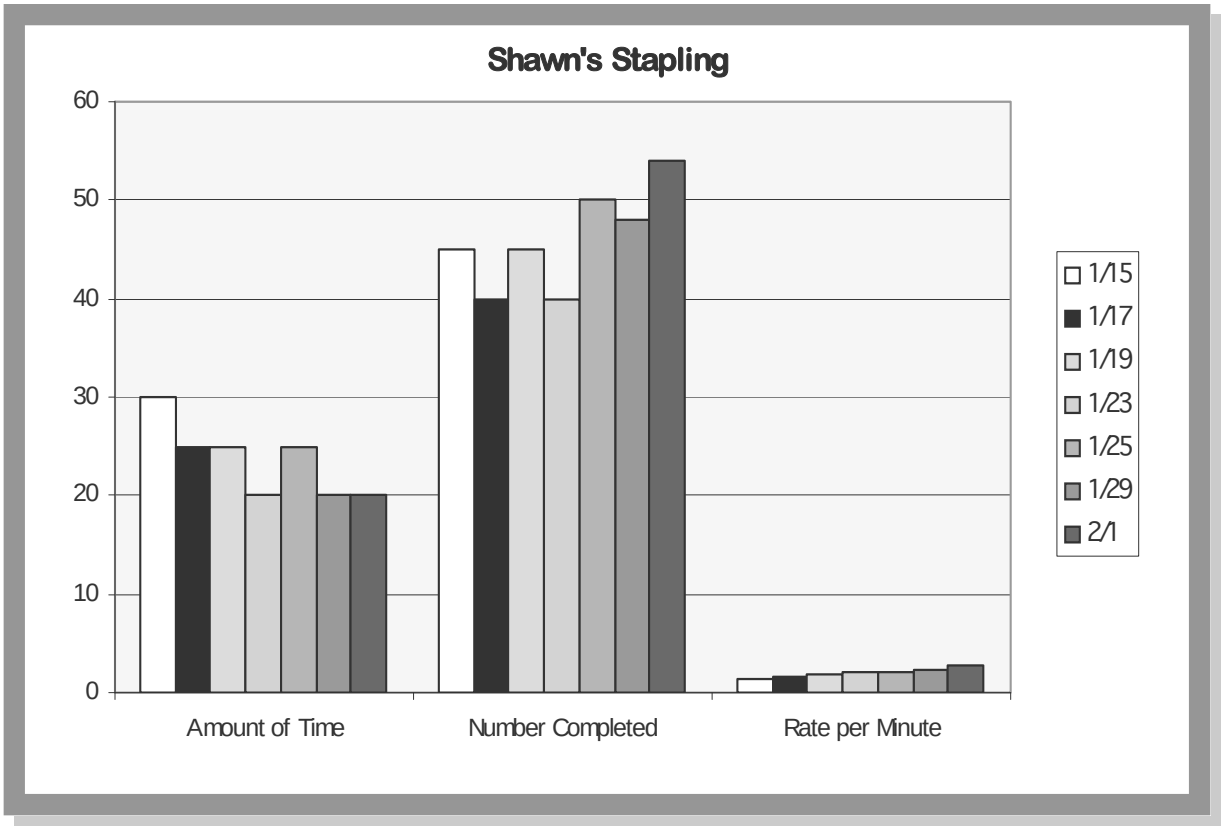
While more information would be needed to know if this was a trend or just an unusual day, it is important to think about what is needed from the data before it is too late to get all of the necessary information.

If Jeremy completes fifteen math problems on Monday and twenty on Tuesday, it looks like he is doing better. However, when we realize that on Monday Jeremy had only 30 minutes to work, and on Tuesday the teacher gave them 45 minutes to work, the data actually shows a decrease in rate.

Shawn is participating in a work study program where he is learning how to do several office tasks. One of those tasks is to straighten groups of papers and staple them together. He uses a jig that was specially made for him. He pushes the papers into the corner of the jig to line them up and then pushes the stack of paper into the electric stapler.

Student: Shawn
Task: Straightening and stapling papers

Date:	# Completed	Amount of Time	Rate per Minute
1/15	45	30 min.	1.5
1/17	40	25 min.	1.6
1/19	45	25 min.	1.8
1/23	40	20 min.	2.0
1/25	50	25 min.	2.0
1/29	48	20 min.	2.4
2/1	54	20 min.	2.7



Summary

Transferring data to a graph can make it easier to interpret. Two types of graphs were discussed: line graphs and bar graphs. Each of them can be useful. Both line graphs and bar graphs as well as other types of graphs are easily created with readily available software.

14

Answering the Questions

In Chapter 2, *Framing Assistive Technology Questions,* it was suggested that there are a variety of questions that a team might ask about assistive technology. Going back to those original questions, it is time to think about how to answer them by using data. Here are the assistive technology questions presented in the first chapter and suggestions about how data might help a team come to agreement on an answer.

Common Types of AT Questions That Can Be Answered With Data

What is the difficulty? Assistive technology helps a child to do something that is difficult or impossible because of a disability. Sometimes, when we examine a child's performance data, we find that we have identified the wrong problem. We may find that a child is not communicating because she does not yet understand how language works. We may find that a student is not turning in his homework because he can't find it when it's time to turn it in. When this happens, our data may show us what the real problem is.

Is there a need for assistive technology to help solve an identified problem? If the problem has been identified correctly, data may indicate that the desirable solution is assistive technology, or it may be something else. Sometimes a student may need a change in instruction or a change in environment rather than the addition of a new assistive technology tool.

Sherri was having trouble listening to the teacher in lecture classes. The team tried several assistive technology options to increase her ability to hear the teacher, but Sherri's comprehension did not increase. They decided to change Sherri's instructional program so that she could participate in a class which used small group instruction rather than lectures. In small groups her comprehension data showed improved performance. For Sherri assistive technology was not a solution to her difficulty.

What assistive technology is needed? Data about the nature of the problem helps to clarify what type of assistive technology is needed. For a child who does not communicate verbally, it's important to know how much language she understands and what communication demands occur in her environment before the right assistive technology tool can be selected. For a child who has difficulty with written assignments, it's important to know his reading ability, spelling ability, and comprehension, as well as the types of writing tasks, when planning to use assistive technology to help him write. For a child who needs assistive technology for mobility, one product may work better on some surfaces than others.

Does the tool that has been tried make a difference? Data can help a team look at how an assistive technology solution works for a child. Data may show that the assistive technology helps in some settings but not in others. Data may show that assistive technology helps with some tasks but not others. Data may show that assistive technology works best in particular conditions. For example, data may indicate that a student should use a laptop computer for writing when working on a term paper but not when taking notes in class.

Which tool should be chosen? If there are several models of a particular type of tool, which one works best? It's always a good idea to choose the simplest tool that will do the job that needs to be done. Data can help a team to understand exactly which tool that is.

Is the assistive technology necessary for the student to receive a Free Appropriate Public Education (FAPE)? This is perhaps the most difficult to answer. A Free Appropriate Public Education is one that provides the child a specially designed program that allows the child to make reasonable progress in the curriculum. It does not have to be the "best possible" program. It does need to be designed to provide a "basic floor of opportunity," not a program designed to "maximize a student's potential" (Hager, 1999). Unfortunately, there is no formula that magically reveals what a basic floor of opportunity is to insure FAPE. The IEP team must do their best to make a fair and reasonable determination with the information they have available. Good data about whether the use of the assistive technology does or does not help the child to benefit from his or her education or demonstrate progress in the general education curriculum can help the IEP team with this important decision.

Is assistive technology required for equal access to an education under Section 504 or the ADA? The team considering the assistive technology needs of a student who does not require specially designed instruction will need to think about access issues. Section 504 addresses only "equal access," but the ADA goes further. These teams also can benefit from collecting good data. Section 504 addresses equal access to an education. The team must determine if assistive technology makes a difference in the child's ability to access the educational program being provided. Things like access to resource information, either from encyclopedias or the internet, may need to be addressed. Under the ADA the requirement is to provide "auxiliary aids and services," which includes assistive technology, in order to insure that the child receives "effective communication, equal access, and consideration of his or her preferences" (Golden, 1998). The need to consider the child's preferences is not part of IDEA or Section 504 but is a part of the ADA. This aspect is often critical in avoiding later abandonment of the assistive technology.

Must the assistive technology be provided outside of the school in order for the student to receive a FAPE? Again, this is a very difficult question and one that the IEP team must answer on an individual basis. If the IEP team has already determined that the assistive technology is necessary to complete a task at school in order to have a FAPE, there may come a time when they need to think about whether the child needs to do that same task at home or in some other environment. For example, a child with a severe writing disability who uses a computer with word prediction at school may need assistive technology to complete homework. A child who uses a voice output communication aid (VOCA) to communicate, needs to communicate in many environments, and that VOCA may be needed in environments other than the school. In either case the same AT or some other AT to accomplish the same task may be needed at home or in another environment. The IEP team must determine whether the AT is truly "needed" or would just be "nice." Once again, specific data is absolutely critical to the IEP team as they work to answer this question.

What is happening with the assistive technology that is in use? When a team has selected an assistive technology tool, and things don't go as expected, data about the child's frequency of use, reasons for use, and results when assistive technology is used may help a team to identify what is going wrong and which might need to be changed.

Outcomes From Use of Data

When teams ask questions like these and use data to help us answer them, there are really only a few possibilities.

- The team may find that there is clear data that shows that assistive technology will make a difference for the user and is needed.
- The team may find that there is clear data that shows that assistive technology does not make a difference for the user. In this case the team may choose another way of solving the problem such as teaching the child new skills or changing the kinds of tasks which are required.
- The team may find that there is not enough data to make a decision and more should be collected.
- The team may find that the data collected uncovered unexpected information. When this happens the team may need to frame a new question.

Case Studies

Also in Chapter 2, *Framing Assistive Technology Questions*, the assistive technology questions raised by the teams of five different students were listed. On the following pages, each student's case is reviewed to see how data was collected and utilized to answer those questions.

Kelly

The occupational therapist believes Kelly is purposefully activating a switch, but the classroom teacher and assistant believe it is random. How can the team tell if Kelly's actions are purposeful or random?

Goal for Technology

Kelly's team wants her to use a switch so that she can take a more active role in the things that happen around her. If she can learn to use a switch on purpose, her teachers and family will be able to hook the switch to things like the blender for helping to fix her own lunch, toys so that she can play with other children, and simple communication devices so that she can interact in new ways.

IEP Goals to Be Addressed With the Technology

Kelly has IEP goals, such as learning cause and effect, which are directly related to the switch use. If she can learn to understand that if she hits the switch *something* will happen, she will have learned one aspect of cause and effect. She also has some basic communication and self help goals for which switch use would be a valuable tool.

Type of Data to Be Collected

Kelly's team disagreed about whether she understood pressing a switch to make something happen. They decided to collect meaningful frequency data to help them decide what was actually happening.

Kelly

Plan for Data Collection

The team agreed to offer Kelly a switch under a variety of conditions and to compare how many times she pressed the switch for each condition. To collect baseline data, they placed Kelly's switch in its usual location, but they did not attach it to anything. Then they counted the number of times Kelly pressed the switch during ten different time blocks. There was no change in her usual program while they began to collect data. The assistive technology specialist on Kelly's team was able to use a standard deviation formula (Korsten, Dunn, Foss & Franke, 1993) to determine how many times Kelly would need to press the switch during each session for the change to be statistically significant (i.e. more than two standard deviations above or below the mean). The team then offered Kelly a variety of rewards attached to the switch. Her frequency of switch activations was recorded for each different consequence in order to determine whether Kelly was pressing the switch on purpose for some rewards and not for others.

Discussion

The team was able to collect quite a lot of frequency data during the two months of the evaluation period. Using a standard deviation formula, the assistive technology specialist was able to determine how many times Kelly would need to press the switch during each session for the change to be statistically significant. When they examined the data, the team discovered that Kelly's performance was significantly reduced when the switch was not attached to any device, and nothing happened when she pressed it. They also saw that her performance increased significantly when the switch activated music or a light display. When Kelly's switch was attached to a variety of battery operated toys, there was no significant difference from the times when the switch was not attached to anything. From this data, the team was able to determine that Kelly was able to use the switch to operate devices purposefully, and Kelly did *not* like to play with battery operated toys. Kelly really did know what her switch would do and was able to choose when to use it and when not to use it.

Jason

Jason's speech language pathologist strongly recommends a voice output communication aid (VOCA) for Jason. His parents are not sure it is needed because they understand him at home and prefer that Jason communicate with speech. How does the team decide whether or not to use a voice output device in some environments?

Goal for Technology

In Jason's case, the issue here is whether there is a goal for technology. Because Jason is able to speak without the VOCA the team does not have agreement that he needs a communication system besides his voice.

IEP Goals to Be Addressed With the Technology

Many of Jason's IEP goals concern communication in a variety of environments. They involve requesting items from adults and from friends, relating information to unfamiliar listeners, and repairing communication breakdowns when people do not understand him.

Type of Data to Be Collected

Jason's team decided that they needed to know how often Jason was having trouble communicating with others and about the kinds of communication situations that were giving him difficulties. They decided that the best thing to do was to observe Jason in a variety of situations and keep a record of his communication experiences.

Plan for Data Collection

Jason's team decided to use a very simple data collection design. An index card with a chart listing the date and time of the communication, the communication environment, the words that Jason was trying to communicate, and the person that he was trying to communicate with was used. Each team member, including Jason's parents, agreed to carry this form when they were with Jason outside of the home or his self contained classroom. The team decided to do this for one week.

Jason

Discussion

When Jason's team reviewed the data, it was possible to identify some significant trends. One thing Jason's parents noticed from their data was that Jason did not even try to communicate when he was in unfamiliar situations. At the mall, at the skating rink, and in the grocery store, he was essentially silent. At church and in his neighborhood, Jason attempted to speak to only three individuals during the entire week. At school things looked a little different. Jason spoke to all of his classmates, the school secretary, five children on the playground, and the school's janitor.

STUDENT : Jason

Date	Environment	Message	Communication Partner	Successful/ Not Successful
1/21	School-Class	Seven	Teacher	+
1/21	School-Class	Fourteen	Classmate	+
1/22	Mall	No message	Store Clerk	–
1/22	Mall	I want that.	Mother	+
1/22	Mall	Yah	Mother's Friend	–
1/22	Skating Rink	No message	Ticket Taker	–
1/22	Skating Rink	No message	Concession Stand	–
1/22	Skating Rink	No message	Mother's Friend	–
1/23	School-Class	Abraham Lincoln	Teacher	+
1/23	School-Class	Civil War	Teacher	–
1/23	School-Lunch	Ticket please	Secretary	+
1/23	School-Lunch	Can I have some?	Classmate	–

Jason

The team was able to agree that Jason needed help to communicate with unfamiliar listeners. But Jason's parents were still hesitant to adopt the use of a high tech communication device. They were afraid that it would make him even more isolated. This team discussed other strategies that Jason might use to help him communicate. These included the use of a pencil and paper to write the beginning letter(s) of words or phrases people did not understand, the use of a communication folder with commonly used words and phrases, and the use of a hand held VOCA. The team made a plan to try each of these solutions with Jason in his classrooms and school environment. Once these trial periods had been completed and data had been collected, the team agreed to meet again to discuss results.

Kristin

Kristin, who has significant motor differences, uses the computer for all written work. She is having difficulty using the standard mouse. The teachers and therapists want to know if there is an alternative that will work better for her. How can the team figure out if there is a mouse alternative that will be easier for her to use?

Goal for Technology

The goal is for Kristin to be more independent and successful in using the computer for written communication, especially classroom assignments. Kristin is very motivated to use the computer. She is able to use a standard computer keyboard with a keyguard but has been having a great deal of difficulty with the standard mouse. She is very frustrated.

IEP Goals to Be Addressed With the Technology

There is a goal on Kristin's IEP about completing all written assignments including math by using the computer.

Type of Data to Be Collected

Kristin's team decided that they would need to try out several different types of mouse alternatives to see if there was one that would be easier for Kristin to use independently. The occupational therapist decided that she would take the lead in trying out a variety of mouse alternatives with Kristin. She had attended a session at a conference and had some ideas about where to start. The OT created a chart with places for the critical information. It included the name of the mouse device, the date and time of day it was being tried, and any adaptations or adjustments that were made. Then she made places to describe how Kristin moved the cursor and activated the button. Finally she made a column to record the results when trying to do the following functions: point, click, double click, and drag. She began by carefully noting how Kristin grasped the mouse tool, the action it required, and any specific placement that seemed to work best.

Kristin

Plan for Data Collection

The OT researched mouse alternatives and identified several that she thought might work for Kristin. Kristin and the OT agreed to try a variety of mice over the course of the next three weeks. The OT worked directly with Kristin to set up and use the mouse alternatives. The OT recorded the information on each one and the specific data about how easily and effectively Kristin could use each one. Kristin could choose to use any of the mouse alternatives for class work between data collection sessions.

Discussion

Kristin was really pleased to see that there were so many options and that she would have the OT's support in finding one that would be easier for her to use. She was enthusiastic throughout the process. Kristin liked the third one they tried and chose to begin using it for her assignments that day. However, she agreed that she wanted to continue to experiment with the others in case there was one that was even better. Two of the mouse alternatives that worked well for Kristin were adapted joy sticks that featured a button that could be programmed for 'click drag,' which had always been especially difficult for her. At the end of the trial the OT ordered the joy stick for Kristin's permanent use. She noted that although they had tried some options that cost nearly $2000 each, the two that had worked best for Kristin were both under $500. Kristin's family was pleased that all types of options including those operated by the head and feet were tried and that Kristin's preferences as well as need were taken into account.

MOUSE ALTERNATIVE EVALUATION
STUDENT : Kristin DATE: 10/9 TIME: A.M.

Set Up	Results	Comments
Device: Standard Mouse Placement: In front of left hand, turn front into computer Body Site(s): Left hand for mouse use Cursor Movement: Set track to shadow on cursor, mod. speed, biggie cursor, 24 pt. print Button Action: Left and right click	Point:1 Click:2 D.Click:0 Drag:0	Drag: Check vision for targeting cursor Click: OK Double Click: Need a button to do this Drag: Is there a way to attach mouse, need more arm stability, gain hand control, difficulty in individuation of
Device: Roller Track Ball Placement: Same as above Body Site(s): Left hand Cursor Movement: Button Action: Click, drag	Point:2 Click:2 D.Click:1 Drag:2	Has better control of mouse but fatigues quickly and then extraneous arm movement starts Need separate button for double click (Tried feet but has to look and check which causes movement patterns)
Device: Roller Track Ball Plus Placement: Same Body Site(s): Same Cursor Movement: Button Action: Click, double click, drag, horizontal and vertical movement	Point:2 Click:3 D.Click:2 Drag:3	Likes better than other previous devices and double click is nice but fatigues quickly Switches can be connected
Include name of mouse device plus any adjustments to driver settings, programming of buttons, markings on mouse, positioning aids, etc. Provide sufficient detail to replicate set up.	*3-does easily 2-does adequately 1-does w/ difficulty 0-cannot do*	*Helpful features of this device. Reasons to rule out this device. Details of results, especially difficulties & adaptations.*

Adapted from Fridie & Fuhrer, 1999

MOUSE ALTERNATIVE EVALUATION
STUDENT : Kristin DATE: 10/9 TIME: A.M.

Set Up	Results	Comments
Device: Head Mouse Placement: Wears on forehead Body Site(s): Head Cursor Movement: Drag Button Action: Click and double click	Point:1 Click:2 D.Click:1 Drag:2	Didn't like this at all. Doesn't need on screen keyboard
Device: Roller Joystick Placement: In front of left hand Body Site(s): Left hand Cursor Movement: Button Action: Click, drag	Point:3 Click:2 D.Click:0 Drag:2	Likes joystick, similar to chair stick Less fatigue noted Bumps joystick on way to keyboard to type, so need lock down/Velcro Best so far in screen control
Device: Roller Joystick Plus Placement: Same; fastened to desk at 45 degrees facing toward keyboard Body Site(s): Same Cursor Movement: Button Action: Click, double click, drag, horizontal and vertical movement	Point:3 Click:3 D.Click:3 Drag:3	Again likes joystick action Can stabilize elbow in chair enough to have greater control Still hits on way to keyboard Recessed desk spot left of keyboard would be better Likes speed settings Works very well
Include name of mouse device plus any adjustments to driver settings, programming of buttons, markings on mouse, positioning aids, etc. Provide sufficient detail to replicate set up.	*3-does easily* *2-does adequately* *1-does w/ difficulty* *0-cannot do*	*Helpful features of this device.* *Reasons to rule out this device.* *Details of results, especially difficulties & adaptations.*

Adapted from Fridie & Fuhrer, 1999

Andrew

Andrew uses talking word processing during school and his parents want it used during the statewide assessment. How can the team decide if he should use talking word processing during the state assessment?

Goal for Technology

Andrew's team needed to know two things. First, how would his use of talking word processing during state assessments affect his ability to graduate from high school? Second, would his use of talking word processing improve his performance on state assessments?

IEP Goals to Be Addressed With the Technology

Andrew's IEP indicates that he will take all the standard state assessments with modifications and accommodations as listed on the IEP. The team needed to identify the accommodations and modifications he would need before they could complete the IEP.

Type of Data to Be Collected

First, Andrew's team needed some factual information about his state's approach to the use of assistive technology in statewide assessments. They went to the website that was managed by the state's assessment program and found that if Andrew used assistive technology of any kind to complete the state assessments, his scores would not be averaged with the other students in his school, but his scores would be accepted as meeting the requirements for graduation. Once they knew that Andrew's use of assistive technology would not affect his graduation, the team went on to the more complicated question of whether or not the AT would help him improve his scores.

Plan for Data Collection

Andrew's team decided that they needed to know more about how Andrew performed on state assessments. They decided to review products in order to compare his performance with and without the use of talking word processing. Andrew's teacher mentioned that sample state assessments were available on the website. The team decided that he could complete some samples with AT and others without it. These sample tests could then be compared before IEP decisions were made.

Andrew

Discussion

Once Andrew had completed sample tests using his talking word processor on some and not on others, they were scored by his school's curriculum director. When the team met to review the results, they found that Andrew had done much better on sample tests when he used the talking word processor if the test required writing of more than one sentence. If the test required one or two word answers, it appeared that using a computer actually slowed him down so much that he was unable to finish the test. Given this information, the team decided that Andrew would use his talking word processor to complete the state writing assessment but would not use it for any of the other assessments.

Samantha

Samantha has made very little progress in using her voice output communication device. How does the team determine what is holding her back?

Goal for Technology

Samantha's goal for use of her voice output communication device (VOCA) is to enable her to communicate more effectively with peers and adults in school and at home.

IEP Goals to Be Addresses With the Technology

Samantha's IEP contains two specific communication goals. The first is that she will initiate interactions with friends during free play time. The second is that she will be able to use her VOCA to answer questions posed by the teacher during morning Circle Time.

Samantha

Type of Data to Be Collected

When Samantha's team met to discuss her use of the VOCA the members first had to come to agreement on what she had accomplished with her VOCA. The teacher reported that Samantha had increased her use of her VOCA in response to questions during morning Circle, and she had data to indicate this change. No one on the team had seen Samantha use her VOCA spontaneously. The team decided to focus on this issue and to try to discover why Samantha was not using her VOCA. They decided that frequency data would give them the most information.

Plan for Data Collection

Samantha's team made some guesses about why she was not using the VOCA to talk to her friends. They wondered if she understood the symbols on her system. They also discussed the sound of the VOCA and wondered if Samantha was embarrassed to use the robotic voice. Finally they discussed the content of the messages they had programmed into the device and wondered whether these were things that Samantha really wanted to say. The team decided to change one thing at a time and collect data on how many times Samantha initiated communication after each change.

Discussion

The team spent the first week collecting baseline data on how often Samantha initiated conversation. They were not surprised to find that she **never** initiated. The first change in her VOCA was a change in the symbol system that Samantha was using. The team decided to keep the line drawings that she had on her VOCA but to color them so that each symbol would stand out more and be easier for Samantha to find. During the second week, data showed that Samantha still did not ever initiate interactions with peers during free play.

Samantha

The second change the team made was in the messages that Samantha had available to her. They developed a set of "conversation starter" messages such as "What are you doing?" and "That's neat!" to replace the old messages like "I want to swing" and "Please give me the crayon." They discussed these changes with Samantha and helped her practice using them. When the team collected data during free time during the following weeks, Samantha initiated interactions using her new messages an average of three times per day the first week and four times per day the second week.

The third data collection phase involved a change in the sound of the device Samantha was using. The team was able to provide her with a new device which was physically similar but used recorded speech rather than a robotic voice. During the data collection phase of this change, Samantha initiated interactions with her friends an average of one time per day during the first week and two times per day during the second week.

The data Samantha's team collected helped them to focus their attention on the kind of messages Samantha had available to her. The team decided to work with Samantha's family to identify more messages that would invite interaction and to reduce the number of messages that started with the phrase "I want..." With these changes in place, Samantha began to use her VOCA more often for natural communication opportunities.

Summary

There are a variety of questions related to the use of assistive technology. Virtually all of them can be answered by the use of effective data collection. Each question will require thought about the type of data needed, the most effective and efficient way to gather that data, and the criteria for success. Each question requires thoughtful planning in order to answer it.

References

Alberto, P. & Troutman, A. (1999). *Applied Behavior Analysis for Teachers (5th Edition)*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Birnie-Selwyn, B., & Guerin, B. (1997). Teaching children to spell. *Journal of Applied Behavior Analysis, 30,* 69-91.

Bowser, G. & Reed, P. (1995). Education tech points for assistive technology planning. *Journal of Special Education Technology, 7*, 4, 325-338.

Bowser, G. & Reed, P.(2001). *Hey! Can I Try That?* Roseburg, OR: Oregon Technology Access Program and Oshkosh, WI: Wisconsin Assistive Technology Initiative. May be downloaded from: www.edtechpoints.org

Brinker, R.P. & Lewis, M. (1982). Making the world work with microcomputers: A learning prosthesis for handicapped infants. *Exceptional Children, 49,* 2, pp. 163-170.

Cassel, J., & Reid, R. (1996). Use of a self-regulated strategy intervention to improve word problem solving skills of students with mild disabilities. *Journal of Behavioral Education, 6*,2, 153-172.

Fennema-Jansen, S. (2001). Measuring effectiveness: Technology to support writing. *Special Education Technology Practice, 3*, 1, 16-22.

Glanz, J. (1998). *Action Research: An Educational Leader's Guide to School Improvement.* Norwood, MA: Christopher-Gordon Publishers, Inc.

Golden, D. (1998). *Assistive Technology in Special Education Policy and Practice.* Albuquerque, NM: Council of Administrators of Special Education.

_____ (2001). *Georgia Project for Assistive Technology Assessment Guide.* (www.gpat.org).

Hager, R. (1999). *Funding of Assistive Technology. The Public School's Special Education System as a Funding Source: The Cutting Edge.* Buffalo, NY: The National Assistive Technology Advocacy Project.

_____ (1997). *Journal of Applied Behavior Analysis, 30*,2, 334.

Kazdin, A. (1977). Artifact, bias, and complexity of assessment: The ABCs of reliability. *Journal of Applied Behavior Analysis, 10,* 141-150.

Korsten, J. Dunn, D., Foss, T., & Francke, M.K. (1993). *Every Move Counts: Sensory Based Communication Techniques.* San Antonio, TX: Therapy Skill Builders.

Lehman, J.F. & Klaw, R., (2001). *From Goals to Data and Back Again*. Pittsburgh, PA: Kid Access Inc.

Lewis, R. (1998b). Reading software for students with learning diabilities: Hypermedia-based children's literature (web document). In *LD Online*. Available:www.ldonline.org

Lewis, R.B. (2000a). Final report. Project LITT (Literacy Instruction Through Technology): Enhancing the reading skills of students with learning disabilities through hypermedia-based children's literature. San Diego, CA: San Diego State University, Department of Special Education. (Accepted 2/2000 by ERIC Document Reproduction Service, ED No. pending).

Lewis, R.B. (2000b). Musings on technology and learning disabilities on the occasion of the new millennium. *Journal of Special Education Technology, 15*,2, 5-12.

Lewis, R.B. & Ashton, T.M. (1999). Interactive books on CD-ROM and reading instruction for students with learning disabilities. What Are Your Views? (web document). In conference proceedings on-line 1999 "Technology and Persons With Disabilities."

MacArthur, C.A. (1999). Word prediction for students with severe spelling problems. *Learning Disability Quarterly, 22,* 3, 158-172.

McCloskey, S. (2000). Environmental Communication Teaching in Action. Minneapolis, MN: 18th Closing the Gap Conference.

Neef, N., Walters, J., & Egel, A., (1984). Establishing generative yes/no responses in developmentally disabled children. *Journal of Applied Behavior Analysis, 17*, 453-460.

Reed, P. (Ed.) (2004). *Assessing Students Needs for Assistive Technology.* Oshkosh, WI: Wisconsin Assistive Technology Initiative.

Reed, P. (2001). *Resource Guide for Teachers and Administrators About Assistive Technology.* Oshkosh, WI: Wisconsin Assistive Technology Initiative.
May be downloaded: www.wati.org

Siedman, I.E. (1991). *Interviewing as Qualitative Research: A Guide for Researchers in Education and the Social Sciences.* New York: Teachers College Press.

Singh, N., Oswald, D., Ellis, C., & Singh, S. (1995). Community-based instruction for independent meal preparation by adults with profound mental retardation. *Journal of Behavioral Education, 5*(1), 77-91.

Trap, J.J., Milner-Davis, P., Joseph, S., & Cooper, J.O. (1978). The effects of reedback and consequences on transitional cursive letter formation. *Journal of Applied Behavior Analysis, 11*, 381-393.

_____ (2000). *Wisconsin Assistive Technology Initiative Assessment Guide.* (www.wati.org).

Wright, H. (1960). Observational Study. In P.H. Mussen (Ed.*), Handbook of Research Methods in Child Development*. New York: Wiley.

Appendix

BLANK FORMS

Assistive Technology Product Comparison

STUDENT: _____ **DATE:** _____

DATA COLLECTED BY: _____

	Tool Used			
Date			**% Correct**	**Comments**

Product Production

STUDENT : _____ DATE: _____

DATA COLLECTED BY: _____

Time	Activity	Observation

Activities:

L - Lecture SG - Small Group SW - Seat Work

D - Discussion T - 1-1 with Teacher O - Other

Voice Output Device Activations

STUDENT: _____ **DATE:** _____

DATA COLLECTED BY: _____

Date	Phrase	# Opportunities	# Correct Activations	% Correct

Device Evaluation Summary

STUDENT : _____ **DEVICE:** _____

DATA COLLECTED BY: _____ **DATE:** _____

Circle the number that best describes the ability of this tool to meet the student's needs.

High	Low					Comments
Size of cells/keys	N/A-0	1	2	3	4	
Number of cells/keys	N/A-0	1	2	3	4	
Sensitivity of touch panel	N/A-0	1	2	3	4	
Screen visibility	N/A-0	1	2	3	4	
Voice quality	N/A-0	1	2	3	4	
Print quality	N/A-0	1	2	3	4	
Computer compatibility	N/A-0	1	2	3	4	
Ease of Programming	N/A-0	1	2	3	4	
Portability	N/A-0	1	2	3	4	
Memory	N/A-0	1	2	3	4	
Set-Up	N/A-0	1	2	3	4	
Overlay changes	N/A-0	1	2	3	4	
Level changes	N/A-0	1	2	3	4	
Overall in meeting the student's needs	N/A-0	1	2	3	4	

	Student	Teacher	Other
Who carries the device?			
Who sets up the device?			
Who programs the device?			
Who changes the overlays?			

List the daily activities for which the device is used.

Comments:

Writing Speed and Accuracy

STUDENT : _____ DATE: _____

DATA COLLECTED BY: _____

Date	Number of Errors	Number of Words Typed	Time to Completion

Vocabulary Use

STUDENT:_____ **DATE:** _____

ACTIVITY: _____ **LOCATION:** _____

DATA COLLECTED BY: _____

Phrase Used	Accurate Choice? (Y/N)

Initiated Communication

STUDENT : _____ WEEK OF: _____

DATA COLLECTED BY: _____

Monday	Tuesday
Wednesday	Thursday
Friday	COMMENTS:

WEEK OF: _____

Monday	Tuesday
Wednesday	Thursday
Friday	COMMENTS:

WEEK OF: _____

Monday	Tuesday
Wednesday	Thursday
Friday	COMMENTS:

Latency of Response

STUDENT: _____

DATA COLLECTED BY: _____

Date	Stimulus	Time to Response	Prompts Offered

Performance Data

STUDENT:_____ **WEEK OF:**_____

DATA COLLECTED BY: _____

	Number of Problems	% Correct	Completed Assignment	Comments
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Weekly Average				

System Comparison

STUDENT:_____ **WEEK OF:**_____

DATA COLLECTED BY: _____

	Picture Board	VOCA	Voice	Comments
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
TOTAL				

Communication Training

STUDENT: _____ **DATE:** _____

DATA COLLECTED BY: _____

	Symbol	Prompt	Notes
1.	_____	C A PP RV M	_____
2.	_____	C A PP RV M	_____
3.	_____	C A PP RV M	_____
4.	_____	C A PP RV M	_____
5.	_____	C A PP RV M	_____
6.	_____	C A PP RV M	_____
7.	_____	C A PP RV M	_____
8.	_____	C A PP RV M	_____
9.	_____	C A PP RV M	_____
10.	_____	C A PP RV M	_____
11.	_____	C A PP RV M	_____
12.	_____	C A PP RV M	_____
13.	_____	C A PP RV M	_____
14.	_____	C A PP RV M	_____
15.	_____	C A PP RV M	_____

KEY:
C—Cue-pause
A - Ask open ended question-pause
PP - Partial physical prompt-pause
RV - Request verbalization-pause
M - Provide full model-pause

Mouse Evaluation

STUDENT : _____ **DATE:** _____

DATA COLLECTED BY: _____ **TIME:** _____

Set Up	Results	Comments
Device: Placement: Body Site(s): Cursor Movement: Button Action:	Point: Click: D. Click: Drag:	Drag: Click: D. Click: Drag:
Device: Placement: Body Site(s): Cursor Movement: Button Action:	Point: Click: D. Click: Drag:	Drag: Click: D. Click: Drag:
Include name of mouse device plus any adjustments to driver settings, programming of buttons, markings on mouse, positioning aids, etc. Provide sufficient detail to replicate set up.	*3-does easily* *2-does adequately* *1-does w/ difficulty* *0-cannot do*	*Helpful features of this device. Reasons to rule out this device. Details of results, especially difficulties & adaptations.*

Adapted from Fridie & Fuhrer, 1999

Index