Running Head: ASSISTIVE TECHNOLOGY

What is Assistive Technology and How Can It Help Students?

An Instructional Module Addressing Language-Processing Differences for Future Educators

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Abstract

The investigator of this paper suggests a definition for assistive technology as any piece of equipment, item, or product that is used to capitalize on, compensate for, or remediate the functional capabilities of an individual's learning strengths and weaknesses. This makes "assistive technology" more than just something used by special education teachers; it becomes tools for all learners. Understanding a student's unique learning style is critical to helping that student achieve the greatest success. College students in teacher education programs need to be aware of how to determine their students' learning strengths and weaknesses and be able to recommend assistive technology tools that might benefit them, especially when it involves language-processing skills like reading and writing.

This paper describes the design of an online instructional module with the goal of teaching future educators what assistive technology is and how it can best help students with language-processing differences like dyslexia or other learning weaknesses in reading and writing. The purpose of the paper was to test the effectiveness of the module as a learning tool. With future educators being the target audience, one-on-one and small group testing was done within this target group. The results of the testing showed the module to be an effective tool for teaching the objectives. Of the 15 small group learners, all of them showed an overall improvement with a pre-test average of 67% and a post-test average of 86%. The group improved on the terminal objective from a 40% to 67% success rate. Additionally, the feedback from the learners was positive.

Acknowledgements

I would like to thank my family the most for putting up with me over the last three years. It has been quite an experience learning while trying to maintain a full-time teaching position, a part-time Web design position, and still be a good father and spouse. It was worth it with the knowledge and experience I have gained for the future.

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Chapter I: Statement of the Problem

There is a story about a student who had a reading rate of maybe one-to-two words per minute. This student was dyslexic and had failed in numerous school environments, and the future looked bleak. But, then, the student was introduced to Kurzweil, an assistive technology tool that reads digitized text aloud while highlighting each word. The student had good listening skills and started using the tool on a regular basis. The student would scan in assignments and go off in a corner to read the computer screen while the words were read to him. Within just a few weeks, a profound change had taken place. This student was catching up on the reading material and participating in class discussions. When this student graduated, he could speak of his learning strengths and weaknesses. He could discuss quite clearly the difference that assistive technology made in his ability to keep up with work and learn.

While some teachers would say this is an example best left to the special education teachers, the fact is that:

> The percentage of students with learning disabilities spending the majority of their school day in inclusive classrooms rather than in pullout programs has increased steadily over the last 10 years. Approximately 44 percent of students with learning disabilities spend 80 percent or more of their school day in inclusive classrooms. (Hasselbring & Bausch, 2006, p. 72)

This means that all teachers must understand learning disabilities and assistive technology and be prepared to integrate technology in their classrooms. Teachers will not be able to rely on the specialists for information; they must learn and integrate the tools as well.

It was once thought students not reading at a high school level could never make it to graduation, or a student who could not take legible notes would not succeed; technology has changed this misconception. Students, like the one mentioned previously, are not uncommon, and they need to be given the same respect and care as every other student.

The problem is not the availability of the tools. They are readily available, and some of them like text-to-speech are available free or integrated in Macintosh and Windows operating systems. So, where is the problem? The problem is in the training of teachers on what assistive technology is and how it can work for **all** students. As Smith and Robinson (2003) explain, "… few teachers are adequately prepared to use technology themselves or to help students use technology in the classroom. Thus, we need to enhance present technology preservice to further integrate technology in today's schools" (p.154). The key is to introduce tools and learning to teachers while they are still in teacher education programs. This way, they will have the knowledge prior to having to use it.

The purpose of this study was to determine the effectiveness of an instructional module to inform students in a teacher education program about what assistive technology is, provide examples of types of assistive technology that might help individuals with language-processing differences, and help the future teachers to match different tools with students' learning strengths and weaknesses.

Chapter II: Literature Review

The literature review is a roadmap to the need for the design of an online, interactive instructional module on assistive technology and language-processing differences. First, it will look at learning disabilities, and their impact on education. Then, it will look at a brief history of assistive technology and the types of tools that are used for students with language-processing differences. The review continues with a look at assistive technology and its use in current classrooms. This will lead into how future educators are instructed on the use of assistive technology and learning styles, specifically focusing on students in the sample population at the chosen university. Finally, the review will conclude with the rationale for the design of an online, interactive module versus other methods of instruction.

Learning Disabilities and Learning Styles

In recent decades, the American education system has focused more attention on learning disabilities. Hallahan and Mercer (2001) described the situation when they indicated "from 1976-77 to 1998-99, the number of students identified as LD [learning disabled] doubled to more than 2.8 million, representing over half of all students with disabilities" (p. 6). Furthermore, this amount did not include students with mild learning differences who did not qualify for this classification. Language-processing differences are a sub-set of learning disabilities and encompass more than just dyslexia, which involves difficulties in receptive and expressive language including phonological processing in reading, writing, spelling, handwriting, and sometimes arithmetic. Dyslexia can also include, or be closely related to, other processing problems, for example, dyscalculia (difficulty with math skills, remembering concepts, facts, time and

money); dysgraphia (difficulty organizing ideas, handwriting, spelling and composition); dyspraxia (difficulty with fine motor skills and coordination); auditory processing disorder (difficulty with language development); and visual processing disorder (difficulty with reading, writing and math) (Miller, 1998).

Beyond learning disabilities, there is an important need to help students understand who they are as learners so they can be taught in the way that best meets their individual learning strengths and weaknesses. Dunn and Dunn (1999) explained how a student's different styles of learning could be broken into visual, auditory, and tactile/kinesthetic. Understanding a student's learning differences, whether classified or not, is important to providing the tools for learning that are appropriate for each individual student. Technology is also an important step in giving all students a chance to gain the most from their learning strengths or attempt to overcome learning differences.

What is Assistive Technology?

Technology has changed the way all students are taught especially when it comes to students with special needs. While technology was being used to help students for many decades, the national discussion came to the forefront with the "Tech Act". The Technology-Related Assistance for Individuals with Disabilities Act Amendments of 1994, Pub. L. No. 100-407, §3, A (1994) defined assistive technology as any item, piece of equipment, or product system that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. This definition helped bring the use of technology into the classroom to assist students. However, even if students are not classified as having learning disabilities, many of these same tools can benefit them, especially when it comes to reading, writing and organizational skills. In fact, the

investigator of this paper suggests a revised definition for assistive technology as any piece of equipment, item, or product that is used to capitalize on, compensate for, or remediate the functional capabilities of an individual's learning strengths and weaknesses. This makes "assistive technology" more than something just used by special education teachers; it becomes tools for all learners, even though the underlying theories can still apply.

According to Garner and Campbell (1987), assistive technology encompassed two major teaching approaches – the compensatory and the remedial approach. The compensatory approach uses assistive technology to complete a given task. In this approach, the technology is used to "circumvent deficits" in the student's abilities. Examples of this are: word processors with spell checking to compensate for weaknesses in spelling, or speech-to-text applications that type everything that is said into a microphone to compensate for weaknesses in hand-eye coordination required in typing. The remedial approach uses assistive technology to "improve areas of deficiency." An example of this is an educational program that helps students practice their phonics to better comprehend what they are reading or a typing tutor to improve typing skills. While these approaches are different, many times the assistive technology is using both of these approaches at the same time, for example, a text-to-speech tool that highlights each word as it reads. A tool like this has been shown to remediate and improve fluency, while also compensating for low reading rates. Compensatory tools for language-processing skills fall into four major types: writing aids, speech-to-text software, text-to-speech software, and organizational tools. Figure 1 describes each of these tools and how they might meet different student needs.

Type of Tool	Examples	Learning Criteria
Writing Aids	Pencil grips, raised paper, computer speller, word prediction	• Pencil grips and raised paper can benefit students who have trouble with physically writing, sometimes diagnosed as dysgraphia. • Computer spellers benefit any student who has trouble spelling. Students with language-processing disorders like dyslexia will benefit from its use. • Word prediction software suggests words to the writer while typing. Students with learning disabilities or those with a weakness in writing and editing should find benefit from this application.
Speech-to-Text	ViaVoice, Dragon Speak Software, Microsoft Voice Recognition in Windows XP	• Speech-to-Text or Voice Recognition Software allows students to talk into a microphone and the words they say will be typed directly into a word processing program. One study showed that students using voice recognition software had significant improvements in reading comprehension, spelling, and word recognition (Higgins & Raskind, 2000).
Text-to-speech software	Kurzweil, Speech in Mac/PC	• Text-to-Speech software or speech synthesis reads digitized text aloud which students can listen to through earphones individually or as a class. This software should benefit slow readers with good listening skills, as it is a multi-modal approach to learning.
Organizational tools	Inspiration, Palm Pilot, MS Organization, word processing tools	• Graphic organizer software helps students to organize their thoughts in outline form or in a flowchart to help them write better essays or produce written work. Many students with language-processing disorders like dyslexia also have organizational weaknesses and benefit from tools like these that help to organize thoughts and daily tasks. • This could include organizational tools like a PDA (Personal Data Assistant) that helps students to create to-do lists and prepare what they need to stay on track with homework and projects.

Figure 1. Assistive technology tools.

Any assistive technology tool will require a commitment by the teacher to make time for learning and training as well as a commitment from the student to accept learning differences and be open to trying new technologies. While there are many different tools that may assist certain types of learners, the role of assistive technology in regular classrooms currently is not clearly understood.

Assistive Technology and the Classroom

Assistive technology is no longer important to just the special education teachers; it is needed in all classrooms. Carlson (2005) explains why:

> … even though the federal government backs many educational support services, individual states use their own interpretation of even what a learning disability is and strict criteria is used to determine eligibility for those programs. If a pupil does not meet every single element of the state's criteria for identification of LD, they are denied access to available support programs that could help them succeed academically. Because of this, many students that might qualify as LD are placed in the regular classroom. (p. 15)

So, not all learning-disabled students will be identified in the classroom and even if they are, Hasselbring and Bausch (2006) send a reality check to teachers with this statistic:

> The percentage of students with learning disabilities spending the majority of their school day in inclusive classrooms rather than in pullout programs has increased steadily over the last 10 years. Approximately 44 percent of students with learning disabilities spend 80 percent or more of their school day in inclusive classrooms. (p. 72)

This research lays claim to the fact that all teachers must understand learning disabilities and assistive technology and be prepared to integrate technology in their classrooms.

Teachers will not be able to rely on the specialists for information. They must learn and integrate the tools as well. With the advances in technology, there are many tools available in the industry to assist students with language-processing differences. Yet, a review of the research indicates that there is not a clear understanding by administrators and teachers of the technology available to help students. Additionally, there is not a clear direction of how best to integrate the technology into the curriculum (Forgrave, 2002; Edyburn, 2000). Before school districts are ready to spend money on technology, they need to know which technology tools will work and provide assistance to meet the needs of the students and staff. They need to understand how assistive technology will be integrated into curriculum and how technology tools can support a student transitioning from high school to college, and into the real world.

Perhaps the lack of knowledge educators and administrators possess about assistive technology and its classroom applications stems from the training and education they received. So, what are college students in teacher education programs taught about learning disabilities and assistive technology? Are they being adequately prepared to face students with classified learning disabilities in their inclusive classroom or any student who has functional learning strengths and weaknesses in written and verbal language?

Future Educators

In one study, (Maushak, Kelly & Blodgett, 2000) college students who were future educators were given a mini-workshop on assistive technology to better prepare regular classroom teachers for the inclusive classroom. In the study, learners were given pre- and post-test surveys on the use of assistive technology and their attitudes about

students with learning disabilities. They were given a brief workshop on the assistive technology (AT) tools and allowed to play with the tools for a short time. The survey found that, "Students appeared to have at least an awareness of assistive technology" but "the survey was self-report, students may have been marking what they felt was the expected responses are not representative of actual knowledge" (p. 173). The report supports the need for including more assistive technology in the preparation of teachers. Nelson (2006) reported on how important it is for this preparation to come in the training of new teachers, when she writes:

> Technology skills, including assistive technology skills, are not effectively modeled when taught in isolation. Schools of education can best serve teacher candidates in the quest to develop knowledge and skills in AT by embedding instruction in methods and field-based course work. (p. 492)

In looking specifically at the target group of college students in the Teacher Education Program at a university in the western region of the United States, the education on assistive technology was limited. Students took one required Special Education course for elementary or secondary education. The secondary course syllabus consisted of understanding disabilities and laws governing the students in the classroom. The required textbook included technology notes at the end of each chapter offering examples of technology that might work for a given disability, but there was no actual time in class focusing on how these technologies work or what their real use is.

Some resources were available online for teacher education students who were willing to go looking. The Texas Assistive Technology Network (TATN) created a set of Microsoft PowerPoint modules that provided information on the assistive technology

tools that might help learners struggling with reading. More details on the modules were available at: http://www.texasat.net/. The National Center for Technology Innovation (NCTI) has a review of technology-based approaches for reading instruction. The site contained a matrix of technology tools matched with different reading and writing skills. All the tools were reviewed by NCTI, a center funded by the U.S. Office of Special Education Programs (OSEP) and can be reviewed at: http://www.nationaltechcenter.org/matrix/. While non-interactive Web sites are excellent sources for acquainting learners with information, they do no measure what the reader's gain from the sites. There is no opportunity for the readers to try out hypotheses and receive feedback and there is no capability to interact between the viewer and the content. For education candidates being introduced to learning disabilities and assistive technology, resources are needed that not only present information but allow for the students to interact with this content in a meaningful way.

Moreover, the question is still, what training is happening in the teacher education classrooms? White, Wepner and Wetzel (2003) explained further by stating:

> Advances in technology have had a direct impact on the individual student's educational process. Schools report that technology is having a positive effect on children's learning and their perception of themselves as learners, which is why children with disabilities benefit from the use of assistive technology. The implementation of assistive technology is dependent on the knowledge, skill and inventiveness of the teachers who use what they have learned from higher education, their teaching experiences, and their attendance at continuing education programs and in-service classes. (p. 1)

Based on the current literature, it can be argued that teacher training with technology is critical to the benefit of all students. A training module is needed to introduce future teachers to the benefits and uses of assistive technology, especially for students in reading, writing, and organization. Edyburn (2003) added another rationale for the development of training modules when he stated, "Teachers, administrators, and parents are in desperate need of easy-to-use decision-making tools that help them identify categories of products that may be useful for individual or groups of struggling students" (p. 22). A training module is more than just visiting Web sites, it is an interactive tool that will help to teach the learners what they need to know and introduce them to the tools through videos of the tools in use. This type of instruction is a much more powerful learning tool.

Rationale for Online, Interactive Module

There are many types of instructional modules from paper-based instruction to a multimedia instructional tool that allows learners to "interact" with the content. The investigator chose to create an interactive, multimedia module. The goal was that the module would increase the learning potential of the learner by using video and sound to see different types of assistive technology tools in action. This was something that cannot be done with a paper-based module. Hofstetter (1995) described "multimedia" as the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate. Creating a multimedia module will involve more of the learner's senses than a paper-based tool would.

Moreover, Harris (2002) indicated that:

> Technologically-assisted instruction must be implemented and critiqued in a variety of settings, at different levels of technological integration, and in cooperation with those who have expertise in educational psychology and instructional technology. If it can be demonstrated that the reported outcomes of multimedia-based instruction are positive, long-term effects on students' performance and motivation, individuals and institutions can more confidently commit the vast human and financial resources required for the transition from traditional modes of instruction to multimedia-based teaching and learning. (p. 839)

There have been multiple studies to determine if multimedia modules are more effective than paper-based instruction. The studies suggested that the use of multimedia instruction is indeed beneficial to students (Welsh & Null, 1991). And, compared with traditional lecture-oriented approaches, multimedia instruction is better liked by the students and yield improvements in student learning (Smith & Woody, 2000; Frey, 1994). Despite many studies suggesting that multimedia instruction benefits students, there are also some that found no significant differences between multimedia classes and traditional classes (e.g., Lee, Gillan, & Harrison, 1996). These inconsistent results may reflect an interaction between multimedia teaching styles and students' learning styles.

Chapter III: Methodology

The methodology section explains the goal of this research, describes the participants, provides the system analysis, and details the instructional module that was designed to meet the learners' needs.

Instructional Goal

The goal of this project was to teach future educators what assistive technology is and how it can help students with language-processing differences in their future classrooms. An early introduction of these important concepts in a teacher education program may ensure that future educators are better equipped to help individual students in their classes.

Objectives

To reach this goal, an instructional module was designed and tested. The objectives of the module are listed below.

1. Given the definition and examples of assistive technology tools, the learner will pick the non-example from a list of assistive technology tools with 100% accuracy.
2. Given the definition and examples of the remedial and compensatory approaches to the use of assistive technology, the learner will pick the non-example from a list of assistive technology tools with 100% accuracy.
3. Given the definition and examples of writing aids, organizational tools, text-to-speech and speech-to-text tools, the learner will pick the non-example from a list of assistive technology tools with 100% accuracy.
4. Given examples of learning strengths and weaknesses that match writing aids,

organizational tools, text-to-speech and speech-to-text tools, the learner will match the learning style with the right tool from a list of tools with 100% accuracy.

Role of the Investigator

The investigator was a Master's Degree candidate at a university in the western region of the United States studying Educational Technology. He was also a fulltime teacher with six years of teaching experience in middle and high school. The investigator had completed his second year of teaching at a small private school for gifted and/or dyslexic students, where he taught high school technology and mathematics. From his work with students, he realized how important learning about assistive technology and individual students' learning strengths and weaknesses could be to future teachers; thus, he designed a module to meet those needs.

System Analysis

A system analysis was conducted focusing on the learners, who were teacher education majors (both baccalaureate and post-baccalaureate) at the chosen research university. A university setting was ideal for this project as learners were readily identified. The analysis examined the three levels of the system: the Suprasystem, System, and Subsystem, and the influence of each of the systems on each other. Figure 2 represents the complete system with arrows indicating influence or communication. One-way arrows show communication in only one direction, while two-way arrows represent bi-direction communication between components. Additionally, dotted arrows indicate weak or intermittent communication between components.

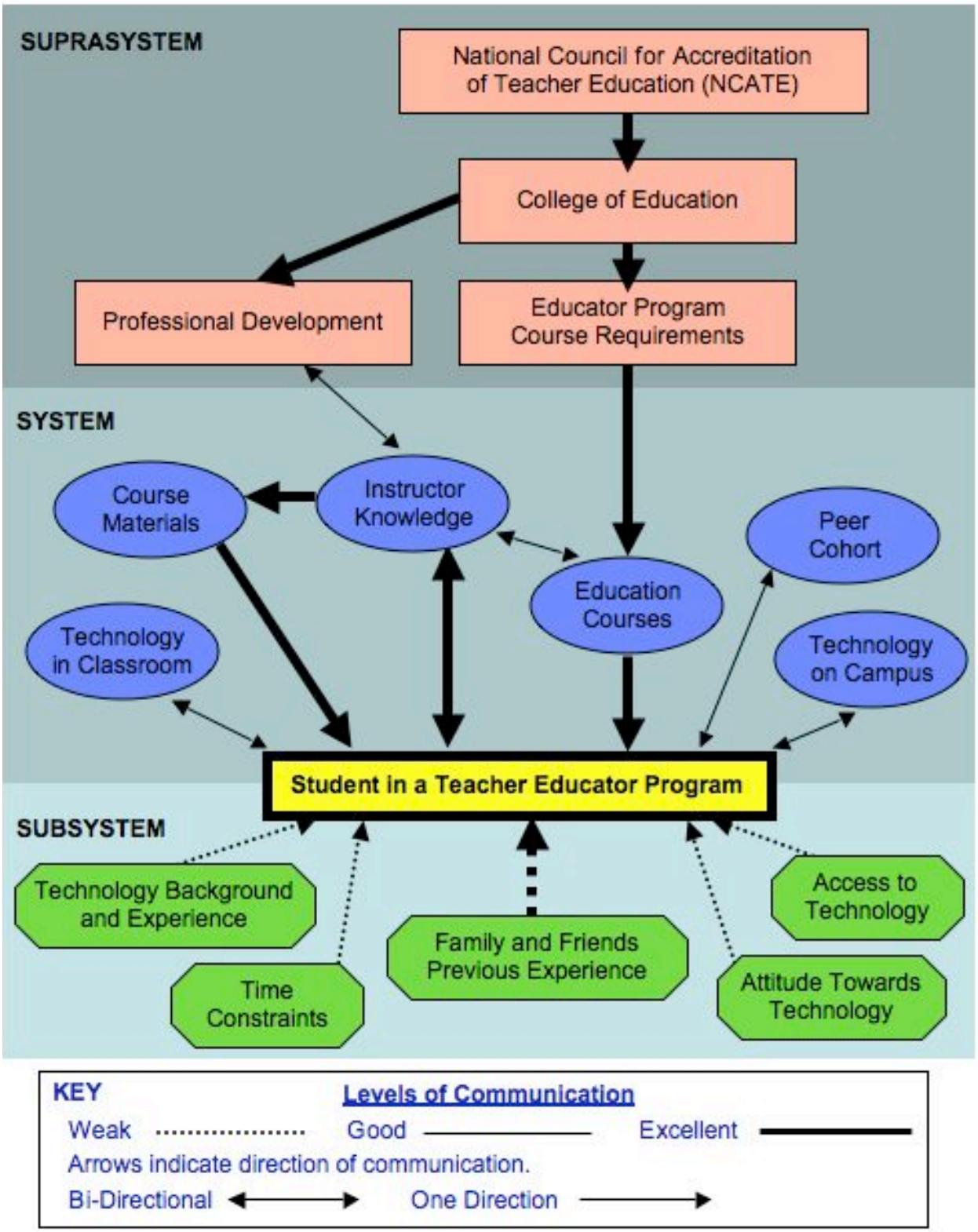

Figure 2. System for the student in a teacher educator program.

SupraSystem. In Figure 2, the suprasystem starts with the National Council for Accreditation of Teacher Education (NCATE). This council gives direction to the College of Education at the university as to the requirements for completion of a teacher certification program.

The College of Education then decides what the course requirements will be for a student in the program and additionally decides on qualified instructors to teach the courses. The course requirements in the suprasystem have a direct relationship on the actual education courses in the system.

System. In the middle of Figure 2 is the system itself, which is directly influenced by the suprasystem and influences the subsystem. At the center of the system is the student in the teacher education program. Major influence on the knowledge of the student comes from the education courses that are taken. This information is directed to the student as a strong line of communication. Additionally, a strong bi-directional communication line connects the instructor's knowledge of the education course to the student. As far as learning about assistive technology and learning disabilities, the main influence on the student will come from the education courses and from the instructor's knowledge. Students can increase this communication by asking questions in class and tapping into the instructor's experiences. The instructor's knowledge is influenced by the professional development opportunities undertaken. The student also receives direct knowledge from the course materials that are provided by the instructor. Additional communication on the topic can come from interactions with peers and instructors in the cohort of students that are on the same education track, from technology in the classrooms, and from technology on campus.

Subsystem. The subsystem is the final system at the bottom of Figure 2. This system is closer to the student's sphere of influence and reflects emotions and experiences that the student brings to college. A student's technology background and experience can directly influence knowledge of assistive technology and its use. This is listed as a dotted line in the system as it is unclear how this will influence students. If students have no technology background, the effect will be minimal. This relationship is the same for the other subsystem influences, which include: time constraints to learning new technology, attitude toward learning technology, and access to technology. Finally, in the middle is the influence of family and friends. This element can play a bigger part in the understanding, especially if either the student or a family member has been diagnosed with a learning disability. This line is shown as a thick dotted line in Figure 2, because if the student has direct experience with assistive technology and learning disabilities, the student's understanding will be much more in-depth.

Participant Description

Target audience. The target audience is students who are currently attending a university in the United States. The target audience should be teacher education majors (baccalaureate, post-baccalaureate, and masters' programs offering initial certification). The goal is to reach the students who can most benefit from taking the instructional module and an audience that can provide educated feedback on the effectiveness of the instruction.

Prior knowledge. For most students in this program, access to and education on software are limited to the basic word processing tools and presentation tools.

Cognitive characteristics. While all learners are high-school graduates, all have at least two years of college education and may have more depending on how far along they are in their teacher education program. While all members of the targeted audience have different learning styles, the instruction will attempt to address these various learning styles by providing information in written, visual, and interactive approaches.

Affective characteristics. How motivated a learner is will depend primarily on how internally motivated the learner is by the knowledge provided. The hope is that learners in a teacher education program will be interested in learning all they can about assistive technology and learning differences. The goal is to make the module more interesting and motivating for the learner by using an interactive, online approach.

Social characteristics. The learners' socioeconomic status varied. The learners in this audience are socially and culturally diverse, reflective of the racial makeup of students at the chosen university. The learners' social support is comprised of the other students in class and in their learning cohort. Learners will work independently on the online module and should leave with a conceptual framework of what assistive technology is and how it might benefit students.

Audience analysis and implications for design. Learners will need to know how to use the Internet to view Web sites, especially ones with animation. This might require the need to update the Web browser to view the module. Included with the instructions of where the module is located, will be some instructions on the requirements for viewing along with Web addresses to download the appropriate updates as needed. Instruction will be brief, straightforward, and structured through six sections. Instruction will be

enhanced with short videos and slideshows showcasing different assistive technology tools in action by the investigator.

Sample Population

The sample population was comprised of teacher education students enrolled in two sections of an educational technology course. The overall goal of the educational technology course was to introduce theories, application of principles, acquisition of practical skills of educational media relevant to teaching/learning situation, in classroom as well as non-school settings, and includes "inclusion" components for assisting learners with mild disabilities. This class was primarily designed for undergraduate education majors. The goal was a sampling of at least 10 students to test the effectiveness of the module and to collect enough data to look at trends and possible enhancements to improve the module. The groups were selected as they fit into the target audience, and the instructor for the classes was open to having the students participate in the module.

Instructional Analysis

Instructional hierarchy. The instructional design process was modeled after the Dick and Carey systematic design instruction (Dick & Carey, 1996). After determining the goals and objectives for the module, a hierarchy of objectives was designed which included the objectives and the terminal objective. This hierarchy is laid out in Figure 3. There are a total of 20 sub-skills and one terminal objective in the module. The terminal objective is to have learners match specific assistive technology tools with student learning styles, strengths and weaknesses that might benefit most from the tool. The final objective brings together all the objectives of the module into an overall understanding of the tools and how they help individual students.

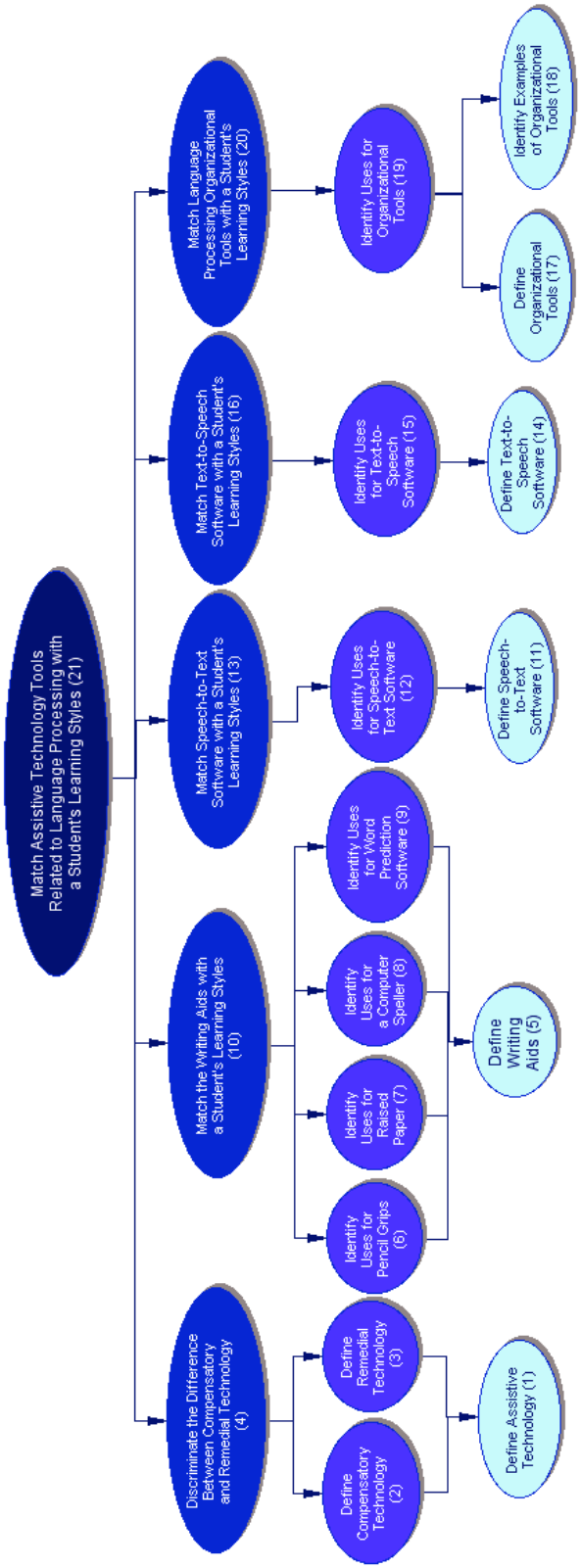

Figure 3. Instructional module hierarchy.

Figure 3. Instructional module hierarchy.

However, before the learner can reach the terminal objective, there are definitions, identifications, and concepts that the learner will need to ascertain. Indicated in Figure 3, the 20 sub-skills are numbered in sequential order based on the order the steps were presented and tested in the training module.

Starting on the left at skill number four in Figure 3, learners need to discriminate the difference between compensatory and remedial technology. To do this, learners must first understand the definition of assistive technology and understand what compensatory and remedial technologies are and how they are used. This will be taught by providing examples of these types of tools and how they benefit learners. After learners have a basic understanding of what assistive technology is, the module will proceed to teaching them about specific types of tools.

Skill number 10 in Figure 3 will address the learner's knowledge of writing aids by matching specific writing aids with learning styles (i.e., strengths and weaknesses). An example would be the use of a computer speller as a writing aid to help students that have a weakness in spelling words.

The next section addresses the understanding of speech-to-text software and how it would align with student learning styles in sub-skill number 13. The same approach is used for sub-skill 16 and sub-skill 20 that address the learner's understanding of speech-to text software and organizational tools, respectively.

Number 21 in Figure 3 is the culminating activity and uses all the previous sub-skills from the module to present the learner with a list of assistive technology tools and a list of student strengths and weaknesses, and ask the learner to match up the tool that might best fit the student. Only one correct set of matching will be correct, and the learner will need to use their knowledge from all 20 sub-skills to make the correct matches.

Module Design

The learners completed an online instructional module. This Web-based interactive instructional module was created in Macromedia Flash and embedded on a Web page. The instructional module included a paper-based pre-test (Appendix A), an online instructional module with embedded questions and interactivity including short video clips of the investigator using different types of assistive technology (Appendix B), and a paper-based post-test (Appendix C). Additionally, there was a paper-based demographic and attitudinal survey. The surveys (Appendix D) were used to determine the validity of the testing in regards to experience, biases based on gender or other factors, and information to help understand the test results. All learners were given a number, and personal information was kept confidential except to the investigator. Test results were delivered to the investigator through the mail or email.

The module was broken into six sections based on the major themes. This breakdown was based on the hierarchy model described previously in Figure 3. Figure 4 shows how this breakdown occurs by question type.

Section 1 – Defining Assistive Technology
1. Items that are Assistive Technology
2. Remedial Approach
3. Compensatory Approach
4. Compensatory Approach
5. Remedial Approach
Section 2 – Writing Aids
6. Examples of Writing Aids
7. Pencil Grips
8. Raised Paper
9. Computer Spellers
10. Word Prediction Software
11. Match Learning Style with Writing Aid
Section 3 – Speech-to-Text Software
12. Speech-to-Text and Typing Skills
13. Speech-to-Text and Skills
Section 4 – Text-to-Speech Software
14. Text-to-Speech and Listening Comprehension
15. Text-to-Speech and Learning Skills
Section 5 – Organizational Tools
16. Examples of Organizational Tools
17. Outliners
18. Graphic Organizers
19. PDAs
20. Match Organizational Tool with Learning Style
Section 6 – Terminal Objective
21. Match Assistive Technology Tool with Learning Style

Figure 4. Module design broken into six sections.

Limitations of module. The module was limited in its ability to teach learners how to use assistive technology. The module was an overview of definitions, tools and learning styles from a reading and writing point of view. The module offered suggestions on what tools might work for different students' strengths and weaknesses, but it was not a guarantee of success with a student. There are many factors that come into play when matching a technology tool to a student including: student motivation, level of strength or weakness, complexity and power of the technology tool, and the teacher's abilities to integrate and impart the way to use the tool. The goal of the module was to provide information about assistive technology and, optimally, excite the target audience of future educators to learn more and try out the tools with their students. Additionally, since the module was taken online, the investigator was not be able to observe non-verbal communications during the training, so results were based on the learner responses only.

Chapter IV: Data Analysis and Results

Testing Plan

In order to improve and enhance the module, so that it was an effective tool for teaching education majors more about the basics of assistive technology, it went through a series of reviews by various human subjects. Data were collected from reviewers and used to revise and edit the module. Figure 5 provides a description of the various reviews and information collected. The investigator's instructor conducted initial reviews. These initial reviews only covered the methodology, content analysis, and literature reviews. This review was critical in helping to create the initial design of the module.

One-on-one training was conducted with content experts as well as one person from the target audience. Small group testing took place during a two-week period where two online classes were notified of its existence and given instructions on how to log in and test it.

Type of Review	**Date of Review**	**Reviewers**	**Data Collected**
Instructor Review	June, 2006	Instructor of proposal writing class	Information collected from the review helped to solidify the design of the module in preparation for the one-on-one sessions.
One-on-One Testing	August-September, 2006	Content Expert, friends from target audience	One-on-one testing feedback was used to improve the module, pre- and post-tests in preparation for small group testing.
Small Group Testing	November, 2006	Fifteen students from the target audience	This information provided the basis for the majority of the formative evaluation and future improvements of the module.

Figure 5. Reviews and testing of instructional design.

Plan for Data Collected

With the instructor's permission, the investigator was given time in the online class to describe the project goals and to show the students how to access the module. Students were given the choice of either downloading the components and printing them or picking up a copy from the instructor's assistant. The complete instructional module consisted of: a consent form for human study, per the rules of the university (Appendix E); the pre-test; instructions on how to access the online instructional module; the post-test; and the demographic and attitudinal survey. Since the investigator was not present during the testing, the instructions provided all of the details the learner needed to complete the module and tests. Once completed, the students returned the packets via mail or email. The investigator then tallied the results to compare pre-test and post-test results. Both sets of test questions were created in a parallel nature to ensure that knowledge asked was the same and could be compared. Since no data was collected from the embedded questions, there may be some gaps in the ability to tell what might have gone wrong if learners answered questions incorrectly. The investigator predicted that the pre-test scores would be in the 30% range, while the post-test scores would be in the 90% range.

One-on-One Results

Three one-on-one reviewers were chosen to complete the module prior to the small group instruction. Figure 6 shows a description of the reviewers.

One-on-One Review	Date of Review	Information about Person
Reviewer One	October, 2006	Reviewer One has a Master's Degree in Informational Learning Technology and has taught for five years at a private school specializing in helping students who are dyslexic and/or gifted.
Reviewer Two	October, 2006	Reviewer Two is currently a master's student in an Educational Technology Program at a local university. She has taught in various public and private elementary schools.
Reviewer Three	October, 2006	Reviewer Three is currently a master's student in an Educational Technology Program at a local university. She is also currently a technology teacher at a private school teaching basic computer courses, video/post production and Web design.

Figure 6. Reviews and testing of instructional design.

These reviewers provided valuable feedback on the module and clarification on some of the questions. Figure 7 shows the results for the one-on-one testing. For a complete breakdown of the scores for the one-on-one testing, see Appendix F. All one-on-one reviewers maintained or increased the overall number of correct responses when comparing pre-test to post-test scores.

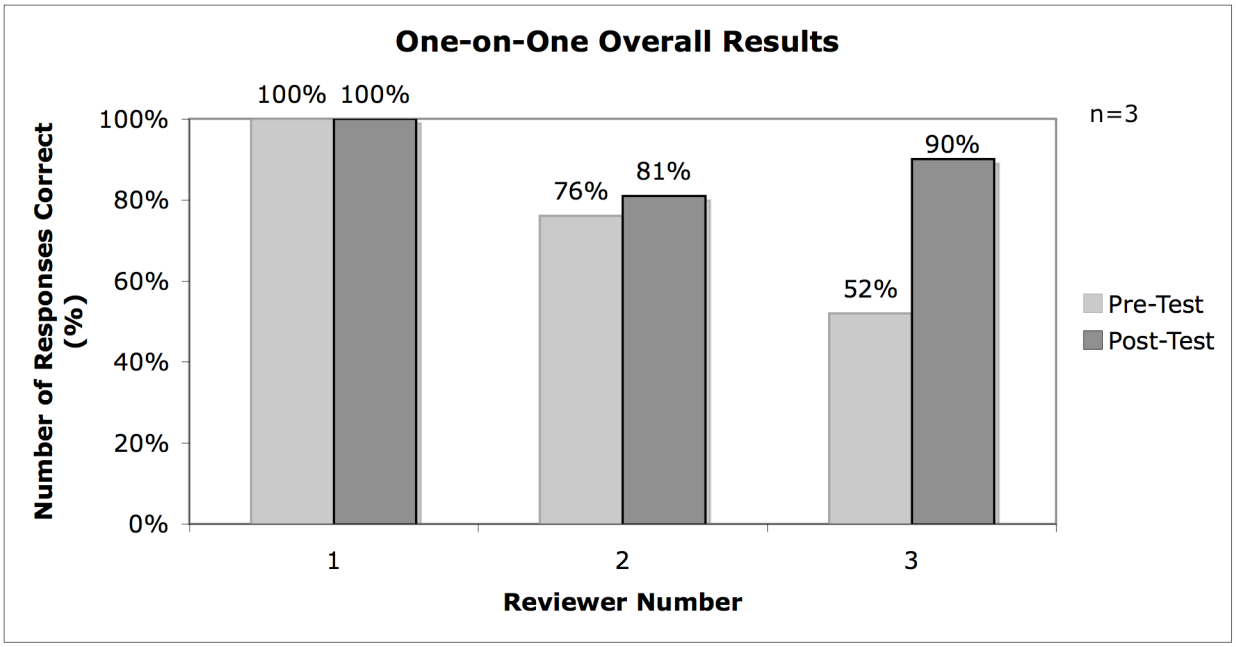

Figure 7. Chart showing one-on-one review results pre-test versus post-test.

Two of the three reviewers successfully completed the terminal objective. No major changes were made in regards to the tests based on the feedback. On Questions number 11, 20 and 21, reviewers were asked to match certain assistive technology tools with a learner strength or weakness. Based on research for good test design, the investigator created the test so that there were extra possible answers on the right side of the matching, thus, learners would not be able to use the process of elimination to guess the final answers. The problem was that the reviewers thought they had to put in a corresponding letter for each item (Figure 8). So, bolded instructions were added to these questions to ensure that learners recognized that they only had to pick the best one from the list on the right and some would be left blank.

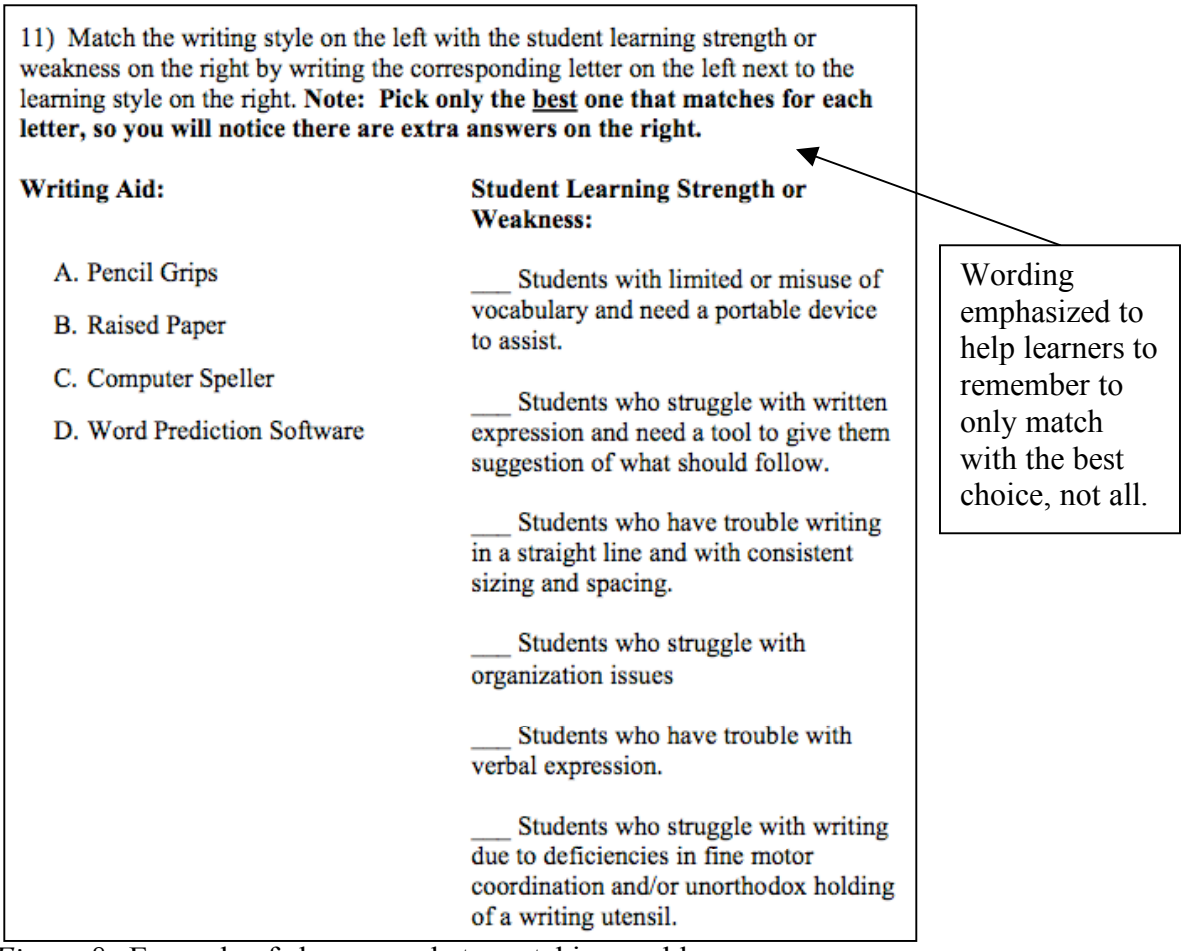

Figure 8. Example of change made to matching problem.

Small Group Results

The small group results provided valuable feedback to determine if the module was an effective tool for teaching learners about assistive technology and its uses. The small group consisted of students in an educational technology class comprised of mostly education majors. Of the 15 learners who took the instructional module, 11 of them were pursuing an education degree. Figure 9 shows a breakdown of the demographics for the learners. Of the 15 learners, 11 were female and 4 were male. The age breakdown was more mixed with learners as young as the 21-25 age group to as old as the 61+ age group. The degree that the learners were pursuing was a mix from undergraduate students (five learners) to graduate students (seven learners). The learner group had very little experience with assistive technology with only three learners indicating intermediate experience and most learners indicating either a basic or no level of experience with assistive technology.

Item	**Learners Description (15 Learners)**
Gender	4 Male, 11 Female
Age	21-25 years old – 3 26-30 years old - 4 36-40 years old - 4 41-45 years old - 1 46-50 years old) - 2 61+ years old - 1
Classification	Undergraduate Students – 5 Second Undergraduate Students – 1 Graduate Students – 7 Doctoral Students – 1 Faculty Students – 1

Figure 9. Chart showing demographic data breakdown.

Item	Learners Description (15 Learners)
Prior Experience with Assistive Technology	None – 7 Basic – 5 Intermediate – 3
Taken a course on Assistive Technology?	Yes - 1 No – 14
Prior Experience with Learning Disabilities	None – 2 Basic – 9 Intermediate – 4
Taken a course n Learning Disabilities?	Yes – 6 No – 9
Diagnosed with a learning disability?	No – 15
Family member diagnosed with a learning disability?	Yes – brother (dysgraphia, developmentally delayed) – 1 No – 14

Figure 9, cont. Chart showing demographic data breakdown.

Only one of the students indicated taking a course on assistive technology. However, this was a mistake, as the learner mistook "assistive technology" for "educational technology', the course the learner was currently taking. For most learners, experience with learning disabilities was limited. Only four learners indicated an intermediate level of understanding, while the rest indicated a basic level of knowledge about learning disabilities. Although six of the learners had taken a course on learning disabilities, five of the six indicated just a basic level of understanding learning disabilities. No learner indicated being diagnosed with a learning disability, and only one learner indicated having a family member who had a learning disability. The learner with the family member who was diagnosed with a learning disability had pre- and post-test scores of 67% and 76%, respectively, which was the average for the pre-test, but below

the 86% average for the post-test. It appeared that having a family member with a learning disability didn't seem to give an advantage to that learner in terms of knowledge about assistive technology.

Appendix G provides a complete breakdown of scoring for all 15 learners with scores and percentages. However, this data has too much detail for a full understanding, so the next few pages will look at each of the sections separately to analyze what was learned and then look at the overall picture in regards to the terminal objective and overall scoring. Figure 10 provides a breakdown of average times for each learner per section. While not timed, each learner completed a demographic and attitudinal survey after completion of the post-test. Most of the learners were able to complete the testing in less than one hour, but the times ranged from as little as 32 minutes to just over 2 hours. In some cases, learners forgot to provide the time for certain sections. These are indicated in Figure 10 with "No Time" and these times were not counted in the average for that section or in the overall average. This was another limitation in having learners test on their own versus testing at a location with the investigator present. If present, the investigator would have been able to estimate the testing time even if the learner didn't provide it. Appendix G provides the full data from testing to compare testing time with the scores on the tests.

	Testing Time			
Learner	**Pre-Test**	**Module**	**Post-Test**	**Total Time**
1	24 min	30 min	14 min	**68 min**
2	8 min	14 min	10 min	**32 min**
3	23 min	44 min	13 min	**80 min**
4	15 min	23 min	10 min	**48 min**
5	12 min	25 min	6 min	**43 min**
6	25 min	40 min	No Time	**No Time**
7	31 min	No Time	10 min	**No Time**
8	15 min	22 min	14 min	**51 min**
9	11 min	29 min	6 min	**46 min**
10	4 min	25 min	5 min	**34 min**
11	12 min	25 min	No Time	**No Time**
12	14 min	34 min	10 min	**58 min**
13	13 min	No Time	No Time	**No Time**
14	13 min	17 min	7 min	**37 min**
15	51 min	55 min	15 min	**121 min**
Average	**18 min**	**29 min**	**10 min**	**56 min**

Figure 10. Small group training module timing.

The instructions for the module explained how the testing would take place and that the evaluation was of the testing materials, not the participants. The instructions stressed that the learners should not worry about getting answers incorrect since the investigation was looking for understanding and feedback on the instruction and it effectiveness at teaching the objectives. Feedback from the learners was very positive, and most of them found the training effective and educational.

Section One of the module was on, "what is assistive technology and what are the remedial and compensatory approaches?" Figure 11 shows the type of questions that were asked and the results of the learners from pre-test to post-test. For questions one through four, there was a marked improvement from the pre-test to post-test scores for the group. There was clear growth in understanding of what assistive technology is with

a jump from 33% to 87%. Question five revealed a slight dip in learning from 80% to 73%. This question required the learner to decide if an example of technology was remedial or compensatory. There may be a need to improve the explanation in the module to increase this learning and ensure understanding.

Section 1 – What is Assistive Technology?

Question	Subject	Pre-Test	Post-Test
1	Define assistive technology	**33%**	**87%**
2	Define compensatory approach	**73%**	**93%**
3	Define remedial approach	**73%**	**87%**
4	Determine which one uses the compensatory approach	**20%**	**53%**
5	Determine which one uses the remedial approach	**80%**	**73%**

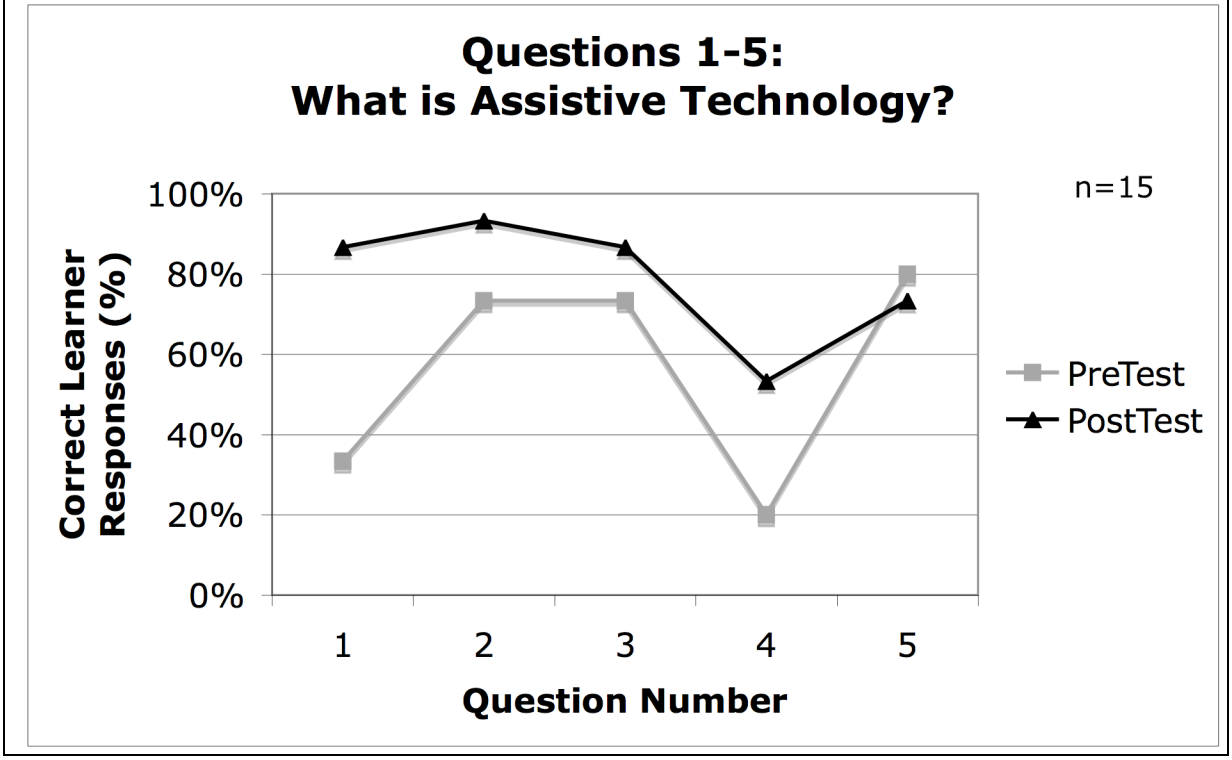

Figure 11. Chart showing the small group results of questions one through five.

Section two taught learners about writing aids and how they can be used to help student learning. As revealed in Figure 12, all six questions showed an increase in learning from the pre-test to the post-test with the biggest increase coming in learning about what a computer speller can do with a leap from 33% to 80%.

Section 2 –Writing Aids – Examples and Uses

Question	Subject	Pre-Test	Post-Test
6	Determine which one is not a writing aid	**93%**	**100%**
7	Pencil grips work best for which students	**93%**	**100%**
8	Raised paper work best for which students	**100%**	**100%**
9	What can computer spellers do?	**33%**	**80%**
10	What can word prediction software do?	**73%**	**93%**
11	Match the writing aid with the student learning strength or weakness	**60%**	**93%**

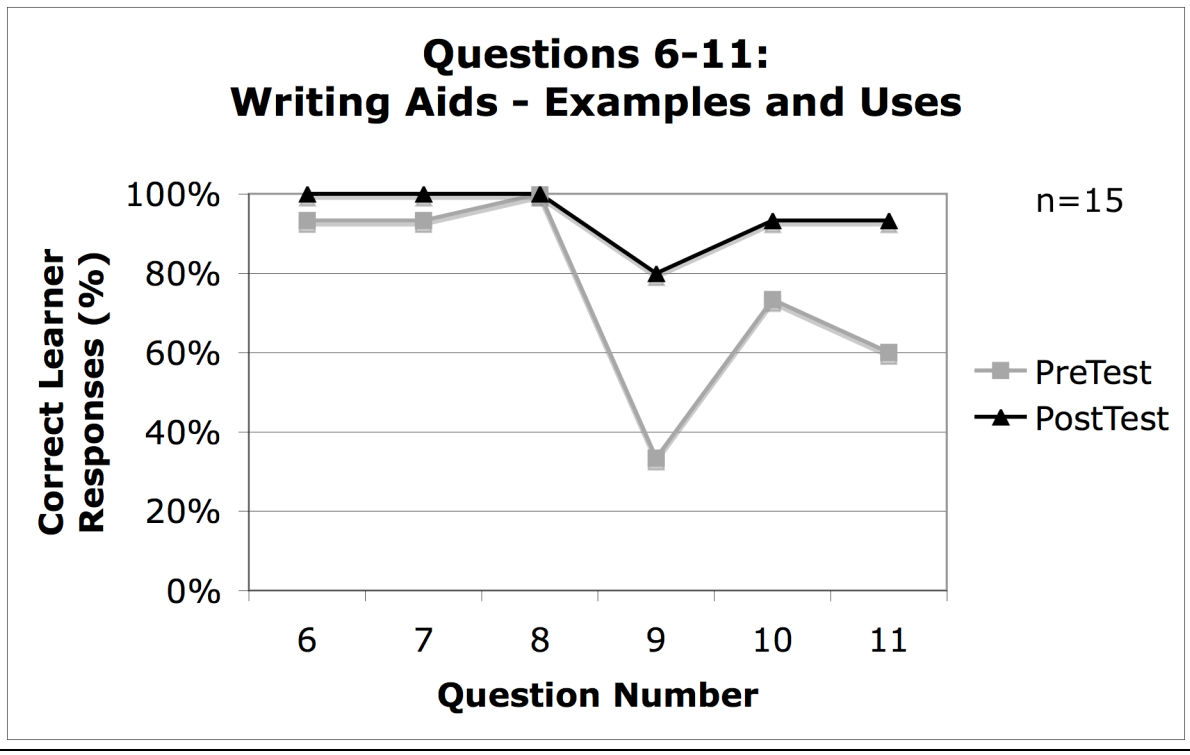

Figure 12. Chart showing the small group results of questions six through eleven.

Question eight revealed that all learners knew what raised paper was and how it was used, reflected in the 100% score for both pre- and post-tests. This might be an item that is mentioned in the module in the future, but not tested. Question 11 was also important when looking at the data. It required learners to match writing aids with learning strengths and weaknesses. With a leap from 60% to 93%, most learners gained an understanding of writing aids and how they can be used to help students.

Section three taught learners about speech-to-text software and how it can be used for certain learning strengths and weaknesses. As Figure 13 shows, most learners had an understanding of speech-to-text prior to taking the test. Those who didn't had a full understanding by the post-test with 100% scores on both questions. From these results, section three was a complete success and learners mastered understanding.

Section 3 –Speech-to-Text – Examples and Uses

Question	Subject	Pre-Test	Post-Test
12	Speech-to-Text and typing skills	**93%**	**100%**
13	Speech-to-Text and other learning strengths and weaknesses	**73%**	**100%**

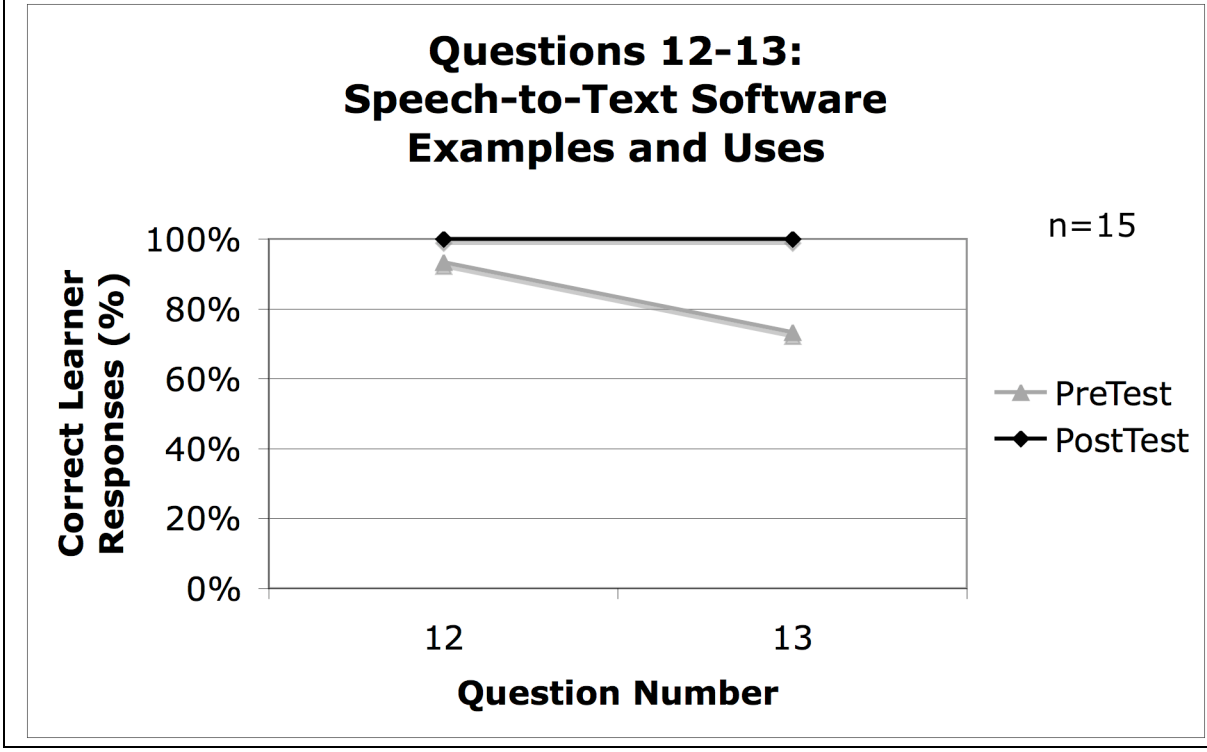

Figure 13. Chart showing the small group results of questions 12 and 13.

Section four showed that there was less knowledge among learners about text-to-speech software or the ability to have the computer read electronic text back to the learner. With both questions, there was improvement in scoring, which can be seen in Figure 14. In question 14, learners went from 80% to a 100% mastery of how text-to-speech works with listening comprehension skills. However, a problem was faced in question 15. Learners only increased understanding from 30% to 47%. In reviewing this question and its answers, the investigator found that the correct answer is not readily

apparent even to those who understand text-to-speech. This question should be rewritten for clarity.

Section 4 –Text-to-Speech – Examples and Uses

Question	Subject	Pre-Test	Post-Test
14	Text-to-Speech and listening comprehension skills	**80%**	**100%**
15	Text-to-Speech and other learning strengths and weaknesses	**33%**	**47%**

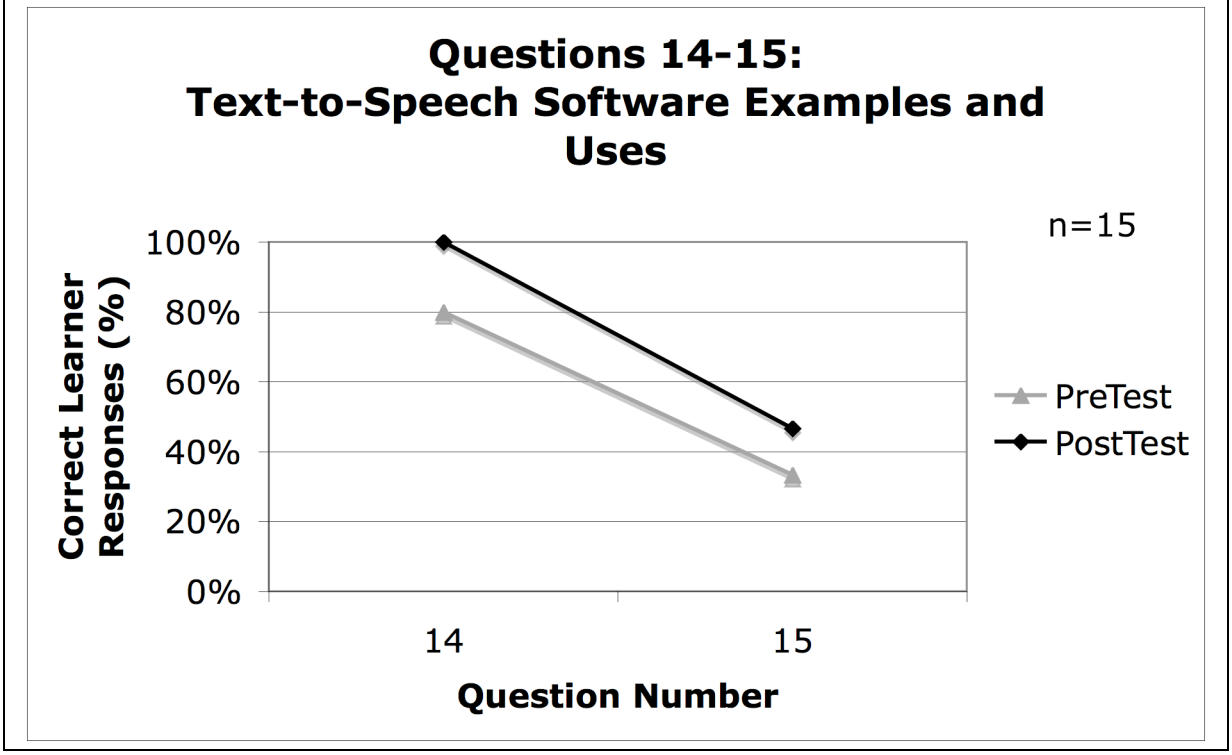

Figure 14. Chart showing the small group results for questions 14 and 15.

Section five covered organizational tools, probably the most powerful assistive technology tools for all learners. Again, for most learners there was a very positive increase in learning from pre- to post-test as seen in Figure 15. Two learners had trouble recognizing which tools were examples of organizational tools in question 16, reducing the post-test scores to 87%. In the future, the module will be re-evaluated to ensure there is enough training on non-examples of organizational tools. On the other hand, there was a major increase in knowledge of outliners in question 17 from 13% to 87%.

Section 5 – Organizational Tools – Examples and Uses

Question	Subject	Pre-Test	Post-Test
16	Determine examples of organizational tools	**100%**	**87%**
17	What can outliners do?	**13%**	**87%**
18	What can graphic organizers do?	**93%**	**87%**
19	What can PDAs do?	**80%**	**93%**
20	Match the organizational tools with learning strength and weaknesses	**67%**	**80%**

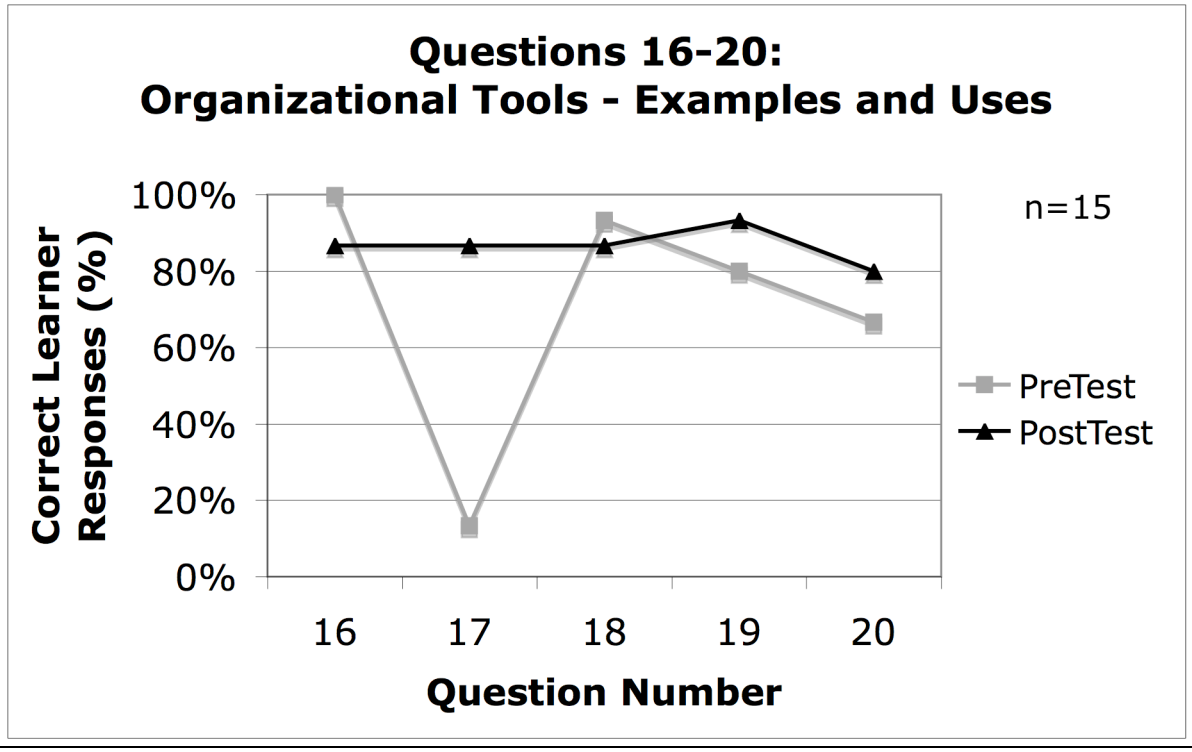

Figure 15. Chart showing the small group results for questions 16 through 20.

Section six was the terminal objective. In this objective, learners had to put all of their knowledge gained in the module to connect appropriate tools with learning strengths and weaknesses. Figure 16 shows the overall scoring for this objective. The challenge was that learners had to get all of the matches correct to achieve a correct overall score. There were four tools on the left to connect with six different choices on the right. One learner did not read the question and put answers on all six choices. For the other

learners who missed the terminal objective, they only missed part of the answer and there was not a clear pattern among them to the mistake made. Overall, there was an increase in learning from 40% to 67%, so there was success among the other learners.

Section 6 – Terminal Objective – Matching Tools with Learning

Question	Subject	Pre-Test	Post-Test
21	Match the assistive technology tool with the learning strength and weaknesses	**40%**	**67%**

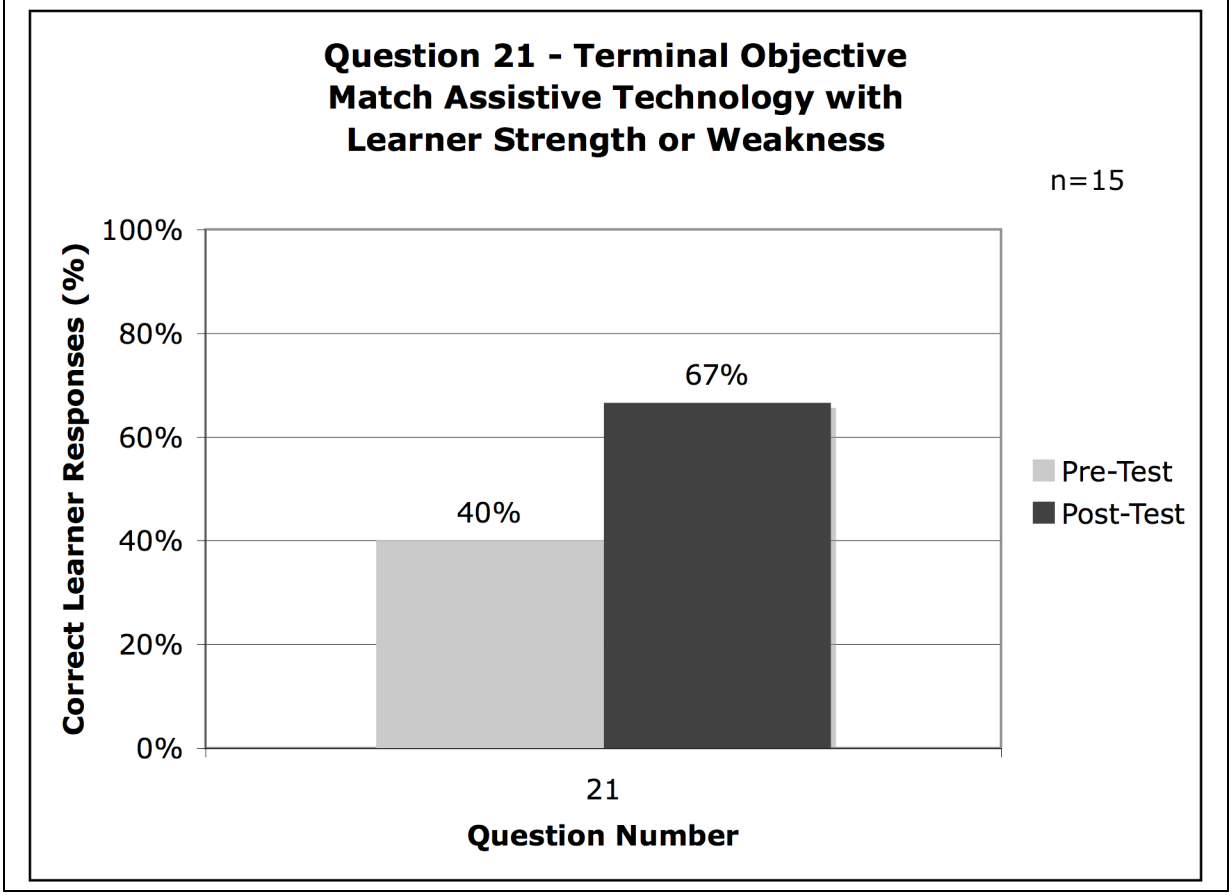

Figure 16. Chart showing the small group results for the terminal objective.

Figure 17 shows how learners did overall by section. Taken as a whole, learners showed improvement in all sections from pre- to post-test with the most increase in defining assistive technology (23% increase) and the terminal objective (27% increase). In that way, the module was a success! The investigator was hoping to create a better

awareness about assistive technology and how it can be matched with student's learning strengths and weaknesses. The increases in scoring are evident.

Average Learner Scores by Section

Section	Subject	Pre-Test	Post-Test	% Change
1	Define Assistive Technology	**56%**	**79%**	**+23%**
2	Writing Aids – Examples and Uses	**76%**	**94%**	**+18%**
3	Speech-to-Text Software	**83%**	**100%**	**+17%**
4	Text-to-Speech Software	**57%**	**73%**	**+16%**
5	Organizational Tools – Examples and Uses	**71%**	**87%**	**+16%**
6	Match Assistive Technology with Learner	**40%**	**67%**	**+27%**

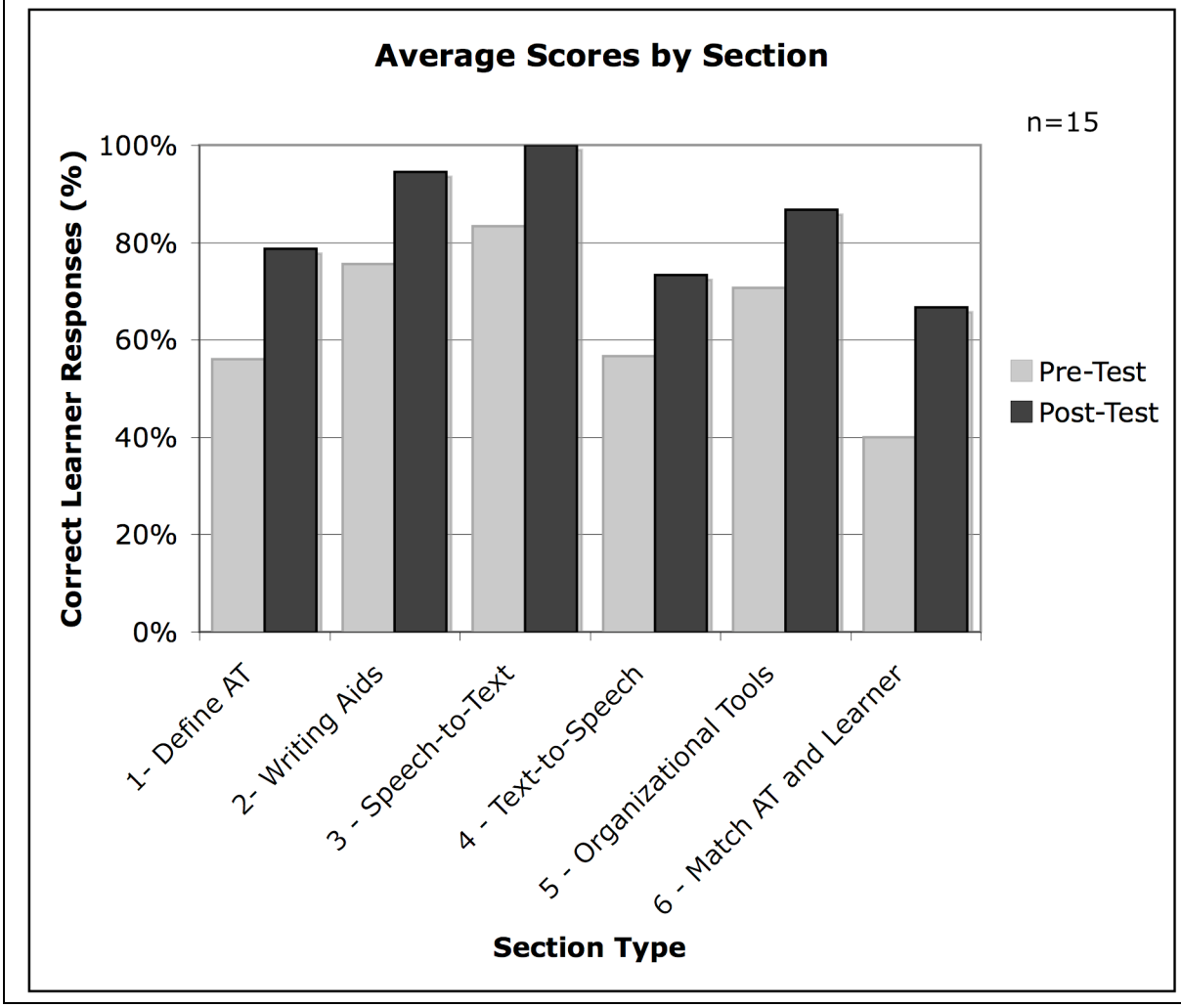

Figure 17. Chart showing the average small group results by section.

Figure 18 breaks down overall scoring by learner. The graph shows where each learner started and where he or she ended after taking the module. For every learner, there was an overall increase in answering questions correctly.

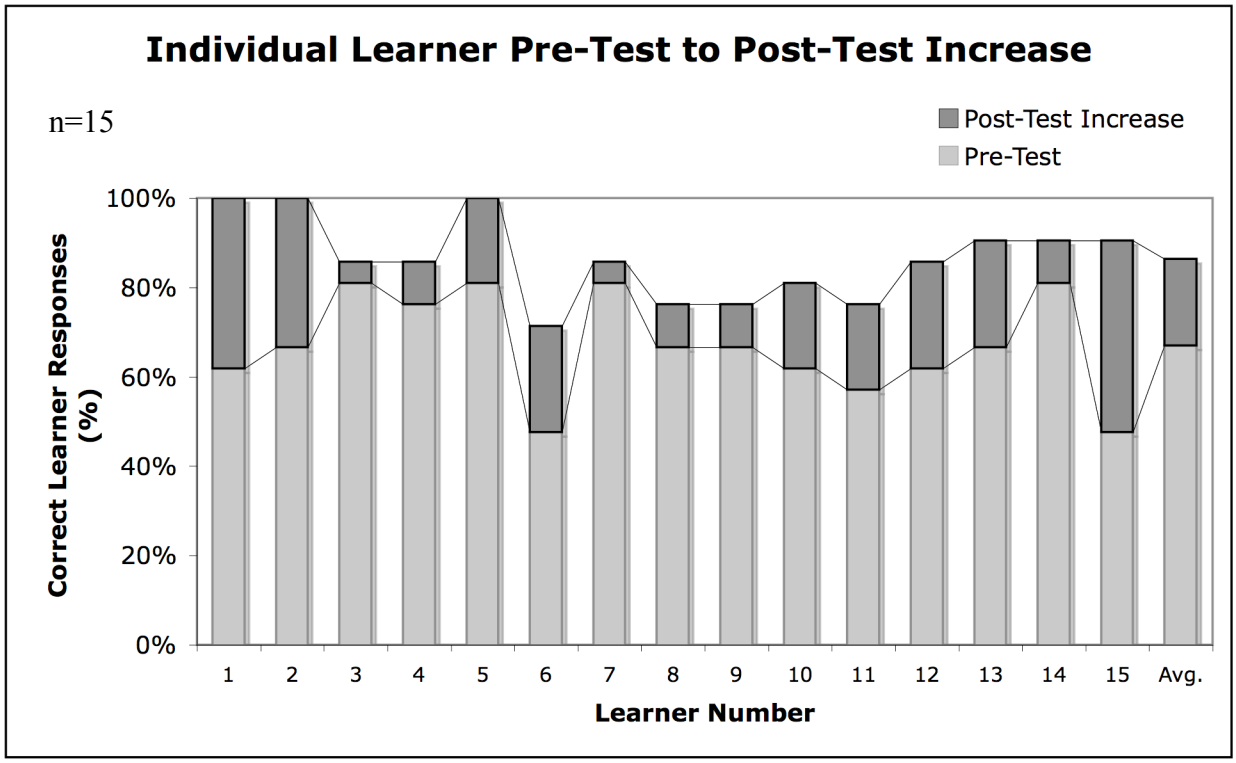

Figure 18. Chart showing the average score by learner.

Anecdotal Data. As part of the module, learners were asked to complete an attitudinal survey. The goal of the survey was to see if learners found the module beneficial. Figure 19 shows the results of this data, and Appendix H provides a complete breakdown by learner. Two learners failed to fill out the survey. Of the 13 who completed the survey, the majority of them "agreed" that the module was beneficial to them. A few learners ran into technical difficulties with the module. This is addressed more in the attitudinal data section to follow. Out of a possible 4.0, the overall average

was 3.0 (Agree). This did not include question two, which was a negative question where the desired value was a one, not a four. For the most part, the averages were in the "agree" category. Some learners were concerned that the module was not easy to navigate.

Please use the 4-point scale to indicate your agreement or disagreement with each statement. Record all responses by circling the corresponding number.		Strongly Disagree	Disagree	Agree	Strongly Agree
		1	2	3	4
1	The instructions were clear.	**----------3.2**			
2	I had technical problems when using the module.	**----------2.3**			
3	The module was easy to navigate.	**----------2.8**			
4	The module was helpful.	**----------3.3**			
5	The module was user-friendly.	**----------2.8**			
6	The module provided enough practice.	**----------3.2**			
7	The module was motivating.	**----------2.7**			
8	The module covered materials that were personally beneficial to me.	**----------2.8**			
9	The module allowed me to attain information and skills unknown to me before.	**----------3.3**			
10	The video examples were helpful.	**----------3.2**			
11	The test questions were clear and understandable.	**----------3.0**			
12	The use of a computer-based tutorial was helpful.	**----------3.2**			
13	I learned something about assistive technology.	**----------3.2**			
14	I learned something about learning disabilities.	**----------3.0**			
15	I have a better understanding about matching technology to learning strengths and weaknesses.	**----------3.0**			
	Overall Average (not including question two)	**----------3.0**			

Figure 19. Average attitudinal data scores.

Appendix H shows a list of comments that were provided by learners at the end of the attitudinal survey. There were conflicts in responses among some of the learners, but

there were some key points that came from the comments. Of the nine learners who provided feedback, five felt that the module was helpful. One of the learners stated that the "information was very useful and will help me right away". Six of the learners ran into trouble because they didn't read the initial instructions about the required resolution size and could not see the rollover answers at the bottom. One of the learners said, "Many of the problems were due to viewing it in the wrong resolution. The quizzes were mostly useless because I could not view most of the answers on the bottom as I rolled over the answer in the question." Two learners noticed that there was a small problem with the programming of the rollovers in the multiple-choice questions. One learner said, "all of your rollovers for E show D in blue, a bit confusing." One learner expressed a wish to have additional videos and pictures to make the module more interesting, saying: "I thought the module was very easy to understand; however, it did lack in excitement for me. I would have enjoyed seeing more examples through pictures or videos."

Summary

Overall, the instructional module was a success. It introduced the target audience of future educators to some of the important terms and assistive technology tools they might need as they enter the classroom. As indicated by the survey results with a 3.3 out of 4, the learners felt the module was helpful to them, even with some technical problems they faced. As far as pre-test to post-test comparison, overall, there was an increase in correct responses for every question and task. Additionally, with a 27% gain in correct responses to the terminal objective, the benefits of the module are clear.

Chapter V: Discussion

Notable Findings

The goal of this instructional module was to provide a tool for learning for future educators. In doing the literature review, it was clear that many of the teachers entering the field lack knowledge about learning differences and assistive technology, so they are inadequately prepared to meet the needs of all their students. This coincides with the surveys where 11 out of the 15 learners indicated none or only basic knowledge of learning disabilities, and 12 out of 15 indicated none or only basic knowledge of assistive technologies. For all learners taking the module, they "agreed" or "strongly agreed" that the module allowed them to attain information and skills unknown to them before. Moreover, many of the learners mentioned how they valued the interactivity of the module, which supports the research as well. Many of the learners commented on how they would like to see this module taken further. Several suggested adding in additional information about remedial approaches and learner differences. It is clear that more modules, like this one, are needed for future educators. However, this module is just one piece in a much larger puzzle when it comes to preparing teachers to meet the needs of all students. In the Future Enhancements section, the investigator provides some ideas to enhance this instructional module.

Recommended Revisions

Based on feedback from the small group testing, the module is successful at teaching learners about assistive technology for students with language-processing differences. Additionally, the testing provided some valuable feedback on changes that

could be made to improve it and make it more successful in the future as a standalone tool. Figure 20 shows a list of items that were commented on by the learners or found by the investigator that might need revisions to improve and enhance the learning experience.

Item	**Recommended Revision**	**Action taken by Investigator**
Rollover answers not visible on screen (5 comments)	This is a small problem with the screen size not appearing properly on some web browsers. There are three possible solutions: A. Re-design the module so the module size is smaller to fit all screens. B. Re-program rollover answers to appear higher up on the screen. C. Be more detailed in the instructions about how important the screen size is.	Fixes have been made to the module to provide better instructions, remove the navigation from the module pop-up window to provide a bigger screen size, and add arrows to the correct answers to help learners to see the answer better.
Answers hard to see (2 comments)	Some learners had trouble recognizing the answer right away, so the rollover was changed to add an arrow and make it obvious. 	All rollover correct answers now are in green and show an arrow.
Answer rollover problem (2 comments)	Rollover of letter "E" reveals letter "D".	Fixed. This was a great catch by learners and was an easy fix in the code of the button.
Pages are too text heavy (2 comments)	Pages might need to be broken up to provide less text per page and keep learners motivated; however, this adds to the overall length of the module.	Investigator needs to consider this one.
Want more pictures and videos (1 comment)	The goal is to have at least one image or video per page, maybe two, where possible.	Investigator needs to add more in the future.

Figure 20. Recommended revisions.

Item	Recommended Revision	Action taken by Investigator
Title page not clear (1 comment)	Re-do title page to make it more visually interesting and provide more understanding to learners	This has been fixed.
No learner objectives (1 comment)	Add a page in module on the learner objectives.	This has been fixed.
Module not easy to navigate (1 comment)	Provide clearer help screens and remove the ability to skip the help screens and go right to the module. This will force learners to look through the help prior to starting the module.	This has been fixed.
Question 17 problem (From data results)	Question #17 needs to be re-written so that the answer fits better with the training in the module.	Investigator needs to fix.
Question 15 needs work (From data results)	Learners did not do well on this question, and it needs to be re-written.	Investigator needs to review this question.

Figure 20, cont. Recommended revisions.

Reflections

These are the personal reflections of the investigator in regards to the research, design, and implementation of this project.

What I learned. Looking at a need and creating an instructional module to address it was good practice for me. I have done small training aids and workshops before, but nothing at this magnitude. Even though I teach students with language-processing differences, it was interesting to look at these differences from a research perspective rather than an observational one. There is a lot of difference between theory and seeing assistive technology in action. And, hopefully, those taking my module will

understand that the information I provide will not work for every student. Teachers have to take into account a student's individual differences and motivation level.

What went right. The data from the learners turned out better than I expected. I was surprised at how effective the module was at teaching learners. I was also surprised at my creativity. I am not an artist by any means, but the colors and buttons I created for the module made it a nice standalone piece with good navigation and a professional look. I struggled with the short timeframe to create the module, but moved through it quickly and found the time to make it work.

What went wrong and what I would do differently. The two biggest problems were writer's block and module sizing problems. I faced writer's block so many times during the year. The block was caused by the other required writing that I was doing for my Master's classes. I had to take many breaks and put this project aside until I was motivated to try again. I also had problems finding the research I needed to present my case in the Literature Review. As far as the module, I ran into problems with my resolution size. Many learners who used a PC ran into problems because they could not see the whole module on the screen. This made it hard for them to see the answers to the multiple-choice questions, and it may have affected their learning from the embedded questions. In the future, I will create modules at the 800x600 resolution size, which seems more standard still for many learners.

Conclusions

Assistive technology is any piece of equipment, item, or product that is used to capitalize on, compensate for, or remediate the functional capabilities of an individual's learning strengths and weaknesses. The goal of this project was to create an online,

interactive module that would teach future educators about what assistive technology is and how assistive technology tools could help their future students with language-processing differences. The module was shown to be an effective tool at teaching these concepts with the sample population of 15 learners showing scores that increased an average of 19% from pre-test to post-test and increased an average of 27% in mastering the terminal objective. The goal of this project was to ensure that the module was effective and to get feedback to make it better. The critical changes to the module have been made based on the recommended revisions and are online and ready to use by anyone at http://www.travis-family.com/mike/atmodule. The investigator feels that the module was an effective tool for learning and will produce more kinds of modules in the future.

Future Enhancements

Now, that the module is online and ready for use, the next step is to create a Web portal of information for future educators to continue learning about assistive technology. Here are some future enhancements that the investigator is planning on pursuing:

- Create instructional modules to address other learning differences including physical disabilities
- Create a Web site portal with links to other resources and assistive technology companies
- Create a discussion board for teachers to "meet" and get advice from each other
- Make suggestions to College of Education Departments to make assistive technology a bigger part of teacher education programs

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Appendix

Appendix A. Pre-Test for module

Appendix B. Instructional module

Appendix C. Post-Test for module

Appendix D. Demographic and attitudinal survey

Appendix E. Human consent form

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Appendix A: Pre-Test for module

____ ID # ---- Please make sure and put your ID number on all documents.

Start Time _____
Finish Time _____

What Is Assistive Technology and How Can It Help Students?

An Instructional Module Addressing Language-Processing Difference For Future Educators

Pre-Test

By Mike Travis, Graduate Student, University of Hawai‘i at Manoa

Pre-Test

The pre-test will give you a preview into what you will be learning in this module. Don't be frustrated if you can't answer many questions; just do the best you can. The purpose of this pre-test is to see what knowledge you already have about assistive technology prior to reading the online training module. This information will help me to know if the training module taught you anything as I can compare your answers here to the post-test answers.

Please feel free to write any comments that you may have about the Pre-Test in the left margin of these papers. Descriptive words such as "unclear", "doesn't make sense", or your own words and comments are welcomed feedback for me as I review your work.

Thank you for taking the time out of your busy day to do this module for me!

1) Pick the item below that is NOT an example of Assistive Technology:

   A. Typing Tutor

   B. Co-operative Learning

   C. Speech-to-Text Software

   D. Pencil Grip

   E. Computer Speller

2) A remedial approach is best defined as an approach that

   A. circumvents deficits.

   B. helps the learner to organize thoughts.

   C. improves areas of deficiency.

   D. teaches a student by using visual cues.

   E. gives the learner time to read and take notes.

3) A compensatory approach is best defined as an approach that

   improves areas of deficiency.

   gives the learner time to read and take notes.

   helps the learner to organize to-do-lists.

   has the student read aloud to the class.

   circumvents deficits.

4) All of the tools below are compensatory tools EXCEPT:

A. Speller Checker

B. Typing Tutor

C. Text-to-Speech Software

D. Pencil Grips

E. Raised Paper

5) (True or False) Using a calculator to multiply two small numbers is an example of the remedial approach.

A. True

B. False

6) All of the following are examples of writing aids EXCEPT:

A. Raised Paper

B. Computer Speller

C. Word Prediction Software

D. Calculator

E. Pencil Grips

7) Pencil grips are best used with students who

A. cannot multiply in their heads.

B. have difficulty organizing their ideas on paper.

C. have trouble spelling.

D. can write creatively and with a lot of speed.

E. struggle with fine motor skills and handwriting.

8) Raised Paper is best used with students who

A. can write creatively and with a lot of speed.

B. need to get organized.

C. have trouble spelling.

D. have trouble writing straight and consistent.

E. cannot multiply in their heads.

9) Most Computer Spellers can do all the following EXCEPT:

A. provide synonyms for a word.

B. type words into the speller as you speak them.

C. give multiple definitions for a word.

D. offer antonyms for a word.

E. read the word out loud to you.

10) (True or False) Word Prediction Software suggests words based on phonetic spelling.

A. True

B. False

11) Match the writing style on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the learning style on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Writing Aid:	**Student Learning Strength or Weakness:**
A. Pencil Grips B. Raised Paper C. Computer Speller D. Word Prediction Software	___ Students who struggle with written expression and need a tool to give them suggestion of what should follow. ___ Students with limited or misuse of vocabulary and need a portable device to assist. ___ Students who struggle with organization issues ___ Students who have trouble writing in a straight line and with consistent sizing and spacing. ___ Students who struggle with writing due to deficiencies in fine motor coordination and/or unorthodox holding of a writing utensil. ___ Students who have trouble with verbal expression

12) (True or False) Speech-to-Text Software is a great tool for students with strong typing skills.

A. True

B. False

13) Speech-to-Text is a great tool for all the following student strengths and weaknesses EXCEPT:

A. Students with weak typing skills

B. Students with weak verbal skills

C. Students with dysgraphia

D. Students with strong verbal skills

E. Students with motor coordination deficiencies

14) (True or False) Text-to-Speech Software is a good tool for students with weak listening comprehension.

A. True

B. False

15) Text-to-Speech is a great tool for all the following student strengths and weaknesses EXCEPT:

A. Students with strong listening comprehension skills

B. Students with weak note taking skills

C. Students with average or above average reading fluency and comprehension

D. Students with attentional issues like ADD or ADHD

E. Students with small vocabularies

16) All of the following are examples of organizational tools EXCEPT:

A. Pencil Grips

B. Graphic Organizers

C. Outliners

D. Personal Digital Assistants

E. 3-Ring or Accordion Binders

17) Most outliners allow you to do all of the following EXCEPT:

A. Export a list to presentation software.

B. Link to other files or web pages.

C. Turn a pre-printed report into an outline.

D. Easily arrange the order of topics and subtopics.

E. Easily organize a plan for attacking a large project or report.

18) Choose the letter below that best fits this sentence.
_____ is an excellent tool for students who need to plan their thoughts in a visual way with images, bubbles and links.

A. A Pencil Grip

B. A Graphic Organizer

C. An Outliner

D. A Personal Digital Assistant

E. Speech-to-Text Software

19) Most PDAs can do all the following EXCEPT:

A. Send reminders to a student for upcoming assignments.

B. Keep a calendar of to-do-items.

C. Provide quick access to Internet sites.

D. Turn all the words you speak into typed text.

E. Calculate small equations.

20) Match the organizational tool on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the strength or weakness on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Organizational Tool:	**Student Learning Strength or Weakness:**
A. Outliners B. Graphic Organizers C. PDAs	___ Students in need of a portable device that can store to-do-lists, contacts, and even access the Internet. ___ Students who struggle with writing due to deficiencies in fine motor coordination and/or unorthodox holding of a writing utensil. _ Students who need to plan work, write papers, and need a tool with collapsible lists and the ability to convert to a presentation. ___ Students who need a tool to layout information in a visual way adding in graphics and links to other pages or information. ___ Students who have trouble with written expression and need a tool that utilizes their verbal skills.

21) Match the assistive technology tool on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the student strength or weakness on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Assistive Technology Tool:	**Student Learning Strength or Weakness:**
A. Speech-to-Text Software B. Organizational Tools C. Text-to-Speech Software D. Writing Aids	___ Students who struggle with reading usually with very low reading rates, but this tool will also benefit any student with good listening skills. ___ Students with vision or hearing impairments will benefit from these tools. ___ Students who struggle with typing either because of dysgraphia or an inability to type efficiently. Students with good verbal skills should also benefit. ___ Students who struggle with kinesthetic/hands-on activities. These tools will benefit them. ___ Students who struggle with planning work, writing papers, or thinking about ideas in a visual way Most students would benefit from these tools. ___ Students who struggle with either the physical attribute of writing or need help in picking the right words that will come next in a sentence.

Appendix B: Instructional module

Instructional Module Instructions

Instructions

The instructional module can be accessed in two ways – online or through the CD.

Online Instructions –

A. To access all the files, go to this address - http://www.travis-family.com/mike/atmodule

B. Click on "Start Online Module". This should open the module in a new window.

CD Instructions –

1. To access the module from the CD, open the CD and click on the file entitled "module.swf"

2. This should open the module in a new window from Flash Player.

The Module is built as a SWF and might require a Flash Player, which is a free download. Here is the address to download, if needed: http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash&promoid=BIOW

If you have additional questions about this instructional module, please contact Mike Travis at mtravis@hawaii.edu.

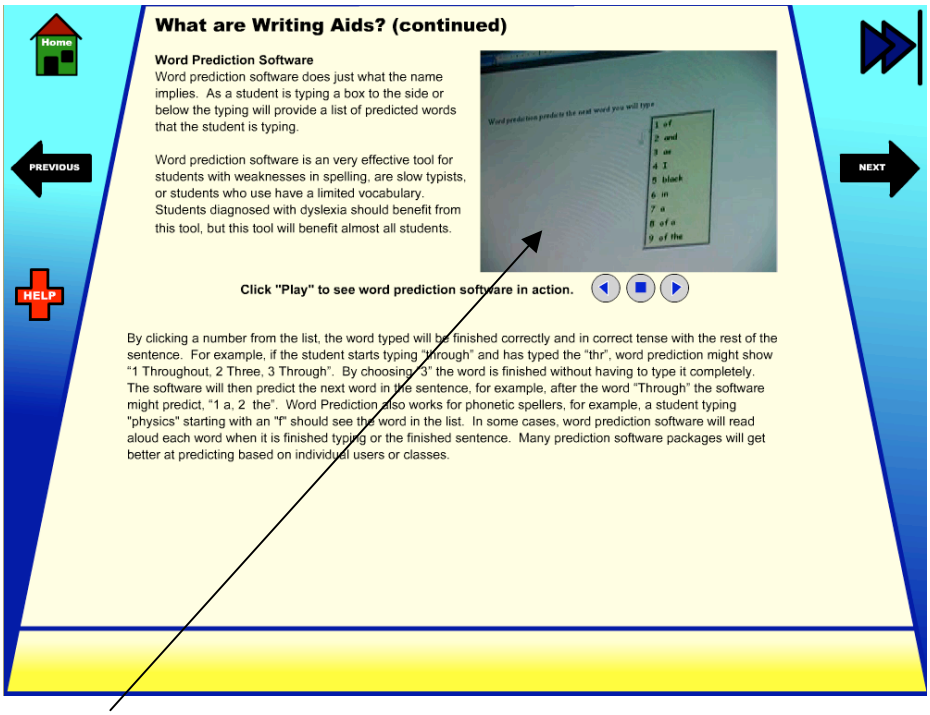
Please write your times here:

Start Time _____

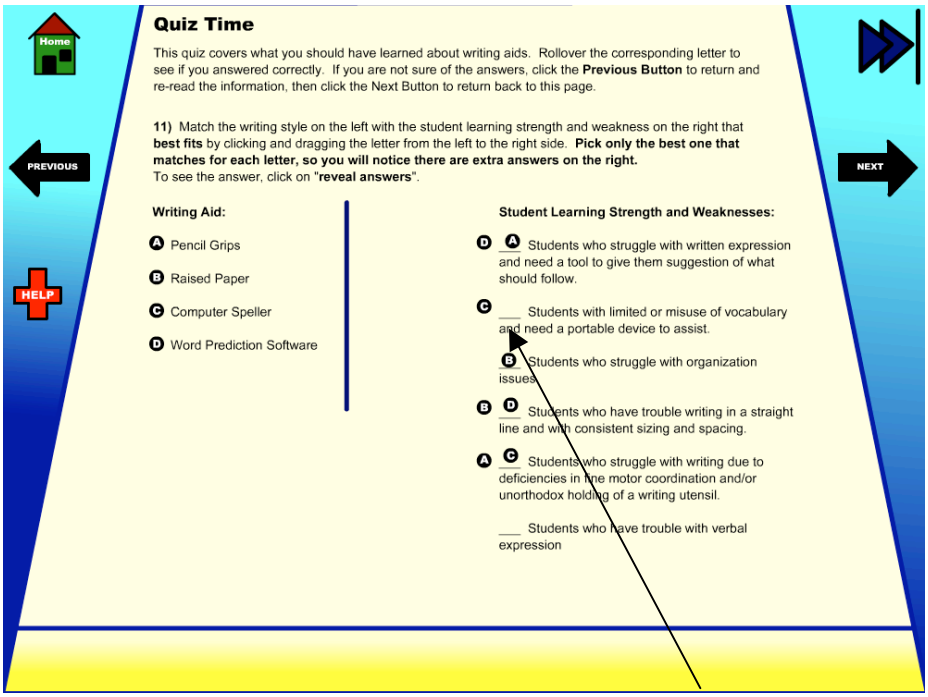
Finish Time _____

Thank you for taking the time out of your busy day to do this module for me!

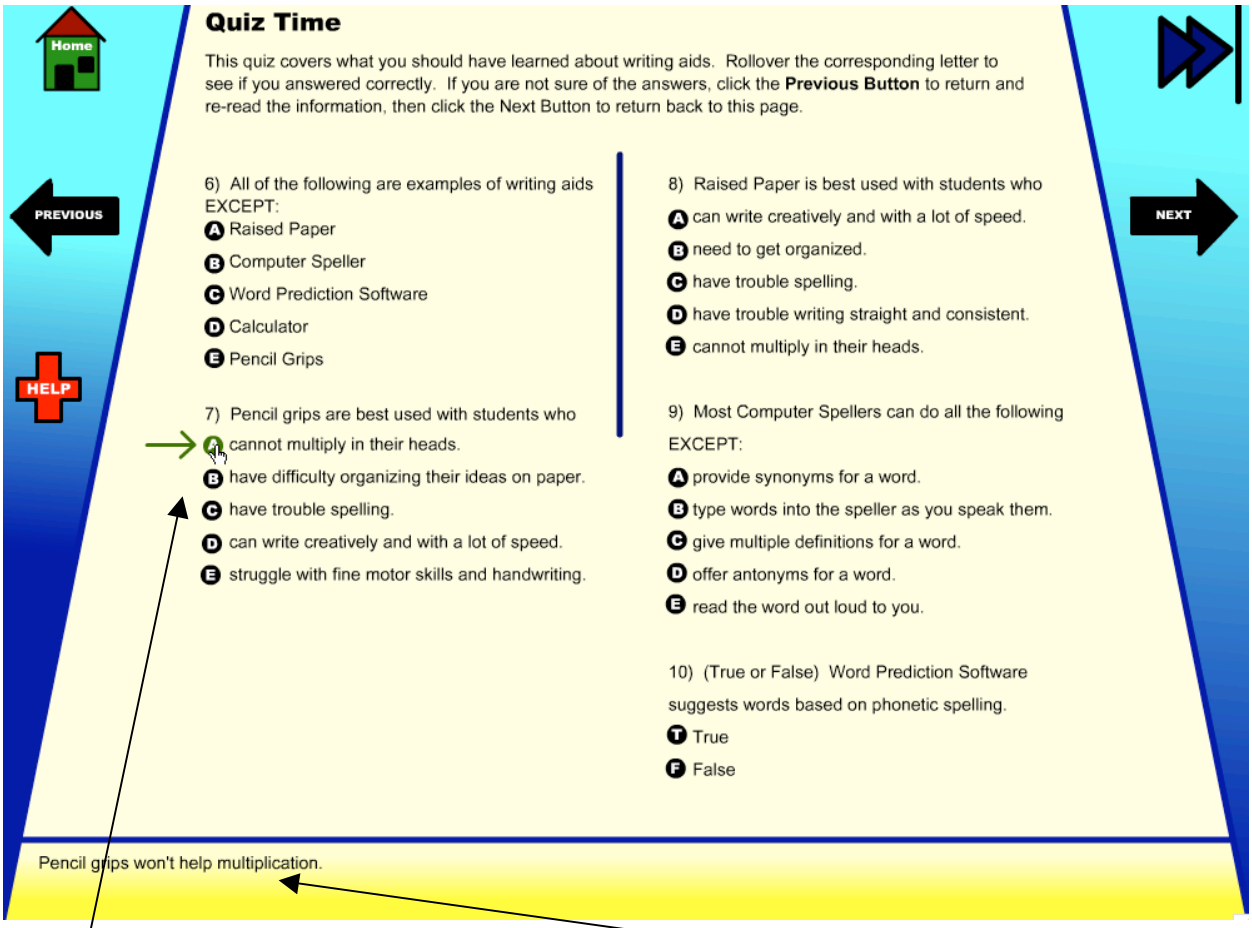
Here are a few screen captures from the module:



Video captures of assistive technology in action provide learners with a more realistic understanding than a paper-based module.



The matching section allows the learner to drag the letter for the tool to match it with the learning strength or weakness. Clicking on the "reveal answer" button reveals the correct answers.



Rolling over the letters reveals the correct answer and provides feedback on the answer at the bottom of the page. (The green arrow was added based on feedback from the learners.)

Appendix C: Post-Test for module

____ ID # ---- Please make sure and put your ID number on all documents.

Start Time _____
Finish Time _____

What Is Assistive Technology and How Can It Help Students?

An Instructional Module Addressing Language-Processing Difference For Future Educators

Post-Test

By Mike Travis, Graduate Student, University of Hawai‘i at Manoa

Post -Test

The post-test is the final test and will be checking to see how much you learned from the module and will be compared to your pre-test. Don't be frustrated if you can't answer all the questions, just do the best you can.

Please feel free to write any comments that you may have about the Post-Test in the left margin of these papers. Descriptive words such as "unclear", "doesn't make sense", or your own words and comments are welcomed feedback for me as I review your work.

Thank you for taking the time out of your busy day to do this module for me!

1) Pick the item below that is NOT an example of Assistive Technology:

   A. Typing Tutor

   B. Two-Column Note Taking

   C. Pencil Grip

   D. Text-to-Speech Software

   E. Raised Paper

2) A remedial approach is best defined as an approach that

   A. gives the learner time to read and take notes.

   B. circumvents deficits.

   C. helps the learner to organize thoughts.

   D. teaches a student by using visual cues.

   E. improves deficient areas of learning.

3) A compensatory approach is best defined as an approach that

   A. gives the learner time to read and take notes.

   B. improves areas of deficiency.

   C. helps the learner to organize to-do-lists.

   D. circumvents learning deficits.

   E. has the student read aloud to the class.

4) All of the tools below are compensatory tools EXCEPT:

A. Computer Speller

B. Speech-to-Text Software

C. Pencil Grips

D. Typing Tutor

E. Raised Paper

5) (True or False) Using math skills software to practice times tables is an example of the remedial approach.

A. True

B. False

6) All of the following are examples of writing aids EXCEPT:

A. Pencil Grips

B. Text-to-Speech Software

C. Raised Paper

D. Word Prediction Software

E. Computer Speller

7) Pencil grips are best used with students who

A. can write creatively and with a lot of speed.

B. cannot multiply in their heads.

C. struggle with fine motor skills and handwriting.

D. have trouble spelling.

E. have difficulty organizing their ideas on paper.

8) Raised Paper is best used with students who

A. need to get organized.

B. cannot multiply in their heads.

C. have trouble writing straight and consistent.

D. can write creatively and with a lot of speed.

E. have trouble spelling.

9) Most Computer Spellers can do all the following EXCEPT:

A. read the word out loud to you.

B. type words into the speller as you speak them.

C. provide synonyms for a word.

D. give multiple definitions for a word.

E. offer antonyms for a word.

10) (True or False) Students that can only type phonetically will still benefit from Word Prediction Software.

A. True

B. False

11) Match the writing style on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the learning style on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Writing Aid:	**Student Learning Strength or Weakness:**
A. Pencil Grips B. Raised Paper C. Computer Speller D. Word Prediction Software	___ Students with limited or misuse of vocabulary and need a portable device to assist. ___ Students who struggle with written expression and need a tool to give them suggestion of what should follow. ___ Students who have trouble writing in a straight line and with consistent sizing and spacing. ___ Students who struggle with organization issues ___ Students who have trouble with verbal expression. ___ Students who struggle with writing due to deficiencies in fine motor coordination and/or unorthodox holding of a writing utensil.

12) (True or False) Speech-to-Text Software is a great tool for students with weak typing skills.

A. True

B. False

13) Speech-to-Text is a great tool for all the following student learning strengths and weaknesses EXCEPT:

A. Students with dysgraphia

B. Students with weak verbal skills

C. Students with weak typing skills

D. Students with strong verbal skills

E. Students with motor coordination deficiencies

14) (True or False) Text-to-Speech Software is a good tool for students with strong listening comprehension.

A. True

B. False

15) Text-to-Speech is a great tool for all the following student learning strengths and weaknesses EXCEPT:

A. Students with attentional issues like ADD or ADHD

B. Students with weak note taking skills

C. Students with strong listening comprehension skills

D. Students with average or above average reading fluency and comprehension

E. Students with small vocabularies

16) All of the following are examples of organizational tools EXCEPT:

A. Graphic Organizers

B. 3-Ring Binders

C. Outliners

D. Speech-to-Text Software

E. Personal Digital Assistants

17) Most outliners allow you to do all of the following EXCEPT:

A. Link to other files or web pages.

B. Export a list to presentation software.

C. Easily organize a plan for attacking a large project or report.

D. Easily arrange the order of topics and subtopics.

E. Turn a pre-printed report into an outline.

18) Choose the letter below that best fits this sentence.
_____ is an excellent tool for students who need to plan their thoughts in a visual way with images, bubbles and links.

A. A Pencil Grip

B. A Graphic Organizer

C. An Outliner

D. A Personal Digital Assistant

E. Speech-to-Text Software

19) Most PDAs can do all the following EXCEPT:

A. Calculate small equations.

B. Provide quick access to Internet sites.

C. Keep a calendar of to-do-items.

D. Send reminders to a student for upcoming assignments.

E. Turn all the words you speak into typed text.

20) Match the organizational tool on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the strength or weakness on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Organizational Tool:	**Student Learning Strength or Weakness:**
A. Outliners B. Graphic Organizers C. PDAs	_____ Students who have trouble with written expression and need a tool that utilizes their verbal skills. _____ Students who struggle with writing due to deficiencies in fine motor coordination and/or unorthodox holding of a writing utensil. _____ Students in need of a portable device that can store to-do-lists, contacts, and even access the Internet. _____ Students who need to plan work, write papers, and need a tool with collapsible lists and the ability to convert to a presentation. ___ Students who need a tool to layout information in a visual way adding in graphics and links to other pages or information.

21) Match the assistive technology tool on the left with the student learning strength or weakness on the right by writing the corresponding letter on the left next to the student strength or weakness on the right. **Note: Pick only the <u>best</u> one that matches for each letter, so you will notice there are extra answers on the right.**

Assistive Technology Tool:	**Student Learning Strength or Weakness:**
A. Speech-to-Text Software B. Organizational Tools C. Text-to-Speech Software D. Writing Aids	___ Students who struggle with reading usually with very low reading rates, but this tool will also benefit any student with good listening skills. ___ Students with vision or hearing impairments will benefit from these tools. ___ Students who struggle with typing either because of dysgraphia or an inability to type efficiently. Students with good verbal skills should also benefit. ___ Students who struggle with kinesthetic/hands-on activities. These tools will benefit them. ___ Students who struggle with planning work, writing papers, or thinking about ideas in a visual way Most students would benefit from these tools. ___ Students who struggle with either the physical attribute of writing or need help in picking the right words that will come next in a sentence.

Appendix D. Demographic and attitudinal survey

Demographic Survey

Participant # _____

Gender: ❒ Female ❒ Male

Age:

❒ 18-20 years old	❒ 31-35 years old	❒ 46-50 years old
❒ 21-25 years old	❒ 36-40 years old	❒ 51-60 years old
❒ 26-30 years old	❒ 41-45 years old	❒ 61+ years old

Classification:
❒ Graduate ❒ Undergraduate ❒ Doctoral Student ❒ Other _____

Major: ❒ Education ❒ Other _____

Prior Assistive Technology/Learning Disabilities Experience:

Prior experience in assistive technology:
❒ None ❒ Basic ❒ Intermediate ❒ Advanced

Have you ever taken a college course on assistive technology?
❒ Yes ❒ No
If you answered "yes", what was the name or number for the class?

Prior knowledge about learning disabilities:
❒ None ❒ Basic ❒ Intermediate ❒ Advanced

Have you ever taken a college course on learning disabilities?
❒ Yes ❒ No
If you answered "yes", what was the name or number for the class?

Have you ever been diagnosed with a learning disability?
❒ Yes ❒ No
If you answered "yes", what were you diagnosed with?

Have any of your immediate family members been diagnosed with a learning disability?
❒ Yes ❒ No
If you answered "yes", what is your relation to that person and what was that person diagnosed with?

Attitudinal Survey

Please complete this survey after completing the module and post-test. By participating in this survey, you will help us to determine if the instruction was effective.

Please use the 4-point scale to indicate your agreement or disagreement with each statement. Record all responses by circling the corresponding number.		Strongly Disagree	Disagree	Agree	Strongly Agree
1	The instructions were clear.	**1**	**2**	**3**	**4**
2	I had technical problems when using the module.	**1**	**2**	**3**	**4**
3	The module was easy to navigate.	**1**	**2**	**3**	**4**
4	The module was helpful.	**1**	**2**	**3**	**4**
5	The module was user-friendly.	**1**	**2**	**3**	**4**
6	The module provided enough practice.	**1**	**2**	**3**	**4**
7	The module was motivating.	**1**	**2**	**3**	**4**
8	The module covered materials that were personally beneficial to me.	**1**	**2**	**3**	**4**
9	The module allowed me to attain information and skills unknown to me before.	**1**	**2**	**3**	**4**
10	The video examples were helpful.	**1**	**2**	**3**	**4**
11	The test questions were clear and understandable.	**1**	**2**	**3**	**4**
12	The use of a computer-based tutorial was helpful.	**1**	**2**	**3**	**4**
13	I learned something about assistive technology.	**1**	**2**	**3**	**4**
14	I learned something about learning disabilities.	**1**	**2**	**3**	**4**
15	I have a better understanding about matching technology to learning strengths and weaknesses.	**1**	**2**	**3**	**4**

Additional comments and/or suggestions for improvement on the module:

Appendix E. Human consent form

Agreement to Participate in
Assistive Technology Study

Michael Travis
Primary Investigator
342-6635

This research project is being conducted as a component for a master's degree. The purpose of the project is to test an instructional module to determine its effectiveness at increasing the awareness and understanding of assistive technology among future educators. You are being asked to participate, because you are currently in a class that leads to an educational degree.

Participation in the project will consist of taking an online interactive module on assistive technology and a survey on the module and some background information about you. Module questions will focus on teaching you about the difference between remedial and compensatory assistive technology and examples of tools that are available to help students. No personal identifying information will be included with the research results. Completion of the form containing background data should take no more than 5 minutes. The module will last no longer than 75 minutes. Approximately 40 people will take the module.

The investigator believes there is little or no risk to participating in this research project. Participating in this research may be of no direct benefit to you. It is believed, however, that you will learn more information about what assistive technology is and what types of student learning styles, strengths and weaknesses might match certain technology tools.

Research data will be confidential to the extent allowed by law. Agencies with research oversight, such as the UH Committee on Human Studies, have the authority to review research data. All research records will be stored in a locked file in the primary investigators office for the duration of the research project. All other research records will be destroyed upon completion of the project.

Participation in this research project is completely voluntary. You are free to withdraw from participation at any time during the duration of the project with no penalty, or loss of benefit to which you would otherwise be entitled.

If you have any questions regarding this research project, please contact the investigator, Michael Travis, at 342-6635.

If you have any questions regarding your rights as a research participant, please contact the UH Committee on Human Studies at (808) 956-5007.

Participant:
I have read and understand the above information, and agree to participate in this research project.

_____
Name (printed)

_____ _____
Signature Date

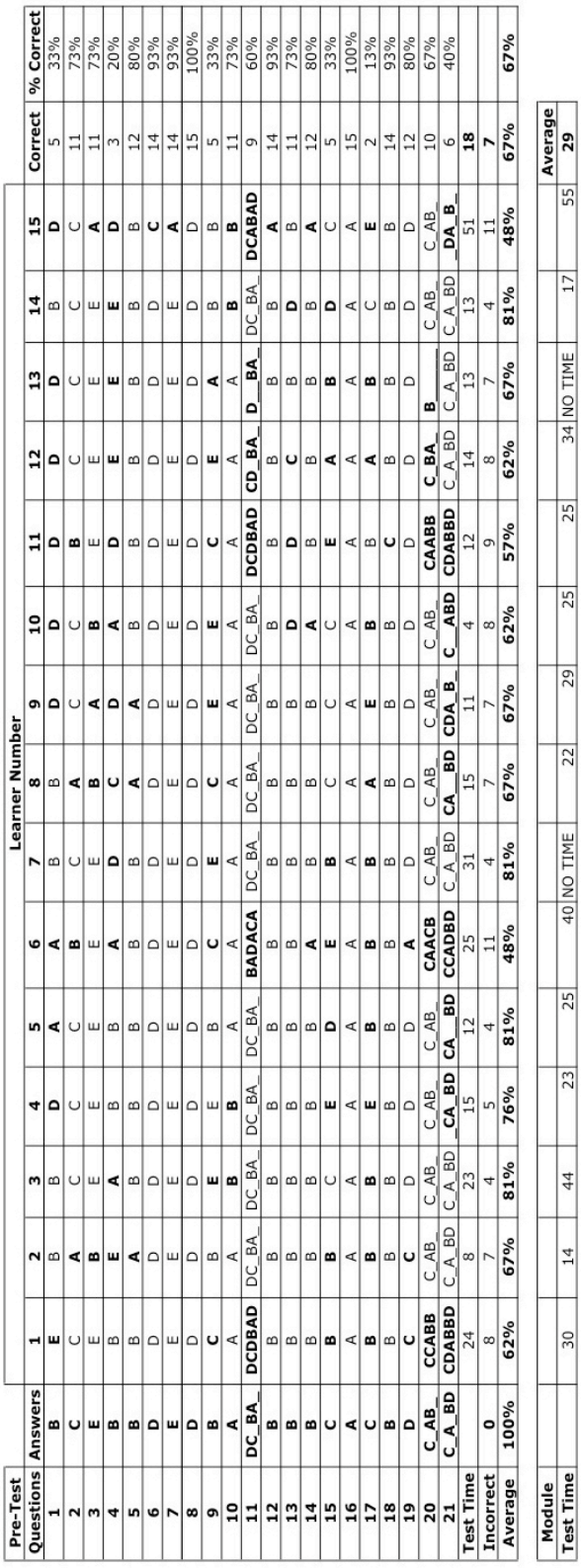
Appendix F: One-on-One results

Pre-Test		Reviewer		
Questions	**Answers**	**1**	**2**	**3**
1	B	B	B	**D**
2	C	C	C	C
3	E	E	E	**C**
4	B	B	B	**D**
5	B	B	B	B
6	D	D	D	D
7	E	E	E	E
8	D	D	D	D
9	B	B	**E**	**C**
10	A	A	A	A
11	DC_BA_	DC_BA_	**DCDBAD**	**CDCBAD**
12	B	B	B	B
13	B	B	B	**A**
14	B	B	B	B
15	C	C	C	**D**
16	A	A	A	A
17	C	C	**B**	**B**
18	B	B	B	**D**
19	D	D	D	D
20	C_AB_	C_AB_	**CAABB**	**CAABB**
21	C_A_BD	C_A_BD	**C_ADDBD**	**CAAABD**
Time		**12 min**	**17 min**	**11 min**
Incorrect		**0**	**5**	**10**
Correct		**100%**	**76%**	**52%**

Post-Test		Reviewer		
Questions	**Answers**	**1**	**2**	**3**
1	B	B	**A**	B
2	E	E	E	E
3	D	D	D	D
4	D	D	D	D
5	A	A	A	**B**
6	B	B	B	B
7	C	C	C	C
8	C	C	C	C
9	B	B	**A**	B
10	A	A	A	A
11	CDB__A	CDB__A	CDB__A	CBD__A
12	A	A	A	A
13	B	B	B	B
14	A	A	A	A
15	D	D	**B**	D
16	D	D	D	D
17	E	E	E	E
18	B	B	B	B
19	E	E	E	E
20	__CAB	__CAB	**__CBA**	__CAB
21	C_A_BD	C_A_BD	C_A_BD	**CAA_BD**
Time		**10 min**	**11 min**	**14 min**
Incorrect		**0**	**4**	**2**
Correct		**100%**	**81%**	**90%**

Module				
Time		**38 min**	**43 min**	**45 min**

Appendix G: Small group data results



Pre-Test Questions	Answers	Learner Number																				Correct	% Correct
1	B	E	B	B	D	A	A	B	B	D	D	D	D	D	D	D	B	D	5	33%			
2	C	C	A	C	C	C	B	C	A	C	C	B	C	C	C	C	C	A	11	73%			
3	E	E	B	E	E	E	E	E	B	A	B	E	E	E	E	E	E	A	11	73%			
4	B	B	E	A	B	B	A	D	C	D	A	D	B	B	E	B	B	D	3	20%			
5	B	B	A	B	B	B	B	B	A	A	B	B	B	B	B	E	B	C	12	80%			
6	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	C	14	93%			
7	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	14	93%			
8	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	15	100%			
9	B	C	B	E	E	B	C	E	C	E	E	C	E	A	B	B	B	B	5	33%			
10	A	A	A	B	B	A	A	A	A	A	A	A	A	A	A	B	B	B	11	73%			
11	DC_BA_	DCDBAD	DC_BA_	DC_BA_	DC_BA_	DC_BA_	BADACA	DC_BA_	DC_BA_	DC_BA_	DC_BA_	DCDBAD	CD_BA_	D__BA_	DC_BA_	DCABAD	9	60%					
12	B		B	B	B	B	B	B	B	B	B	B	B	B	B	A	14	93%					
13	B	B	B	B	B	B	B	B	B	B	D	D	C	B	D	B	11	73%					
14	B	B	B	B	B	B	A	B	B	B	A	B	B	B	B	A	12	80%					
15	C	B	B	C	E	D	E	B	C	C	C	E	A	B	D	C	5	33%					
16	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	15	100%					
17	C	B	B	B	E	B	B	B	A	E	B	C	B	B	C	E	2	13%					
18	B	B	B	B	B	B	B	B	B	B	B	C	B	B	B	B	14	93%					
19	D	C	C	D	D	D	A	D	D	D	D	D	D	D	D	D	12	80%					
20	C_AB_	CCABB	C_AB_	C_AB_	C_AB_	C_AB_	CAACB	C_AB_	C_AB_	C_AB_	C_AB_	CAABB	C_BA_	B_____	C_AB_	C_AB_	10	67%					
21	C_A_BD	CDABBD	C_A_BD	C_A_BD	_CA_BD	CA__BD	CCADBD	C_A_BD	CA__BD	CDA_B_	C__ABD	CDABBD	C_A_BD	C_A_BD	C_A_BD	_DA_B_	6	40%					
Test Time		24	8	23	15	12	25	31	15	11	4	12	14	13	13	51	18						
Incorrect	0	8	7	4	5	4	11	4	7	7	8	9	8	7	4	11	7						
Average	100%	62%	67%	81%	76%	81%	48%	81%	67%	67%	62%	57%	62%	67%	81%	48%	67%	67%					

Module																		Average
Test Time		30		14		44		23		25		40	NO TIME		22		29		25		25		34	NO TIME		17		55	29

Post-Test		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Correct	% Correct
Questions	Answers																	
1	B	B	B	A	B	B	B	B	B	C	B	B	B	B	B	B	13	87%
2	E	E	E	E	E	E	E	E	E	E	B	E	E	E	E	E	14	93%
3	D	D	D	B	D	D	D	D	D	D	B	D	D	D	D	D	13	87%
4	D	D	D	D	C	D	A	A	C	D	C	C	D	D	D	A	8	53%
5	A	A	A	A	B	A	A	A	A	A	A	B	A	A	B	B	11	73%
6	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	15	100%
7	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	15	100%
8	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	15	100%
9	B	B	B	A	B	B	B	B	B	A	B	D	B	B	B	B	12	80%
10	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	14	93%
11	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	DDBCDA	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	CDB__A	14	93%
12	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	15	100%
13	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	15	100%
14	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	15	100%
15	D	D	D	D	A	D	E	B	C	D	B	E	B	B	D	D	7	47%
16	D	D	D	D	D	D	D	D	A	D	D	B	D	D	D	D	13	87%
17	E	E	E	E	E	E	E	E	A	A	E	E	E	E	E	E	13	87%
18	B	B	B	B	B	B	C	B	B	B	B	B	B	C	B	B	13	87%
19	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	14	93%
20	__CAB	__CAB	__CAB	__CAB	__CAB	__CAB	CBCAB	__CAB	__CAB	__CAB	__CAB	__CAB	__CBA	__CAB	__CA_	__CAB	12	80%
21	C_A_BD	C_A_BD	C_A__BD	C_A_BD	C_A_BD	C_A_BD	CACBDD	_CA_BD	CA__BD	C_ADB_	C_A_BD	C_A_BD	C_A_BD	C_A_BA	C_A_BD	C_A_BD	10	67%
Test Time		14	10	13	10	6	NO TIME	10	14	6	5	NO TIME	10	NO TIME	7	15	10	
Incorrect	0	0	0	3	3	0	6	3	5	5	4	5	3	2	2	2	3	
Average	100%	100%	100%	86%	86%	100%	71%	86%	76%	76%	81%	76%	86%	90%	90%	90%	86%	86%

Appendix H: Small group survey results

Key: 1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree

1. The instructions were clear.
2. I had technical problems when using the module.
3. The module was easy to navigate.
4. The module was helpful.
5. The module was user-friendly.
6. The module provided enough practice.
7. The module was motivating.
8. The module covered materials that were personally beneficial to me.
9. The module allowed me to attain information and skills unknown to me before.
10. The video examples were helpful.
11. The test questions were clear and understandable.
12. The use of a computer-based tutorial was helpful.
13. I learned something about assistive technology.
14. I learned something about learning disabilities.
15. I have a better understanding about matching technology to learning strengths and weaknesses.

	Question Number															
Learner	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Avg.**
1	4	1	3	4	3	4	3	3	3	3	3	4	3	3	3	**3.1**
2	4	1	4	4	4	4	3	3	4	4	4	4	4	4	4	**3.7**
3	2	3	2	3	2		2	2	3	3	3	2	3	3	3	**2.6**
4																
5	3	2	2	4	2	3	3	3	3	4	3	3	3	3	3	**2.9**
6	3	3	2	3	2	3	3	3	3	4	3	3	3	3	3	**2.9**
7	3	2	3	3	2	3	3	2	3	3	2	3	2	2	2	**2.5**
8	3	2	3	3	3	3	2	3	3	4	3	3	3	2	2	**2.8**
9	4	3	3	3	3	4	3	3	4	3	3.5	4	4	4	4	**3.5**
10	3	3	2	2	3	2	1	2	3	1	3	2	3	2	2	**2.3**
11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	**3.0**
12	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	**2.9**
13	3	3	3	4	3	3	3	3	4	3	3	3	4	3	3	**3.2**
14																
15	3	3	3	4	4	3	3	3	4	3	3	4	4	4	4	**3.5**
AVERAGE	**3.2**	**2.3**	**2.8**	**3.3**	**2.8**	**3.2**	**2.7**	**2.8**	**3.3**	**3.2**	**3.0**	**3.2**	**3.2**	**3.0**	**3.0**	**3.0**

Appendix I: Small group responses

Learner 1:
The module itself was great, but the questionnaires were difficult to fill out on a computer. I liked the use of Flash. It made the module easy to navigate. The layout was good, without too much info on any one page. The information was very useful and will help me right away.

Learner 2:
No comments

Learner 3:
Many of my problems were due to viewing it in the wrong resolution. The quizzes were mostly useless because I could not view most of the answers on the bottom as I rolled over the answer in the question. Also, I couldn't view the entire screen at once. Could you provide instruction on the first page on how to get the screen resolution? And you should strongly advise the people do this because it is very frustrating otherwise!
Didn't know what "rollover" meant. Your Es turned to Ds when selected.
A comma have and then would clarify your text.
Too much text on one screen. More graphics/white space needed.
Multi-sensual? - sensory?

Learner 4:
Your website did not do the "rollover" correctly. The only item that changed when you rolled over it was E appeared to be D in all instances. I still do not know what you meant by rollover sine it did not work. I tried this in 3 places: Sinclair library computer lab (and I had them install the free download you described), CRC lab and my house (also have the free download from your site). So I did not have any corrected answers shown expect for the few instances where you had a reveal answers button on the matching.

Learner 5:
Addition of navigation bar with Topic name would help to get directly to a page, rather than having to go back page-by-page.
The yellow area to display answers is inconvenient and hard-to-use on my laptop. I have to scroll down and cannot see the question at the same time.
Also, all of your rollovers for E show D in blue, a bit confusing.

Learner 6:
No comments

Learner 7:
Overall, it's a nicely done module. It would be helpful to have separate video for each assistive device. Multiple examples of different types and uses would be more helpful. The written examples were good – more visuals would be helpful.

A cleaner start – module re: assistive tech for Ss. (students) with learning disabilities would make this more focused. Assistive Tech. for use in writing tasks. Though this would be good for all Ss.
Why weren't remedial approaches covered? Why only compensatory? More info would be helpful to support your going with one over the other.
The look of the module is great. Quizzes right in there after each section were good.
Making info fit on one page (w/o scrolling) would make it better.
Objective of what Ss. will learn as a result of going through the module would also be helpful. What is the purpose for learning this info? Basic knowledge or for use when teaching Ss? A resource for Ts (teachers) (Education Majors)
There could be more info relative to learning styles and the tools. It's mentioned on home page. Learning styles – visual, auditory, kinesthetic, logical, etc.

Learner 8:
No comments

Learner 9:
I thought the module was very easy to understand; however, it did lack in excitement for me. I would have enjoyed seeing more examples through pictures or videos. (Something to break up all of the reading.) Overall – Good Job! Thanks for sharing it with me. I learned some valuable insight that I'm sure I can use later in my educational career. Good Luck to you!

Learner 10:
I had a hard time figuring out the matching. It would have been nice to see my answers for all the quizzes. Only the last two matching had my answer and correct answer, which was beneficial to me. I thought this module could have used more examples or explanation because I still wasn't clear about some of the terms.

Learner 11:
I couldn't see the rollover answers unless I zoomed my screen, which make test really small.

Learner 12:
There should be two versions for videos, "Dial up" and "Broadband".

Learner 13:
Hi Mike,
Thank you for allowing us to look at your module. I just have a few suggestions:

1. There is a lot of text on every page. Is there anyway you can break up the information? It's just like having to open a book and read. All text should be in serif font for ease of reading.
2. For the first quiz time, I didn't know I had to scroll down to see the answer at the bottom of the page, so I floundered for a few moment. Would be nice to say this in the instructions, "scroll down to see the answer at the bottom of the page".

3. One the first screen the mini movie was too fast. Would like it to run slower. Also the organizational tools were too small to see.
4. On the speech to text page, the last sentence should be grouped with other benefits.
5. Quiz question #17 was not clear.

Thank you for soliciting our feedback. I hope it helps your project. Aloha!

Learner 14:
The flash tutorial is easy to navigate and knowledge is useful to learn. But the interface is too text-dense. My eyes felt tired and my attention was easy to drift away while reading small letters on the screen. If you could turn that into a slide show, that would be more attractive, or simply add the audio of the text content as an option for audio learners.

Learner 15:
No comments.

Appendix J: University approval for research involving human subjects

UNIVERSITY OF HAWAI'I

Committee on Human Studies

MEMORANDUM

July 7, 2006

TO: Michael Travis
Principal Investigator
Educational Technology Department

FROM: William H. Dendle
Executive Secretary

SUBJECT: CHS #14558- "What is Assistive Technology? An Instructional Module for Future Educators"

Your project identified above was reviewed and has been determined to be exempt from Department of Health and Human Services (DHHS) regulations, 45 CFR Part 46. Specifically, the authority for this exemption is section 46.101(b)(2). Your certificate of exemption (Optional Form 310) is enclosed. This certificate is your record of CHS review of this study and will be effective as of the date shown on the certificate.

An exempt status signifies that you will not be required to submit renewal applications for full Committee review as long as that portion of your project involving human subjects remains unchanged. If, during the course of your project, you intend to make changes which may significantly affect the human subjects involved, you should contact this office for guidance prior to implementing these changes.

Any unanticipated problems related to your use of human subjects in this project must be promptly reported to the CHS through this office. This is required so that the CHS can institute or update protective measures for human subjects as may be necessary. In addition, under the University's Assurance with the U.S. Department of Health and Human Services, the University must report certain situations to the federal government. Examples of these reportable situations include deaths, injuries, adverse reactions or unforeseen risks to human subjects. These reports must be made regardless of the source funding or exempt status of your project.

University policy requires you to maintain as an essential part of your project records, any documents pertaining to the use of humans as subjects in your research. This includes any information or materials conveyed to, and received from, the subjects, as well as any executed consent forms, data and analysis results. These records must be maintained for at least three years after project completion or termination. If this is a funded project, you should be aware that these records are subject to inspection and review by authorized representatives of the University, State and Federal governments.

Please notify this office when your project is completed. We may ask that you provide information regarding your experiences with human subjects and with the CHS review process. Upon notification, we will close our files pertaining to your project. Any subsequent reactivation of the project will require a new CHS application.

Please do not hesitate to contact me if you have any questions or require assistance. I will be happy to assist you in any way I can.

Thank you for your cooperation and efforts throughout this review process. I wish you success in this endeavor.

Enclosure

2540 Maile Way, Spalding 252, Honolulu, Hawai'i 96822-2303
Telephone: (808) 539-3955/(808) 956-5007, Facsimile: (808) 539-3954, Web site: www.hawaii.edu/irb

OMB No. 0990-0263

Protection of Human Subjects
Assurance Identification/IRB Certification/Declaration of Exemption
(Common Rule)

Policy: Research activities involving human subjects may not be conducted or supported by the Departments and Agencies adopting the Common Rule (56FR28003, June 18, 1991) unless the activities are exempt from or approved in accordance with the Common Rule. See section 101(b) of the Common Rule for exemptions. Institutions submitting applications or proposals for support must submit certification of appropriate Institutional Review Board (IRB) review and approval to the Department or Agency in accordance with the Common Rule.

Institutions must have an assurance of compliance that applies to the research to be conducted and should submit certification of IRB review and approval with each application or proposal unless otherwise advised by the Department or Agency.

1. Request Type	2. Type of Mechanism	3. Name of Federal Department or Agency and, if known, Application or Proposal Identification No.
[ ] ORIGINAL [ ] CONTINUATION [X] EXEMPTION	[ ] GRANT [ ] CONTRACT [ ] FELLOWSHIP [ ] COOPERATIVE AGREEMENT [ ] OTHER:_____	
4. Title of Application or Activity "What is Assistive Technology? An Instructional Module for Future Educators"		5. Name of Principal Investigator, Program Director, Fellow, or Other Michael Travis

6. Assurance Status of this Project *(Respond to one of the following)*

[X] This Assurance, on file with Department of Health and Human Services, covers this activity:
Assurance Identification No. F-3526 , the expiration date September 23, 2008 IRB Registration No. IORG0000169

[ ] This Assurance, on file with *(agency/dept)*_____, covers this activity.
Assurance No._____, the expiration date_____ IRB Registration/Identification No._____*(if applicable)*

[ ] No assurance has been filed for this institution. This institution declares that it will provide an Assurance and Certification of IRB review and approval upon request.

[X] Exemption Status: Human subjects are involved, but this activity qualifies for exemption under Section 101(b), paragraph 2 .

7. Certification of IRB Review (Respond to one of the following IF you have an Assurance on file)

[ ] This activity has been reviewed and approved by the IRB in accordance with the Common Rule and any other governing regulations.
by: [ ] Full IRB Review on (date of IRB meeting) _____ or [ ] Expedited Review on (date)
[ ] If less than one year approval, provide expiration date _____

[ ] This activity contains multiple projects, some of which have not been reviewed. The IRB has granted approval on condition that all projects covered by the Common Rule will be reviewed and approved before they are initiated and that appropriate further certification will be submitted.

8. Comments

CHS #14558

9. The official signing below certifies that the information provided above is correct and that, as required, future reviews will be performed until study closure and certification will be provided.	10. Name and Address of Institution
11. Phone No. *(with area code)* (808) 956-5007 12. Fax No. *(with area code)* (808) 539-3954 13. Email: dendle@hawaii.edu	University of Hawaii at Manoa 2444 Dole Street, Bachman Hall Honolulu, HI 96822
14. Name of Official William H. Dendle	15. Title Compliance Officer
16. Signature	17. Date July 7, 2006

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