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Assistive Technology:  
A Tool for Enhancing Classroom Instruction for  
Students with Learning Disabilities

A Literature Review

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SPED 644

December 1, 2008

Xavier, a fifth grader tried repeatedly to read the third grade reader, but he could not and put the reader down in frustration. Bobby looked at the numbers that the teacher wrote on the board, but cringed because he knew that he could not calculate the problem. Timothy a new student, left his class for the washroom, but was unable to return to his class because he did not know which classroom was his; he could not read the names on the door. Sharon's mom could not take her to school that day, so she allowed her to go by herself because it was just half a block away. She was late for school because she had struggled to read the street signs on her way to school. All these children have one thing in common; they are all students with a learning disability. Assistive Technology (AT) can help these children achieve these tasks and also help them perform better academically, socially and even physically (Lee, 2006). AT can help not only the students but also their teachers, by making adaptations to teaching strategies in each of their respective grades.

Every child is special; they are each unique and exceptional in their own way. Education helps bring an awareness of these special unique attributes to the surface, and the classroom is the ideal location where these attributes can be nurtured and developed. In those settings, the teacher is the one who facilitates this process, by giving the students the opportunity to grow academically and socially growth. In so doing, teachers add a whole new realm of experiences to students' lives which can accomplished with the aid of assistive technology, where students' lives can be enhanced tremendously. Using AT is a strategy that is not only geared towards students with learning disabilities but it can also be used to help all students, in all subject areas, and at any age level.

The purpose of this paper is to show the uses of AT as an educational tool, and to highlight a few devices that can be used in the areas of Reading, Writing, and Math for students with learning disabilities. Through the use of low-tech and high-tech devices, AT will be able to help students become better readers, writers, and mathematicians. In the area of Reading, the use of

AT will help students improve upon and build on their spelling abilities, and also better students' decoding, listening, and oral skills. In the area of Writing, the use of AT will enable students to write neatly and legibly, to form letters correctly, and to write sentences that are grammatically correct. In the area of Math, the use of AT will enable students to be able to make proper calculations and computations.

### **What is Assistive Technology?**

According to the Assistive Technology Act of 1998 (Assistive Technology [AT] Act, 1998), “assistive technology means any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (p. 6). The law goes on to say that, “an assistive technology service is any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device” (p. 6). These devices, equipment or systems can be very cost effective to schools and the end result will be very beneficial. They range from “low-tech, low-cost items to high tech, more expensive devices. Low-tech devices require little or no training; high-tech devices may require extensive training” (Lee, 2006, p.1). Assistive technology can be a fundamental tool in special education because many students with disabilities require instruction that can be tailored towards their needs, and AT can afford them that type of instruction.

There are a wide variety of assistive technology software and devices that are available to suit the needs of students with disabilities (Duhaney & Duhaney, 2000). Using technology to assist students with disabilities has been an intervention that has been in existence long before Public Law 94-142 was passed in 1975. Technology then was mostly used to assist students with severe physical disabilities. The use of assistive technology was made mandatory by Elementary and Secondary Education for the Act Amendment of 1967, (P.L. 90-247) which was later renamed The Education of the Handicapped Act (EHA) in 1970 (Major Disability-Related

Legislation 1956-1999). At present the Act has now been renamed The Individuals with Disabilities Education Act (IDEA) and was the one that gave school districts a general description of their responsibility in providing support services in the area of AT to students with disabilities. “The reauthorization of IDEA in 1997 dramatically changed this situation by clearly defining assistive technology and requiring consideration of the assistive technology needs of every student receiving special education services” (Dell, Newton, & Petroff, 2008, p. 9).

When IDEA was reauthorized in 1997, it mandated that AT be included in the students’ Individual Education Plan [IEP] (School of Public Health, 2005). Through the enactment of No Child Left Behind (NCLB) 2001, technology funds was made available to schools on a needs basis by the federal government to improve academic achievement with students with learning disabilities. NCLB encouraged the use of technology by stating the following: “the Administration believes schools should use technology as a tool to improve academic achievement, and that using the latest technology in the classroom should not be an end unto itself” (Bush, 2002, p. 22). As part of the law, NCLB mandates of teachers that any instructional methods used must be based on sound scientific research.

### **Assistive Technology as an Educational Tool**

According to Loeding (2002), AT can be an educational tool that can be of great importance to students with LD in four ways: (1) by making it possible for them to correct or build on deficient skills that will make them more self-sufficient; (2) to make their learning experiences more effective, and enjoyable whereby a greater volume of learning will take place; (3) to allow for self-monitoring, and self-evaluation; (4) to allow for self-instruction.

With society moving towards the technological age, it is necessary for schools to use documented research that would reflect such a change. Teachers now have to deliver instruction to students with diverse learning needs who bring with them a variety of learning styles, languages, cultures, abilities and disabilities. Teachers have to gear their instruction to suit those

learners needs and in so doing implement programs consistent with universal design for learning (UDL). According to the Council for Exceptional Children [CEC] (2005), “the teacher creates varied and inclusive learning situations that use digital and assistive technologies” (p. xi).

Numerous studies have shown that assistive technology as an educational tool has had a profound impact on the learning of students with learning disabilities (Bryant, Erin, Lock, Allan, & Resta, 1998; Dell et. al, 2008; Duhaney & Duhaney, 2000; Forgrave, 2002; Hasselbring & Glaser, 2000; Johnston & Ryan, 2005; Lundberg, 1995; Lee, 2006; Sivin-Kachala & Bialo, 1994c). Some of the studies also revealed that the manner in which teachers use and make adaptations to the technology is what makes the difference in the students’ learning. According to Polloway, Patton, and Serna (2008), AT is a supportive instructional tool that would enhance the learning of students with LD in academic, social, functional and community living skills. Under IDEA, schools’ special education programs must provide assessments and services that can be adapted to suit the needs of all students as a result of free and appropriate education which allows for compensation of their disability, and also empowers them to become more independent (Polloway et. al., 2008). IDEA does not have an approved list of AT services and devices, but the devices and services must meet the criteria stipulated under IDEA (Dell et al., 2008).

### **AT as a Support for Reading in the Classroom**

Reading and writing are core areas that need to be addressed when teaching students with LD. These areas are the foundation of these students’ academic learning disabilities and, if attended to efficiently, students will be able to achieve some measure of success. AT enables students to compensate in areas where they lack the necessary skills for learning. It can help improve on certain skill deficiencies. Some students may not be able to function academically without the use of AT whereas there are other students who just need AT as a support (CEC, 2005). AT can be effective for students with LD; it does not remove or eradicate the disability,

but it can assist children in reading and help them achieve success. “A student who struggles with reading but who has good listening skills might benefit from listening to books on tape” (Raskind, 2006, p. 1).

There are some common every day low-tech devices such as color highlighters that are inexpensive that will allow students to identify troublesome words that may look similar like found and fond. When students use such a device it will enable them to differentiate between the words (Raskind, 2006). The following are other ways in which AT can help students with LD with reading:

- A student who has difficulty reading can look at a series of pictures in sequence from a view finder/computer, and be able to write a story based on what the pictures portray. If the student can not write the story then he/she will be able to produce the story orally.
- A student can learn to read the sounds of the letters in the alphabet by listening to a listening device.
- A student with dyslexia with the help of AT can read aloud in the classroom.
- A student can attempt more challenging reading materials with assistance from an AT device that will be able facilitate him/her.
- A student who may have difficulty reading on a flat surface may use a slant board.
- A student who has difficulty with reading comprehension can get the reading material tape recorded. It can also be presented using graphic organizers/story mapping (Raskind, 2006).

There are various other ways in which teachers can use AT to assist students with reading. Reading using the “talking” computer can help students with LD master decoding skills. The

device also helped readers with dyslexia read above their reading ability (Lundberg, 1995). Electronic books is another device that can improve the reading of students with LD. Through the use of E-books, students with LD are better able to read and interact with their reading text (Rhodes & Milby, 2007). There are other available tools that can help teachers such as audio books, graphic organizers and outlining, audio cassette players/listening devices, word prediction programs, proofreading programs, portable word processors, and the list is too numerous to mention all (Dell, Newton & Petroff, 2008). Writing is another area where AT can be very beneficial to students with learning disabilities.

### **AT as a Support for Writing in the Classroom**

According to Forgrave (2002), “students with learning disabilities often have difficulties with writing” (p. 2). According to Harris, Graham and Mason, (2003), writing is one of the basic skills that creates problems for all students irrespective of abilities. It is a demanding task that requires students to make use of their motor skills and cognitive processes. As cited in Harris et al., (2003), Scardamalia and Bereiter (1986) also agreed with Forgrave when they “identified five areas of writing competence that are particularly difficult for the general school population” (p.1). This statement brings to the forefront the surmountable task that students with LD face by having to cope with the stress of writing along with their disabilities.

Writing is a communication tool that puts ideas, information, knowledge and feelings into a written format that is readable by others. Each learner brings his or her own experience, and knowledge to the educational learning environment but it is up to the teacher to use the students’ skills and abilities to develop good writers. This is extremely difficult for students with learning disabilities because they come to the educational learning environment deficient in skills and abilities that are below those of their peers. As a result, this makes writing more challenging for them and their teachers. This means that teachers have to find innovative ways of getting students with LD to write, and be motivated to write. One fundamental way in which this can be

achieved and help students overcome some of these deficiencies is the proper use of AT. As a result, AT must be included as part of the instructional strategies.

Studies have shown that the use of AT in writing can be very beneficial to students with learning disabilities (Lee, 2006; Loeding, 2002; Polloway et. al., 2008; Zhao, Englert, Chen, Jones, & Ferdig, 1999). Just like with reading, there are quite a number of devices that can help students with LD. The word processor is an AT device that is very effective in assisting students with writing. Students using such a device can achieve a greater success output than students of the same ability who do not use the device (Sivin-Kachala & Bialo, 1994a,). Not all AT devices have to be bought commercially. There are quite a few devices that teachers can produce on their own without spending any finances such as using an empty gallon bleach bottle which can be used as a white board when cut into a rectangular shape. There are other low-tech, inexpensive devices that can be adapted to suit students' needs such as a pencil which can be adapted for proper gripping with the help of a low-tech device. This can be done by "building up the shaft of a pencil to improve a student's control" (Dell et al., 2008, p.5). This would enable students to feel more comfortable holding the pencil when expressing any kind of thoughts (Loeding, 2002).

Literacy (i.e., the ability to read and write) can be promoted through the use of technology (Loeding, 2002). Writing is a powerful tool and once a student has grasp the conventions of it especially when interacting with technology, the reward of expressing oneself in print can be quite motivating. This statement is further illustrated in a report that was concerned with the use of technology for the promotion of literacy. The report found that the writing status of children with mild disabilities rose to the point where they produced more creative and longer pieces of writing after using a Web-based literacy learning environment called TELE-Web (Zhao et al., 1999). Sivin-Kachala & Bialo (1994a) also supported the use of word processors.

Word processing and other computer software are very good tools that can assist students with LD put their ideas down on paper without having to worry about spelling or grammar. These software programs come with spelling/grammar checkers that are easy for students to manipulate or they can be assisted by their teacher if the need arises. These software programs also help with the editing process of writing. According to Hasselbring & Glaser (2000), “Researchers have found that students are more willing to edit their work and to make necessary corrections on a word processor than on handwritten drafts” (p.5). This device is especially helpful to students who have problems with their fine motor skills, and those who are constantly rewriting in an effort to give their readers a clearer perspective (Hasselbring & Glaser, 2000). Where typing may be difficult for students, there are devices called voice recognition software or speech synthesizers that can be used to enable students to talk into a computer while their work is being transcribed. It does not only support reading and writing but it can also be used for Math.

### **AT as a Support for Math in the Classroom**

Mathematics is a subject that requires logic and thinking skills, and poses considerable problems for all students. Most students with LD lack those skills and as a result are unable to make sense of information given to perform proper calculations (Johnston & Ryan, 2005). With the use of AT, students with LD can be motivated to function as well as their peers in a Mathematics environment. According to Sivin-Kachala and Bialo (1994b), “three recent studies suggest that technology can have a positive impact on students’ attitude toward mathematics” (p.20). The demand for technology is increasing rapidly and mathematical skills is a strong requirement of high tech technology. This demand is not only in the world of work but also in everyday life.

Students with LD need to be involved with math in interactive ways, and be able to build positive attitudes toward it which can be done with the use of AT. There are a number of low-

tech and high-tech devices that students can use that would make math interactive and motivating. There are students who have difficulties placing numbers correctly in each column when adding vertically, and they can be assisted with the use of color coded graph paper. This is a low-tech device that allows the students to put the answer in the correct column. Highlight markers are another such device that enables students to write numbers on the line. A hand-held calculator is a device that can also assist students in writing numbers correctly. Many students with LD have reading difficulties and this interfere with their ability to solve word problems. AT enables students with LD to interact with and access the curriculum in settings that would not have been possible or plausible (Morrison, 2007). There are computer-assisted devices that can help students with the identification of math symbols especially if they have difficulties with visual perception. These devices also help students differentiate between symbols that may look similar like addition and multiplication signs. AT can help students in all aspects of the math curriculum; basic computation, fractions, algebra, geometry, calculus and across the spectrum from pre-school to university level, and this can be achieved with the full support of teachers.

### **Discussion**

If teachers plan carefully and use AT devices to enhance instruction throughout the school curriculum, math, reading and writing will not be the only subjects that students with LD will benefit. Teachers need also to explore other avenues in their instructional curriculum where they can enhance learning through the use of AT. According to Rhodes and Milby (2007), “The National Association for the Education of Young Children (NAEYC) has stated that technology should be employed as an active part of the learning process” (p.255). This statement is also supported by Lee (2006) who stated, “assistive technology is an important piece of the whole support system individuals with learning disabilities require to achieve success” (p.1). Technology is the vehicle that drives the twenty-first century and teachers need to make use of it in their teaching and instruction in order to meet the diverse needs of all the students that they

teach.

There are a number of AT devices that are available that can help teachers meet those students needs. According to Hasselbring and Glaser (2000), “teachers have found that technological innovations can help level the playing field for special needs students and enable these students to succeed in the regular classroom” (p.104). Research has shown that technology has had, and is having a significant impact on students’ learning in the areas of reading, writing and math, and which should not be restricted to those three. As stated by Johnston and Ryan (2005), “for most people technology makes things easier. For persons with disabilities, technology makes things possible” (p.6).

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