A Literature Review:

An Investigation of Various Types of Assistive Technology (AT)

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Abstract: The purpose of this paper is to analyze assistive technology literature for students with disabilities. The literature search rendered N=57 literature and n=17 manuscripts were identified in the special education technology field studies. Each source was evaluated according to the following criteria: types of disability, learning objectives and tasks, types of assistive devices available, application, and competency in matching the assistive technology with a specific disability. Results show (1) research in this field tends to be limited to faculty development and need assessment focus, (2) technological interventions appeared scattered, vague, incomprehensive and non-specific, and (3) pre-service teachers' comfort level of assistive technology in an inclusive classroom remain low. An updated list of various type of AT suggesting teachers to match each technological tool to a specific disability is summarized in Table 1 and it is also included in this study.

Introduction

Assistive technology is defined as any device or items that can be used to increase, maintain or improve the capabilities of individuals with disabilities (IDEA, 1990). Assistive technology can play an important role in special education because many students with disabilities need special instructional treatment. A number of assistive technology devices and software are available that, with careful planning and guidance, can benefit students with disabilities (Duhaney & Duhaney, 2000). Technological intervention within special education has a long history. It began with the funding of assistive technology in 1967 by Education for the Handicapped Act. The IDEA (Individual with Disabilities Act) requires schools to provide assistive technology services and equipment for a student with a disability to ensure a "free and appropriate" public education. The reauthorization of IDEA(1997) mandate AT to be included into the Individual Education Program (IEP). In 2001, with passage of No Child Left Behind (NCLB), the U.S. Department of Education is embracing technology research in order to improve the effectiveness of educational intervention and in turn, academic achievement.

Special education teachers are given increased responsibilities for students with disabilities in their classroom. Teacher education programs have recognized their obligation to provide solutions for the dilemmas their teachers face in the inclusive educational environment (Murry & Murry, 2000). Do teachers feel competent in choosing, using and matching assistive technology to student with a disability? Despite the many research and development projects that have resulted in a wide variety of new assistive tools, software, and techniques, the answer is still a no. The use of technology in itself is not guaranteed to promote inclusion. This review points to the need for a better trained teacher program to use technology and a consistent support network for teachers.

Recent research indicate that assistive technology has had a positive impact on students' learning (Kober, 1991; Sivin-Kachala & Bialo, 1993). Studies also reveal that it is how teachers adapt and utilize the technology that makes a difference and not the technology itself. The effect of assistive technology on student with disabilities were positive, reaching that potential requires knowledge on the part of the user (Merbler, Azar, & Ulman, 1999). There are four considerations when matching students with disabilities to assistive technology. The first consideration is to assess the student and know his/her capabilities and limitations. The second consideration is to know what is available in assistive technology. The challenge is to match the two for a successful learning experience. The third consideration is the ease of use of a device, the learning curve for the user or bystanders, and the noise level of the device. The fourth consideration is to match the assistive technology tool to age, gender, preferences of the user to promote acceptance and use (King, 1999).

This paper is organized as follows: the study, results, solution, and conclusion. An updated list of various type of AT suggesting teachers to match each technological tool to a specific disability is summarized in Table 1 in the Appendix.

The Study

This review focused on recent research evaluating assistive technology in special education. The following criteria were used for all searches: (a) studies were published between 1964-2003 in the English-language journals referenced in ERIC and First Search; (b) types of disability, learning objectives and tasks, types of assistive devices available, application, and competency in matching the assistive technology with a specific disability. The search process resulted in a final listing of 17 special education assistive technology.

Analysis of Research Studies

During the past decade, there has been a steady growth in the research base on assistive technology and special education. Until recently many researchers have shown interest in the field of assistive technology and special education. A vast majority of the research has mainly focused on the usefulness of assistive technology in special education (Howell, 1996; Merbler, Hadadian, & Ulman, 1999; Lankutis, 2002), inclusive classroom (Merbler, Hadadian, & Ulman, 1999), separate disability categories (Mirenda, 2001; Bryant & Erin, 1998; Weikle & Hadadian, 2003; Pierce & Porter, 1996; Pratt, 2001; Ludlow, Brannan, Duff, & Dennison, 2002), proposed solution (Jackson, 2003; Murry & Murry, 2000;) and faculty development and needs assessment (Bryan, Taylor & Hinojosa, 2002; Franklin & Beach, 2002; Goodale, Carbonaso & Snart, 2002). Only one literature provided a comprehensive view of some disability categories (Duhaney, 2000) and one book provided information on assistive software (Mehling & Power, 2003).

Technology has become powerful allies of students and teachers in many inclusive classroom. AT equipment can facilitate inclusion of students with disabilities by making previously difficult or impossible tasks feasible (Merbler, Hadadian, & Ulman, 1999). Later study showed that web sites and concept mapping software have opened new pathways for students with alternative learning styles. Many assistive devices and software programs designed for children with disabilities are also useful resources for any struggling student. (Lankutis & Kennedy, 2002). Early work by Howard (1996) predicted the key factors that prevent technology integration in special education, such as older hardware, untrained teachers and inconsistent support network. He further described the subgroups of learners with related types of disabilities and found that in general, the nature of assistive technology can be used to students with mild disabilities, physical and sensory disabilities, but are not beneficial to students moderate to severe mental disabilities. Interestingly, these results remained unchanged.

Several studies have investigated varies disabilities. Mirenda (2001) summarized and analyzed the extent research literature on aided autism and assistive technology for students with autism across a variety of dimensions. She urged for collaborative efforts across disciplines: education, speech-language pathology and applied behavior analysis. Others have reported that assistive technology (AT) devices and services have major implications for individuals with learning disabilities. Faculty members in higher education must take responsibility for designing teacher preparation and practica to better prepare teachers to work with students who use AT devices to compensate for their specific learning disabilities (Bryant & Erin, 1998). Results gathered from Weikle & Hadadian (2003) indicated that the inability to communicate has been a principal factor in the lack of success in inclusive school, work, and social settings for persons with severe disabilities. Communication abilities such as asking questions, making comments, and retelling stories appear to strongly correlate with later success with written language. Although there is excellent evidence for the efficacy of using various technologies to enhance emergent literacy skills in young children with disabilities, society has been slow in acknowledging these positive findings. To remediate this situation, Pierce and Porter (1996) provided practical recommendations to enable parents and professionals to enhance their literacy-related activities suing assistive technology.

In a related study, Pratt (2001) and her team connected campus classroom with school children across the state each semester. The primary goal of these partnerships was to engage teacher candidates whom came from rural communities and did not have very diverse background, to connect with children in needy areas. The pre-service teachers learned about technology, watched master teachers in action, discussed what they see and stretched their ideas about what schools they might want to work in after graduation. Her study showed that a high poverty level did not change the fact that the teachers had set high expectation. A similar study was conducted by Ludlow, Brannan, Duff, & Dennison (2002) to study perceptions of practicing teachers on technology competency. They

reported that practicing teachers often find that their knowledge and skills were seriously out of date and sometimes not congruent with current best practice even just a few years out of their preservice programs. The authors stated that the problem is caused by a persistent critical shortages of professional in special education and related services, resulted in a situation where many professionals were untrained or inadequately trained for the positions they hold. In one study, Murry & Murry (2000) offered simple solution suggesting teachers to use low cost, low tech equipments such as CD, video scanner, screen magnifiers, keyboard audio feedback, amplifiers, Braille utilities, voice output application, and keyboard modification.

The most recent and largest adjunctive study to date was descriptive studies on faculty development and needs assessment research (Bryan, Taylor & Hinojosa, 2002; Franklin & Beach, 2002; Goodale, Carbonaso & Snart, 2002). The use of technology to support modifications for students with learning disabilities and behavioral and/or emotional disorders in the general education classroom was examined (Jackson, 2003). Results indicated that the use of a web-based lesson template increased the inclusion of students with LD and/or EBD in the general education curriculum. Only one literature provided a general view of meeting the needs of learners with disabilities using assistive technology (Duhaney & Duhaney, 2000). Learning theories and the subgroups of varies disabilities were examined. Varies commercial software designed for speech and language impairments, hearing and visual impairments, learning disabilities, and physical disabilities were also outlined in the study. A suggested list for assistive technology devices was illustrated in Mehling and Power's book, "Technology and Teacher Education: A Guide for Educators and Policymakers (Mehling & Power, 2003).

These findings also suggested that there is a lack of comprehensive research on disabilities subgroups. Many subgroups including ADHD, cognitive disabilities, traumatic brain injuries, gifted and talented, and culturally and linguistically diverse population, were not examined. Other areas not examined were augmentative, note-taking, auditory memory, problem solving, positioning, mobility, computer access, environment care, self care, physical education, recreation, and leisure and play therapy to students with special needs. There has been relatively little research published on matching and selecting assistive software for children with a disability. Several studies have failed to find significant correlation between selection and matching of assistive technology and students with disability. The review supports the primary thesis of this paper, which is an investigation on assistive technology in special education. More research is needed before these instructional strategies can be deemed generalizable.

Results

This paper presents an analytical framework for selecting and matching assistive technology to learners with a disability. An updated list of available software is included in the Appendix. See Table 1.   Results of this study are summarized as follows:

1.   Research in this field tends to be limited to faculty development and need assessment focus. Studies on faculty development and needs assessment research comprised of the majority of recent research in technology integration.

2.   Technological interventions appeared scattered, vague, incomprehensive, and non-specific. The results showed that the studies on disabilities were scanty, and compartmental. Many subgroups including ADHD, cognitive disabilities, traumatic brain injuries, gifted and talented, and culturally and linguistically diverse population, were not examined. Significant correlations between selection and matching of assistive technology and students with disability were not examined.

3.   Pre-service teachers' comfort level of assistive technology in an inclusive classroom was low. Critical barriers to technology integration have not changed. The factors most often cited are: (1) cost and obsolescence, (b) teacher training, (c) support and maintenance, and (d) adequate curricula.

Conclusion

Assistive technology can play an important role in special education because many students with disabilities need special instructional treatment. A number of assistive technology devices and software are available that, with careful planning and guidance, can benefit students with disabilities (Duhaney & Duhaney,

2000). In compliance with the No Child Left Behind (NCLB) Act, the U.S. Department of Education is embracing technology research in order to improve the effectiveness of educational intervention and in turn, academic achievement. Special education teachers are given increased responsibilities for students with disabilities in their classroom. The use of technology in itself is not guaranteed to promote inclusion. This review points to the need for a better trained teacher program to use technology and a consistent support network for teachers.

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Appendix

Table 1. Matching Assistive Technology to A Disability.

Type of Disability	Objectives/Tasks	Devices	Applications
Cognitive Learning	Reading	Electronic reading machine	WYNN L&H Kurzwell 3000
	Reading	Portable reading pens	Quickionary ReadingPen Scan-a-Word
	Reading	Portable handheld dictionaries	Speaking Language Master The American Heritage Dictionary
	Reading	Instructional software	My Reading Coach
	Language Arts	Instructional software	Simon Sounds It Out
	Writing	Word Cueing and Prediction Programs	Co-Writer
	Writing	Speech Synthesis software	Write: Outloud Intellitalk II
	Writing	Speech recognition software	DragonDictate ViaVoice
	Writing	Spelling, grammar, and style checkers	Write This Way
	Note-taking	Portable keyboards	Alphasmart 2000
	Mathematics	Instructional software	Math for Everyday Living Math Sequence
	Mathematics	Talking calculators	Radio Shack Talking Calculator
	Auditory memory	Portable prompting devices	Mobile Digital Recorder
Visual	Reading	Video magnifiers	Aladdin Pro+ Magni-Cam
	Reading	Scanner/OCR systems	Reading Edge
	Reading	Braille translation software	Duxbury Braille Translator MegaDots
	Computer access	Screen magnification software	Vista PC1 SoomTextXtra MAGic
	Mobility	Low-tech aids	Long cane
	Listening	Electronic aids	Mowat Sensor Sonic Pathfinder
Hearing	Listening	Assistive listening devices	Hearing aids Personal FM Educational System Easy Listener
Communication	Augmentative communication	Dedicated AAC	DynaVox3100 Liberator II
Hearing Communication	Speech	Speech training software	Speech Viewer III
Physical	Seating and positioning	Forms and cushions	TumbleForms PinDot
	Mobility	Powered wheelchairs	Action Storm Series Power
	Environmental control	Environment control units	PowerLink 3 Control Unit Relax II
	Activities of daily living	Low-tech devices	Various reaches and grippers
	Computer access	Keyboard modification	Accessibility Options Easy Access (Apple)
	Computer access	Alternative pointing services	Headmater2000

			NoHands Mouse CrossScanner
	Computer access	Alternative keyboards	Intellikeys BAT Personal Keyboard
	Computer access	Alternative input method-switch with scanning	WinScan 2.0 with WiVik2 with Scanning Switch Clicker Plus
	Computer access	Alternative input method-speech recognition	DragonDictate ViaVoice