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Assistive Technology for the Cognitively Impaired:
A Study of Literacy, Comprehension, and the
Print Publishing Industry

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In an attempt to promote literacy for all students, many times educators find themselves with too little funding, too few resources, and too wide an achievement gap between their students. Particularly in special education and integrated classroom settings, this gap seems wider, seeking to accommodate those children with varying levels of cognitive abilities. For this population in particular, the barriers to reading proficiency are tremendous, yet in recent years the development of assistive technology has sought to lessen this achievement gap. Assistive technology can be defined as “any item, piece of equipment, or system [that is] used to increase, maintain, or improve functional capabilities of individuals with disabilities” (Reisberg 1). These programs can assist any and all children who struggle academically, yet when catered towards children with cognitive disabilities, one will find a particularly high measure of success. In this paper I seek to discuss the ways in which the print publishing industry has developed to assist children with cognitive disabilities. Assistive technology and the digital ebook market are at the forefront of these developments, promoting reading comprehension amongst this population through assistive literacy applications and text-to-speech technologies. This development is severely limited, however, by a lack of research and study, as well as a lack of proper training for those educators expected to teach these literacy skills in a special education environment. In order to more effectively and comprehensively serve this population, I conclude that necessary next steps include free and affordable program integration, resolved technological and training issues, and recognition of differences between children with varying cognitive impairments.

Assistive literacy applications, and a resulting increase in classroom iPad use, are a core means to promote literacy for children with cognitive impairments. Studies conducted by Elizabeth Davidson and Liana Lingofelt found that iPads increase focus for special education students, especially in the areas of “reading comprehension, vocabulary, and fluency” (5). Taking into account recent developments in ebook programming, functionality, and design, these results make sense, as “technology-based applications give access to previously inaccessible experiences” for these students, seeking to “enrich their learning in a variety of ways” while addressing “different learning styles” (Davidson and Lingofelt 6). The applications focus on literacy skills ranging from vocabulary acquisition to identifying main ideas in a text. For example, the iPad application Flashcards+ is used for vocabulary acquisition, correlating related photos with words to promote comprehensive learning retention for varying types of learners. This range, along with increased access to e-reader technology, is fundamental in catering to the wide range of cognitive abilities found within the special education population. In regards to visual comprehension and the print publishing industry, there is also a tangible benefit to these applications. Investigations into the benefits of “e-paper” and e-reading have found that “e-paper is potentially superior to printed paper in terms of optics, due to the customizable nature of the platform”; results “demonstrated that subjects actually show improved reading comprehension when point size and line spacing are increased” (Tanner 3). Developments in ebook design allow for this customization and, as a result, lead to improved readability and increased assistive literacy access. Incorporating physical customization, in terms of design and functionality, with a wide range of assistive applications for all types of learners leads to an all-around improvement in access and tangible academic literacy benefits for children with cognitive disabilities.

Additionally, recent developments in text-to-speech technology—particularly DAISY books—are at the forefront of technological literacy assistance for children with cognitive disabilities. Text-to-speech technology includes “speech synthesizers, including text-to-speech programs, Web-to-speech readers . . . , and talking word processors.” In these programs, “files are copied into the program and then are spoken by the computer,” then allowing the user options “to select different voices (male and female), change the speed the text is processed, and increase or decrease the size of the font” (Reisberg 2). These programs have been thoroughly incorporated into the digital ebook market, most specifically through the advent of the “talking book.” These books came into development “in 1994, when the first Digital Accessible Information System (DAISY) prototype was launched” for “print-disabled readers”; the DAISY talking book was also the first of its kind to provide “additional navigational features such as flipping between pages, placing bookmarks and using the tables of contents” (Lundh and Johnson 55). This particular market within the print publishing industry was unprecedented in its singular focus on the print-disabled population, and throughout the last twenty or so years has rapidly developed alongside the regular digital ebook market. The result is a tangibly effective assistive literacy tool, with current research supporting “text-to-speech solutions as a means of improving reading rates and comprehension for students with . . . learning disabilities,” focusing on the areas of vocabulary retention, “phonological decoding and word recognition,” and “silent word reading and oral reading of text,” which seamlessly translate into highly “improved reading skills with printed materials” (Erickson 11). The DAISY talking book is the print publishing industry’s most directly impactful form of assistive technology for children with cognitive

impairments, as it incorporates visual and audio learning techniques in a comprehensive and approachable way.

However, it is crucial to recognize that these assistive technologies are fairly new, and therefore are linked to very little research and comprehensive study sources. While it is approximated “that at least five percent—possibly up to ten percent—of all Americans have some sort of print disability,” it seems that “despite the number of potential talking book users, and despite the technological advances in talking books” (among other forms of developing assistive technologies, such as literacy applications), in fact “little basic research has been carried out in this area” (Lundh and Johnson 56). A highly tangible explanation for this lack of research is that the assistive technology itself “is still in a nascent stage” and, therefore, any opportunities to address technological issues and perhaps promote further developments and forward-thinking improvements have not yet been presented; however, it at the very least “seems clear that if a connection can be made” between “specific reading strategies and technology,” then “student comprehension should increase” (Davidson and Lingofelt 10). Furthermore, these assistive technologies have not existed for a substantial enough period of time to take more than one singular form. Alternate forms for varying types of learners at varying levels of literacy comprehension will become necessary through further years of development, as each child has particular cognitive strengths and weaknesses that need to be individually addressed. While “research supporting the use of AT in reading for students . . . is limited,” research “to guide the selection of specific supports to meet individual student needs is even more limited.” To most effectively serve this population, it is necessary to “move beyond questions regarding the use of AT generally . . . and focus on the impact that AT supports have on students with varying

profiles of strength and weakness in reading” (Erickson 11). The need is tremendous, and the benefits seem apparent, yet it is still too early to truly conduct studies and synthesize impactful research.

An additional roadblock to the effective development and implementation of assistive technologies for children with cognitive impairments is an overall lack of training for educators. The lack of proper training in how to effectively utilize these technologies serves as a huge barrier for literacy development within the special education student population in particular. In fact, according to Davidson and Lingofelt, “two-thirds of teachers . . . receive little to no technology-related professional development when receiving technology like iPads” (5). Without any technological training or comprehensive assistance for those educators expected to best serve this high-needs population of students, how can the students then be expected to effectively utilize these technologies? First and foremost, individuals must understand the following:

“Technology is only as effective as the teachers that are implementing it. Without adequate professional development, training, IT infrastructure and support, technology that is simply handed over to unprepared teachers or in an unsupported building is no more effective than any other intervention lacking instructor knowledge.” (Davidson and Lingofelt 31)

Without recognition of this concept, future assistive technology developments will be to no avail, as the studies will be fruitless and the seemingly tangible results ineffective. If a teacher does not know how to use the assistive technology required to advocate for the increased literacy of her students—particularly those within the special education population, children with cognitive disabilities—those students will never benefit and will ultimately be incapable of utilizing the technology effectively. This barrier is often listed alongside additional factors, such as “negative staff attitudes, inadequate assessment and planning, insufficient funding, difficulties obtaining

and maintaining the equipment, and time constraints” (Reisberg 1). When these barriers interact with one another, the effective implementation of assistive technology seems both unnecessary and impossible, and those students with cognitive disabilities will most chiefly suffer as a result.

The most substantial change that must be made in regards to assistive technology and the publishing industry is the increased affordability and accessibility of these programs and devices. Free and affordable program and device integration seems feasible, as “growth in the availability of open source software, freeware and shareware, [and] many types of assistive technology programs, once available only through commercial vendors, are now available inexpensively or free on the Internet” (Reisberg 2). A key example of this is the Bookshare.org online e-library, which “provides print disabled persons with access to over 41,000 books and 150 periodicals that are converted to Braille, large print, or digital formats for text-to-speech audio”; these titles are then made “available to all the collections of thousands of individuals who scan books” through a “special exemption in the U.S. copyright law that permits the reproduction of publications into specialized formats for the disabled” (Reisberg 4). Promoting accessibility for all individuals, including educators and students with cognitive impairments, lies at the core of necessary improvements within the assistive technology sphere. It is at this particular juncture that the print publishing industry most needs to take a stand, as its frontrunners wrestle between profitability and accessibility despite financial circumstances and disability status. The most effective means through which affordable access can be promoted by the publishing industry is likely through the library market. Perhaps now that “publishing houses are beginning to see the value in making . . . titles available to libraries as e-books,” a natural consequence will be that “price and availability” no longer limit “lending institutions wishing to expand their digital holdings” (Tanner 9). Any

increased library access to these titles and programs coincides with an increase in accessibility, as the houses strike up bulk library sale deals, and those who need them most quickly become able to afford assistive technologies: ebooks, talking books, and assistive literacy applications.

An additional necessary improvement must also be to address any technological issues and incompatibilities for those utilizing these assistive applications and devices. It is highly important to address compatibility issues with iPad technology and the applications on iPads (for example, the aforementioned Flashcards+ application), as this incompatibility leads to a lack of improvement in reading comprehension that has nothing to do with the students themselves (Davidson and Lingofelt 19). While it has proven difficult enough to tangibly record results in literacy improvement among students utilizing these programs and devices, when compatibility and accessibility issues arise, those results become even more difficult to analyze. Many students within Davidson and Lingofelt's studies "expressed frustration with how some of the apps were not user-friendly, nor helpful in building their reading proficiency," which is quite concerning feedback, considering that the overall goal of these technologies is to help the students they serve (30). If technological issues and incompatibilities are hindering the student's basic ability to utilize the assistive technologies, it is the responsibility of those in control of the applications and devices to troubleshoot these problems. This is yet another juncture at which the print publishing industry, particularly the digital ebook market and its strong connection to the development of talking books, must work to seamlessly integrate any improvements and address compatibility concerns at all turns. Furthermore, assistive literacy applications that require premium status to "unlock" particularly helpful features—such as Subtext, a main idea comprehension tool—must work with educators, libraries, and the like to promote greater access to these features without

such prohibitive costs (Davidson and Lingofelt 27). Financial circumstances and disability status should not hinder one's ability to access assistive technologies, as these are highly indispensable educational tools that effectively promote literacy among children with cognitive impairments.

Furthermore, it is absolutely critical that both the print publishing and assistive technology industries seek to move beyond single, streamlined programs and applications, in favor of addressing variations in disabilities and learning styles. What works for one particular student may not work for another, and it is at this juncture that the future of assistive technology must head, altering these technologies to cater toward particularities and promote a wider range of success for those of varying cognitive abilities. Recognition of discrepancies between what kind of technology assists which kind of child is crucial for further progress. For example, "gains were greatest for students with the poorest silent reading ability without AT, and text-to-speech actually interfered with the reading comprehension of students with the best silent reading skills"; this type of differentiation (a "profile-based approach") proves most comprehensive, even though "most of the research regarding AT to date fails to consider subtypes of learning disabilities" and particular "profiles of strengths and weaknesses in reading" (Erickson 11). A profile-based approach to assistive technology development seems overwhelming, considering every single particularity of every single cognitive disability and child. Yet these industries cannot effectively serve this population if they do not take into account that, for example, "some of the functionalities of DAISY talking books that were developed for users with visual impairments are of little use to users whose print disabilities are due to dyslexia/reading and writing difficulties" (Lundh and Johnson 61). Recognizing profiles and particularities is critical, and perhaps will be less overwhelming once the established technologies have worked through

compatibility errors, limited accessibility, and the like; that is, once the assistive technologies are further developed, comprehensive studies can be conducted, and more tangible improvements can be made to assist and improve the literacy skills of children with cognitive disabilities.

Ultimately, the print publishing industry has greatly improved their involvement in the development of assistive technologies for children with cognitive impairments. This involvement first takes shape through an increase in accessibility to and functionality of assistive literacy applications and corresponding e-reader technology, particularly in classroom settings. Further involvement exists in the form of talking books—specifically DAISY books—which incorporate substantial advancements in text-to-speech technology in the hopes of promoting literacy for those of varying degrees of cognitive literacy comprehension, as well as different preferred learning styles. These assistive technology advancements, however, are met with setbacks. As a result of nascent technology, there is a fundamental lack of research and study on this subject, yet ideally this deficiency will be supplanted through further years of technological development and implementation. Lack of technological training and support for educators exists as an even more fundamental setback, as those individuals expected to implement assistive technologies have little to no comprehension of how to actually use the technologies and teach their students how to effectively use them. Through three proposed improvements, however, it appears likely that the field of assistive technology, and the print publishing industry’s deeply rooted connection to its development, will continue to improve in order to effectively serve those it purports to represent. Through an increase in free and affordable programs, applications, and devices; a renewed focus on improving technological incompatibilities and encountered errors in accessibility and use; and further development of assistive technologies that recognize variations

in learning styles and needs amongst the wide range of children with cognitive disabilities, accessible, affordable, and comprehensive advancements can be made, and this population can not only be most effectively served, but can tangibly work toward a successful increase in literacy skills and comprehension.

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