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Implementing assistive technologies: A study on co-learning in the Canadian elementary school context

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ABSTRACT

This study focuses on teacher and student co-learning with assistive technologies (such as text-to-speech readers) in a specialized program for students with learning disabilities. Canadian students in Grades 4-5 who were reading well below grade level were selected for this intensive intervention. Study participants include both teachers and students. Research includes qualitative data collected from teacher observations and interviews, as well as a detailed analysis of the student participants' reading and comprehension scores on tests. The researcher and teachers engaged in systematic (weekly) review and analysis of their perceptions of student progress based on both the reading and comprehension data and observations, and then made mid-course corrections in the technology approaches used in the reading intervention program. Results indicate that this assistive technology intervention, guided by teacher-researcher collaboration and reflection, yielded both student and teacher gains. This study attempts to address gaps in the literature, demonstrating that assistive technologies, introduced in a timely way and implemented with support, can provide measurable gains in reading fluency, comprehension, and engagement. This study also shows the potential gains from teacher-researcher collaboration when introducing new technologies, while illustrating some of the current complexities associated with assistive technology interventions in school settings.

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1. Introduction

Learning to read is something students are expected to accomplish in the first three years of school. By their 4th year, students are expected to read both fiction and non-fiction materials, using reading as a tool for learning and information acquisition (Ontario Ministry of Education., 2006). The achievement gap for struggling readers is well-established (Allington, 2006; Edyburn, 2006). There are two aspects of importance in these reading difficulties: problems decoding and interpreting the actual print; and problems accessing the vocabulary, learning materials, and ideas appropriate for the student's grade and cognitive level.

Technology innovations are available to help students with special learning needs gain access to the curriculum and information, and report their findings so that they can keep pace with their grade-age peers. Examples of assistive technologies include text-to-speech (TTS) software, classroom voice amplification systems, and programs which convert speech to text. According to Edyburn (2007), the use of these technologies is an area that is under-researched and also presents a challenge to current thinking about demonstrating performance. If a student reads well on a test with assistive technology assistance, for example, not all educators agree that this technology-assisted assessment is reliable or fair (Edyburn, 2007).

Another consideration is the timing, or when the compensating technologies should be introduced for a learner. If students are struggling with reading, their teachers need to consider whether they should focus on further *remediation* to correct the reading problem, or *compensation* – the use of compensatory assistive technology strategies (Edyburn, 2007). According to Edyburn, assistive technologies should be introduced well before students are required to access large amounts of content but are unable to do so because of reading difficulties. If compensation for reading is not introduced, then students who struggle with reading will potentially struggle more with all subjects as the curriculum content increases in higher grades (Edyburn, 2007). Assistive technologies such as TTS software allow students with learning disabilities associated with reading to have access to the more challenging curriculum materials that are written at the level of their cognition and development, rather than only materials that are written at the (lower) level which is more reflective of their reading level. In this

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way, assistive technologies can provide more equitable classroom environments.

It is critically important, however, for students with special needs to be able to participate fully in a way that does not make them feel outside of the mainstream communications and functions of the regular classroom. If the student with special needs is the only student using a computer, this may make the student feel isolated from peers. For this reason, King-Sears and Evmenova (2007) encourage teachers to find opportunities to implement innovative technologies with all of the students in the class. With this approach, assistive technologies support the students with special needs and simultaneously expand all of the students' technology capabilities. An example of this approach would be the introduction of concept mapping or graphic organizer software for every student, with the specific goal of assisting those students in the class who have difficulties with organization.

1.1. Least restrictive environment

One goal of inclusive schooling is to provide as much support as possible for students with learning disabilities within the least restrictive setting possible (Kim, Woodruff, Klein, & Vaughn, 2006). *Least restrictive environment* is a term used in special education which often describes where the student is placed, such as in a specialized classroom or in the general education setting. According to Rozalski, Stewart and Miller (2010), schools bear the responsibility to find ways for special education students to access the general curriculum and also provide the supplementary support to help them be successful. Champagne (1993) has defined *the least restrictive environment* as one which allows students the ability to use communications which resemble everyday life to the greatest extent possible. Assistive devices should not make the disability more apparent than necessary or this may present a more restrictive environment and a potential implementation barrier. In contrast, if most or many of the students in the class are using the instructional technologies, and the assistive nature of the technologies becomes disguised as everyday learning, this can potentially provide more inclusive and enabling environments.

1.2. Additional assistive technology considerations

The assistive technology that is provided for students with special needs must not only help the student to access the regular curriculum but it also needs to be available in a user-friendly format. For some students and teachers, this may mean that the device, program or application should be sufficiently portable to use both at home and at school. Cost and insurance as well as the portability of the assistive technologies are considerations. Software such as Kurzweil, which reads scanned text aloud, is more accessible to students if it is on the web or if it can be accessed on tablets as well as on a computer (Sider & Maich, 2014). For students who already have reading challenges, learning to use assistive technologies may present additional barriers, or at a minimum an implementation dip, as they begin to use the new technologies. Other recognized barriers to the use of assistive technologies in classrooms are teacher training, teacher skill level, and the unrelenting pace of technology development (Hasselbring & Bausch, 2005; King-Sears & Evmenova, 2007).

1.3. Text-to-speech software

Unlike systems which read only specified texts, TTS computer-assisted software allows a student access to both paper and digitized text, and opens access to on-line communication such as the internet and email. Computer-based TTS technology involves scanning print materials into the computer, which then uses optical character recognition to view the scanned image as text. In the final step, the student selects a voice and speed for the computer to read the text aloud, usually into headphones. Text may also be saved as an audio file and played back on a personal MP3 player (Edyburn, 2003). Some examples are Kurzweil 3000™, TextHelp™, and Premier™. TTS technologies can potentially offer many benefits such as, improving student access to print, supporting the writing process by reading back to the student, and increasing independence by removing the need for someone to read the materials to the student.

A small number of studies research specifically whether digitized readers or TTS software applications make a difference in reading performance, and identify the factors which impact student success (Edyburn, 2007; Stetter & Hughes, 2010). Previous studies have had mixed results. For example, Montali and Lewandowski (1996) find that a bimodal presentation of text (visually on screen and aurally through recorded voice) using a computerized reader can improve the reading comprehension and word recognition for two-thirds of a group of Grade 8 and 9 students with low reading skills. However, a TTS reader appears to interfere with comprehension for less disabled readers (Elkind, Cohen, & Murray, 1993), or has little effect on comprehension (Schmitt, McCallum, Hennessey, Lovelace, & Hawkins, 2012). Strangman (2003) finds that Grade 4 and 6 students are motivated and demonstrate better comprehension using books read on the computer, while Farmer, Klein, and Bryson (1992) find no significant difference in student comprehension for middle and high school students. A more recent study on a computer-based TTS software system finds no difference in results in reading comprehension with and without the TTS technology (Schmitt, Hale, McCallum, & Mauck, 2011).

These studies suggest that TTS assistive technology may be helpful if it increases access to grade-appropriate text or text at a higher level than the student could read on her or his own, and if it also improves understanding of the material. Careful assessment of the appropriateness and type of TTS reader is important as it may interfere with comprehension and speed of reading for some students (Edyburn, 2007; Schmitt et al., 2011). For teachers who wish to implement TTS technologies in the middle grades of elementary school, the research results to date are sparse and somewhat contradictory.

1.4. Co-learning

Keeping up with new developments in assistive technology is a significant challenge for teachers due to the rapid pace of change in commercial products available and the large amount of research published recently (Edyburn, 2004). Co-learning and collaboration may provide the support that is necessary for an assistive technology implementation. Kim et al. (2006) find that insufficient research has been done into the effectiveness of co-teaching for students with disabilities. They define co-teaching as the situation where two teachers work in a class and hold shared responsibility for the students' progress. Kim et al. find also that four factors facilitate the efficacy of co-teaching: preplanning, shared goals, connecting special and general education content, and continuous evaluation to adjust instruction. Questions to be considered in co-teaching deliberations include where the instruction will take place, what will be taught, and how it will be taught. To answer these questions, co-teachers collaboratively determine the strategies they will use for students with disabilities and each teacher's role (Kim et al., 2006).

The study presented here examines co-learning among a researcher and two teachers in a specialized program to develop assistive technology skills to compensate for and remediate reading difficulties for junior-level students (ages 9–10). The teachers

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