The Teacher's Role in Assistive Technology for Everyday Inclusion

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Abstract: *In this paper we argue that assistive technologies intentionally disguised as everyday communication devices can include more learners with special needs in the classroom and in society. Newer assistive technologies can also encourage shifts in the education discourse beyond the somewhat restrictive, binary-focused definitions of ability/disability toward designing more inclusive and enabling environments. Technology affordances can open new learning spaces designed for inclusion and independence, employing technology in more innovative ways which resemble everyday uses of technology. The findings from the three case studies of graduate student research reported in this paper encourage a reconsideration of the model of providing assistive technology supports primarily through formal policy mechanisms such as identification and specialized equipment allocations. Instead, the findings indicate that assistive technology integration approaches of the future might more profitably focus on the assets of the learner combined with the potential of the technology to reproduce everyday communications.*

Keywords: assistive technologies, least restrictive environment, special education,

Context: Everyday Technologies

Designing assistive technology supports for learners with special needs involves more than the efforts and commitment from the learner's support team to provide an assistive technology device such as a computer. When assistive technology is introduced, both the learner and the teacher need to feel comfortable using the assistive technology. If the assistive technology support makes a learner's individual abilities or learning style more conspicuous, an unintended result may be that students can feel more isolated from the rest of the class. According to Yell and Drasgow (2013) decisions about the most enabling environment for learners with special needs traditionally have been conceptualized as which environment is the *least restrictive.* In this paper we argue that conceptions of the least restrictive environment should include considerations of how assistive technologies can help learner practices resemble the communication with "the ordinary flow of society" (Champagne, 1993, p.5). Teachers are an important element of this enablement.

In the Ontario education context, assistive devices are provided in a formalized way through funding formulae for learners who have been through an identification process. Because of these formalities, both the process of identification of the learner and the assigning of a single, specific device can provide barriers to what Champagne (1993) calls opportunities to get close to everyday life and communications. Three case studies of graduate student research are presented here which investigate assistive technologies across a wide spectrum of learners. Emerging from the findings of these studies is the need to reconsider the model of providing assistive technology

supports primarily (and at times solely) through these formal policy mechanisms. Teachers can play a key role in introducing everyday technologies and communications.

Theoretical Considerations

Policies and procedural considerations of the least restrictive environment have been developed by policy and case law (Yell & Drasgow, 2013). In the case of special education legislation, significant focus has been placed on defining the term *restrictive* because the goal of the legislation is to allow a learner with special needs optimal opportunities to learn and be independent. Understandings of policy through case law can arguably be enriched, through theoretical considerations of how learner inclusion and learner independence can be fostered in more enabling environments (Kalantzis & Cope, 2012) and timely and effective uses of everyday assistive technologies (King-Sears & Evmenova, 2007). According to Yell and Drasgow (2013) planning and policy considerations around the least restrictive environment have often been understood as the physical location for the learner's instruction; instead, placement should include considerations of the facilities, the personnel and the equipment as well as the setting (Yell & Drasgow, 2013). The three case studies presented here introduce possibilities for less restrictive (and more inclusive) approaches to learning where learners are not seen as having disadvantages, but in possession of different abilities that can be leveraged to approach learning.

Designing the most enabling environment possible for learners resonates with Champagne's (1993) encouragement of an expansion of the definition of *least restrictive environment.* Rather than focusing solely on including students with special needs in classes with age-appropriate peers, his interpretation includes considerations of providing a learning environment which most closely *resembles everyday life and everyday communications*. In a similar vein, teachers and adult caregivers might also consider how important it is for the technological equipment to be, in the words of King-Sears and Evmenova (2007) "an integral part of the way that instruction occurs in their classrooms" (p. 6).

Dyck and Pemberton (2002) also encourage a consideration of timeliness for the assistive technology intervention for learners who, for example, have struggled with reading for years. They ask educators to consider when is the optimal time to bypass reading (through technology or other means of support) in order to allow learning to continue. As Edyburn (2007) comments, there has been a lack of support to help teachers pinpoint when it makes sense to introduce technology to replace cognitive tasks. While adults no longer have to struggle to calculate compounded interest tables, there is still a sense that children need to be able to compute mathematics and decode reading. Teachers and caregivers need to consider when to incorporate compensatory strategies at optimal points in the learner's growth and development (Dyck & Pemberton, 2002; Edyburn, 2007) in order to allow learners to progress.

In addition to considerations of creating environments where learners use everyday communications and technologies and when they are introduced to them in a timely way, some theorists have highlighted the need to reconsider the overall teacher and caregiver discourse surrounding learners with special needs. Kalantzis and Cope (2012) find that terminology that describes learners in a deficit way has become less acceptable; they encourage teachers to recognize a "range of body forms" and provide what they term as "programs of action" which enable improved access (p. 161). They encourage teachers to consider and build the conditions

of *enablement* rather than repeating and reinforcing previously-established classifications of disability (Kalantzis & Cope, 2012).

Graham and Iannacci (2013) argue that teacher education needs more critical and emancipatory approaches which challenge the labeling of students into categories relative to what has been determined as the norm. They want to encourage preservice teachers to deconstruct earlier definitions based on deficits and consider instead the experience and characteristics of each child in a system that should be expecting diversity as the norm. They encourage teacher educators not to replicate "the dominant discourses that universalize and fossilize disability and those who have one" (p. 13) and develop new approaches that speak of promise and potential. Graham and Iannacci also encourage teachers to reconsider learner tasks and broaden the array of practices available to the learner. In these ways, Graham and Iannacci (2013) challenge the dominant educational discourse around differently-abled students.

All three of the case studies presented here align with the theoretical constructs that have been discussed. These are: a) least restrictive environments, b) timely assistive technology interventions, and c) enabling environments for learners.

Case study is a form of qualitative research that not only presents a specific case or study, but can be helpful as a research methodology for guiding policy and practice (Baxter & Jack, 2008). In this paper, the case study method is used so assistive technology interventions for learners can be more fully explored in different contexts and viewed through multiple lenses. The case study researchers are graduate education students. Their case studies and the direction they represent have implications for teacher practice, clinical practice, and policy development.

Case Study 1: The teacher's role in implementing text-to-speech software

The achievement gap for struggling readers has been well established - struggling readers experience an achievement gap because they can't work effectively with curriculum materials at their cognitive level (Edyburn, 2007). According to Edyburn (2007), assistive technology has the potential to allow students to reduce this gap so they can access regular curriculum.

There are two important aspects of 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 level. If a learner is unable to access the learning materials, the learner falls behind the other students in the class. Text-to-Speech (TTS) software has the potential to improve access to the curriculum materials. A TTS program "reads" print to a student, usually through earphones. Most are computer-based, and read both on-line and print materials. Some software such as Premier and Kurzweil offer other aids such as the ability to add study notes, to summarize text, and to assist students as they write. Previous research into the use of TTS and other text readers has had mixed results (Stetter & Hughes, 2010). Some studies show that students are able to access print at higher levels than without the software, but do not show improved comprehension (Manset-Williamson, Dunn, Hinshaw, & Nelson, 2008). TTS may interfere with comprehension and speed of reading for some (Schmitt, Hale, McCallum & Mauck, 2011).

The TTS for reading case study investigates the effects of the use of a text-to-speech reader in a six-week intensive reading program for junior-age students with reading disabilities where students receive intensive remediation in reading and assistive technology skills. The study was designed to determine whether junior-age students could achieve competence with TTS within a six week intensive placement, and to determine the effects of the use of TTS on their access to print and their reading comprehension. Data were gathered through interviews of the intervention program teachers to obtain their observations and assessments of the students using a criterion-based reading test.

Students were referred to this six-week withdrawal program for assistance with a variety of learning difficulties not attributable to their cognitive level. Five students received remediation in reading, the use of TTS, and other technologies. Three of the students had limited previous experience with TTS. Two of the students had a prescribed personal computer and TTS software but were not successful with it and were reluctant to use it in their home school classroom. Explicit instruction was provided in the use of the Kurzweil 3000 TTS reader. Application of new software skills occurred throughout the day in activities such as reading books, completing worksheets and math problems, writing a student journal, researching on the internet, emailing friends at their home school, and preparing a presentation using PowerPoint. Teachers devised learning aids to facilitate comprehension, such as key questions, comprehension organizers, and teaching students how to use the Kurzweil program to highlight key points as they read and reread fiction and non-fiction materials.

Findings from this study (White, 2013) indicate that the students found the computer voice odd at first but became comfortable with it by week two. By week six, all students could use Kurzweil independently to scan their own materials, to assist them with their own writing, and to read print and on-line text. Observations and test results using a criterion based reading assessment, Developmental Reading Assessment (DRA) Bridge Pack, demonstrated higher fluency and comprehension scores over the six weeks when using Kurzweil. Students' motivation to read improved significantly as they accessed the same popular books their peers were reading, and used TTS to email their friends. All students found books they loved to read.

The teachers were an important contributor to the success of this case study in several ways. They were skilled with TTS and other technology and were able to support student mastery of the technology. They devised learning strategies to improve comprehension which were tailored to individual student needs. They looked for popular book series that would engage the children to encourage them to continue reading at their home schools; and they were able to solve daily challenges with the use of the hardware, such as connection and printing problems (White, 2013). Students were assessed using the Developmental Reading Assessment (DRA) Bridge Pack Grade 4-8 (2004), which has comprehension cues to assist students to recall and summarize the story. Book levels used for weeks 1 and 6 were individually selected according to DRA guidelines and the previous assessments from the home school for the students.

Results demonstrated that TTS computer-based readers offer effective technology tools when implemented to a level of student mastery and efficiency with the technology. Figure 1 represents the fluency scores for students during the week six DRA Bridge Pack 4-8 (2004)

assessment, comparing fluency scores between reading a paper copy of the DRA booklet and a digital one which was scanned into Kurzweil and read to the student. The students selected the words-per-minute speed at their comfortable listening rate, 125 wpm. Each student read a different book at the same level, first in print and two days later with Kurzweil. Students were able to access much more print using Kurzweil.

Figure 1

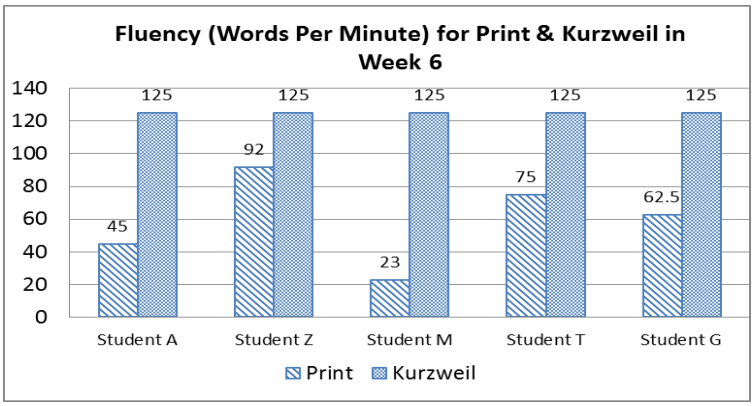


Figure 2 represents the comprehension scores for students during the week six DRA assessment. It compares comprehension scores between reading a paper copy of the DRA booklet and a digital one which was scanned into Kurzweil and read to the student. Four of the five students showed improved comprehension.

Figure 2

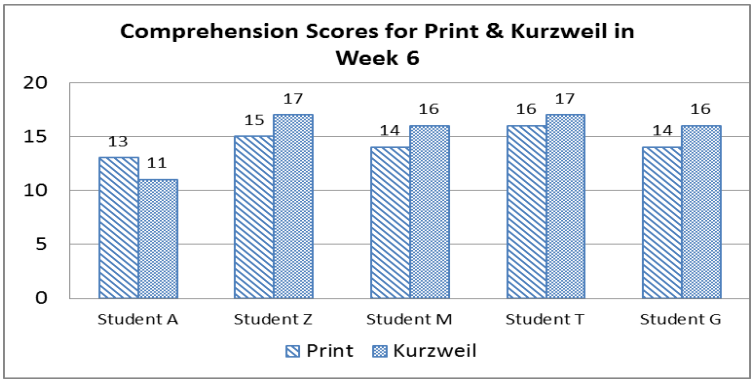
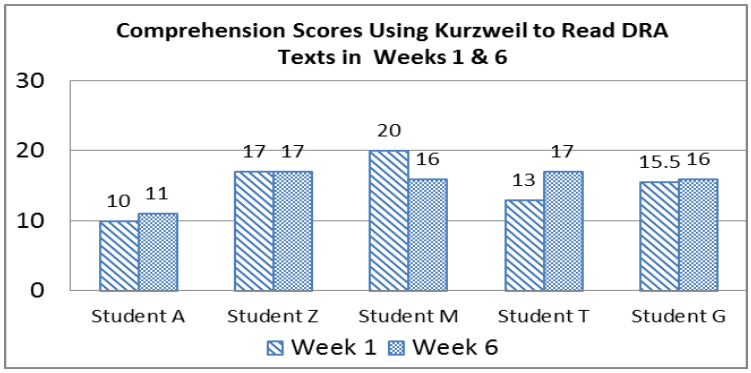


Figure 3 represents a comparison of comprehension scores over weeks one and six using Kurzweil. Comprehension scores using Kurzweil were higher or maintained for more difficult reading material in week six for 4 of the 5 students. Student M had a lower comprehension score on the DRA in week six, but her teacher noted that she had been reading grade-level material (grade 5) recreationally with good comprehension based on oral retelling to the teacher, and emailing her friends at her home school to discuss the book (White, 2013).

Figure 3



There were several challenges that teachers faced when implementing the program including: 1) extensive time required to scan and edit materials to show the pictures and text appropriately; 2) lack of an available library of already-scanned books in the school; 3) books ordered from a public source for scanned books had no editing for picture or print size and left in extraneous details such as titles at the top of pages; and 4) the technology frequently had glitches which required problem-solving and flexibility (White, 2013).

Edyburn (2007) suggests that students should be offered technology when it is needed to allow them to participate fully in the curriculum. The findings of this case study suggest that this point is reached for students in the junior division, grades 4 to 6. Results indicate that junior students are able to demonstrate improved fluency and comprehension when provided with ready access to text-to-speech technology to assist them with their reading, combined with skillful instruction in an immersive technology environment. Students were initially uncomfortable with the technology, but they soon mastered it. Teachers reported that instructional strategies to support comprehension improved student performance. In an instructional environment which included ready access to technology for all the students, they were willing to use their TTS and computer for their work, and four of the five chose to use it for recreational reading as well. King-Sears and Evmenova (2007) find that technology skills are an important preparation for future career success. When technology is an integral and valued part of the classroom instruction, the student using assistive technology on a laptop blends in with his or her peers, and is likely more comfortable using it. This atmosphere creates a more enabling, less restrictive learning environment (Kalantzis & Cope, 2012; Champagne, 1993) and allows more students to fully participate in the academic and social life of the classroom.

Case Study 2: Developing communication software for adults with autism

The second case study also examines how to create more enabling environments using technology. The research focuses on the development of an iOS app (mobile operating system application) that makes use of situated learning, augmented reality, and communities of practice to create an authentic learning environment. The population to be studied is young adults and adults with autism spectrum disorder. This research study is in its developing stages; the design, methodology and potential implications of the research connected to the theme of this paper are discussed here.

Individuals with autism spectrum disorder (ASD) are categorized as having social impairments, including impairments with verbal and nonverbal communication, as well as having repetitive patterns of behaviour, including the desire to follow strict routines and a resistance to change (American Psychiatric Association [APA], 2013). These individuals also have low adaptive skills, causing them difficulties when planning and organizing (APA, 2013). Young adults as well as adults with ASD often have a high prevalence for anxiety and depression (APA, 2013). These limitations can be huge barriers for individuals when they are in the classroom, workplace, or other social environments.

The iOS app that was developed is a transportation app, which can be used to navigate Toronto by using the Toronto Transit Commission's (TTC) subways, buses, street cars, and light rail cars. Users can either type in their starting address to use the transportation system or the app can locate where they are using GPS. Afterward, the user can type in the destination address and the app will provide them with the best route. During the trip, the app will provide turn-by-turn navigation as well as signal when the user should start preparing to exit the vehicle. For this study, participants will be asked to navigate from one destination to another location within the city. Qualitative and quantitative data will be collected through researcher observation and the use of questionnaires and interviews. The questionnaires and interviews, paired with the collected observations, will measure intrinsic learning within these individuals as a result of the use of the app.

The study was developed in the hopes of creating an authentic learning environment for the participants. Authentic learning, as looked at in this study, occurs when there is construction of knowledge, disciplined inquiry, and a value beyond school (Wehlage, Newmann, & Secada, 1996). This type of environment allows individuals to produce their own knowledge, rather than simply reproduce information (Wehlage et al., 1996; von Glasersfeld, 1989). Learning in this regard allows individuals to take control of what they learn in an active manner, giving each individual more power over their learning (von Glasersfeld, 1989). Additionally, this study provides a task to the individual that is both meaningful as well as authentic, which is the basis of situated learning (Brown, Collins, & Duiguid, 1989). This type of environment aligns with Champagne's (1993) view of the least restrictive environment (LRE), as individuals are learning in situations that are true to everyday life. The design and implementation of this app provides a meaningful learning environment for individuals with ASD, which is suggested in order to achieve the LRE (Rozalski, Stewart, & Miller, 2010). In this type of environment, individuals are able to learn to navigate transit without being isolated from the general population or restricted in any form. The use of a phone app fits in well with communication that most closely resembles everyday life.

Young adults and adults with autism spectrum disorder can be fully integrated within society in terms of school and work. Depending on the level of their impairments, young adults and adults with autism spectrum disorder are able to attend secondary and post-secondary schools as well as hold part-time or full-time jobs and participate within their community. However, as mentioned above, this may not be easy for these individuals as they may suffer from anxiety, depression, or low adaptability (APA, 2013). These feelings are not exclusive to ASD, as other neurodevelopmental disorders can also have similar symptoms in unfamiliar situations

(APA, 2013). This demonstrates a need for interventions that are practical and timely to allow individuals to fully integrate within communities.

Edyburn (2007) discusses the concept of timely interventions when incorporating support tools. Intervention should take place in a timely manner and in such a way that benefits each individual based on his or her learning needs (Edyburn, 2007). Providing young adults and adults with ASD with this app provides them with a tool that can be used to support them throughout their journeys to school, work, or community-based programs. Targeting this population provides an intervention that is opportunistic to their developmental needs, by providing a way that they can navigate a scenario with additional supports in place.

To provide the most support, the app has been developed to provide supports that would not be available to the user otherwise. Using augmented reality (AR), the app provides supplemental virtual information that has been layered onto the physical world (Azuma, 1997). The app has been designed in a very minimalistic manner that looks similar to other iOS applications. Additionally, there is no labeling of the app as part of a research project or alluding to the participants' diagnosis of ASD. This reduces the chance of any negative social implications for participating in this research project, and also protects the individual from being involuntarily labeled as someone with a disability. By removing a label for this app, it can be used by anyone, regardless of his or her ability/disability status. This type of inclusive environment is of the upmost importance in order to break down barriers that are a product of stereotypes of disability (Graham & Iannacci, 2013; Iannacci & Graham, 2010).

The potential implications of this study can provide an advantageous pedagogical approach to all individuals, both those with disabilities as well as those without. By providing an environment that makes use of authentic learning, timely interventions, and tools that can be used by all, the hoped-for result is that barriers for learners with disabilities should be reduced. This should produce an environment that is rich, fulfilling, and inclusive.

Case Study 3: Investigating policy possibilities for assistive technologies

The third case study is a policy investigation of assistive technology, which focuses on two key themes: special education and technology. Current policies related to both special education and technology were examined, including a resource guide for the Individual Education Plan (Ministry of Education Ontario [MOE], 2004) and the standards for the development, program plans and implementation for individualized programs (MOE, 2000). In addition, several curriculum policy documents were analyzed such as the curriculum policies for Language Arts and Social Studies (MOE, 2009, 2013). Finally, interviews were held with policy writers in order to examine the role of technology in designing a curriculum resource based on the policies.

The policy context for inclusive workplaces is changing in Ontario. In 2010, the Accessibility for Ontarians with Disabilities Act (AODA) became law (Government of Ontario, 2011). The AODA's core principles include: dignity, independence, equal opportunity, and integration. According to the Special Needs Opportunity Window (SNOW, 2013) the first AODA standard is Customer Service. This standard provides educational institutions with a framework to use when establishing policies, practices, and procedures to ensure that they are

accessible to people with disabilities. These include determining effective ways to: communicate with individuals who communicate using assistive technology; incorporate assistive technology into instructional practices; assist school boards in resolving their current practices which create barriers to individuals with disabilities; and providing information (e.g. curriculum, worksheets, emails) in an accessible format (SNOW, 2013).

The approach advocated by the OADA policy is one of inclusion yet the approach used in schools may not be closely aligned with this. Storey (2007) argues that ableism is an overlooked form of prejudice which is historically common in schools and society, and is used when analyzing why students with disabilities experience academic difficulties. Ableism is associated with a medical model of trying to fix people with disabilities; it encourages the belief that it is better to not have a disability or if you do have a disability, then one should do things in the way that non-disabled people do. Storey (2007) suggests that while school boards, curriculum committees, and textbook companies embrace multiculturalism and contributions of women and people from ethnic and cultural minorities in the general education curriculum, incorporating disability-related content in all areas of the curriculum may be lacking. Providing professional development for teachers which focuses on disability, discrimination, and multiculturalism may assist teachers to identify the impact of ableism in schools and society. Effective special education training for teacher candidates could also significantly impact their attitudes and the profession as a whole (Storey, 2007).

Research by Graham and Iannacci (2013) on teacher candidates' beliefs regarding students with learning disabilities supports a need to deconstruct the current deficit-focused practice in schools which reinforces norm-based disabled/abled parallel forms of education and which results from the current identification process and instructional practices for students with exceptionalities. They find that teacher candidates stereotypically conceptualize learning disabilities using negative constructs, focusing on the students' limitations instead of their potential. Terms such as *impairment* or *inability* compare students with disabilities to the class norm (Graham & Iannacci, 2013). Their research suggests that disability is a social construct based on society's values and beliefs. Possible explanations for this discourse include how the Ministry of Education defines exceptionalities in their official policies, documents, and website, and this may perpetuate and reinforce the deficit model.

A review of current MOE curriculum policies documents and some specific special education resources also finds some policy contradictions related to assistive technology. One curriculum policy states, "Since technological advances continue to develop at an unprecedented rate, educators should promote the learning of multiple literacies as crucial to living successfully in an age in which communication and change have so much importance" (MOE, 2009, p.55). Another considers that, "The integration of ICT into the (name of) program represents a natural extension of the learning expectations" (MOE, 2013, p. 53; MOE, 2009, p.57). These demonstrate the Ministry of Education's belief that technology is an important part of the educational experience which is designed to help learners be valuable and contributing citizens. However, these documents do not clearly outline how teachers are to use technology to assist students with exceptionalities and refer the reader to two specific special education documents. The first document is the *Individual Education Plans Standards for Development, Program Planning, and Implementation* (2000) which does not mention technology applications. An

Ontario curriculum resource: *The Individual Education Plan (IEP): A Resource Guide* (2004) refers to assistive technology only as an accommodation (MOE, 2004).

Interviews with policy contributors from one Ontario region confirm the current deficit-focused discourse for special education. The policy contributors were chosen because of their participation in a regional team Special Education project. This project outlined the need for more provincial consistency when assessing and evaluating the achievement of students with developmental disabilities. The students requiring more program consistency were those not able to access the provincial curriculum; instead they needed to be assessed and evaluated on their IEP's alternative learning expectations. One area of the interviews with participants focused on benefits and barriers related to accessible technology. When asked how they envisioned the use of everyday technology in the resource document they created, the policy gaps became apparent. Common statements supported the belief that technology was already embedded in curriculum categories such as math and safety; that it was the individual school board's responsibility to embed technology into programs based on their process; and that the use of technology was tied to Special Education Allotment (SEA) grant funding, which assigns equipment based on identification of a disability (Ellis, 2013).

Many of the participants in the study believed technology was an important tool to improve achievement, independence and inclusion for students with developmental disabilities. They acknowledged, however, that without meeting the Ministry of Education's Special Education Allotment Grant guidelines, students were unlikely to gain access to this equipment. Other barriers identified related to implementation of technology into the student's program which included teachers' attitudes towards technology, adequate student and staff training, and reluctance of students to use their equipment (Ellis, 2013). These findings resonate with earlier findings by Gold and Lowe (2010).

In summary, this third case study finds contradictions between the language of enablement in more recent curriculum policy documents while the language in more long-standing Special Education policies focuses on how students require identification and specialized equipment rather than access to everyday technologies.

Summary and Recommendations

The findings from the three case studies reported here indicate that teachers, caregivers, and policy makers need to consider that assistive technology has the potential to be enabling but also isolating for a person who is differently-abled. The case studies also show that, while the least restrictive environment for students should include access to everyday communications and everyday technologies, we are not "there" yet with technology and special education policies and practices. There is a need for more concerted efforts at the policy level to encourage a discourse that sees learners both as differently-abled and capable of using everyday technologies matched to their learning style and capacity.

While findings indicate that technology barriers do persist and are real, they also show that there are opportunities for teachers and pre-service teachers to be key players in expanding assistive technology for all, including those with special learning needs. In this way, assistive technologies can be focused on building community rather than isolation. Together, the case

studies are significant, as they indicate ways forward and insight into successful implementation of assistive technologies in inclusive settings for learners with disabilities.

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