

Teacher Perceptions of Assistive Technology to Help Learners with Disabilities

by

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Abstract

Assistive technology is considered a significant element that provides major support for learners with disabilities owing to the opportunities it presents to improve their learning by facilitating easier interactions with their instructional material. This research was designed to explore the perceptions of teachers about their knowledge and experiences relative to the use of assistive technology in their classrooms. Online questionnaires with open ended questions were disseminated to teachers enrolled in a graduate education program at an Eastern Canadian University. An inductive approach was adopted to analyze the responses of participants to discern emerging themes from teacher comments in response to the questions. Based on the findings, conclusions, recommendations and inferences were developed pertinent to best practices, teacher knowledge and teacher experiences in the use and implementation of assistive technology in their classrooms. Information drawn from the questionnaires supported the view that a large percentage of teachers used assistive technology in their classrooms. Further, it became clear from the information that teachers needed more support than they were able to access in order to feel comfortable implementing and using assistive technology with participants noting the need for more professional development and greater ease in accessing more current types of technology. These findings were discussed along with implications for government, school districts, teacher education programs and future research

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Chapter 1: Introduction

Background Information

In the classroom context, teachers support and direct students with diverse cultural backgrounds, abilities, needs, learning styles and experiences. Educators or instructors, therefore, have the obligation to use various strategies and resources in engaging, motivating, and encouraging active learning as well as participation by all learners (Courduff, Duncan, & Gilbreath, 2014). Technology is a support to teachers in addressing diverse needs of learners because there are assistive technologies that can aid in availing learning instructions to even students with various inabilities. With technological development, terms like assistive technology have become common in the learning environment, assistive technology refers to software and devices that assist both learners with abilities and disabilities (Saraceno, 2013). The underlying assumption is that there is enough evidence confirming how students, both with abilities and disabilities, have been able to improve their learning capacity by spending time with the assistive technologies thus becoming better equipped to use the learning devices. Introducing these devices in the classroom makes effective sense as an approach to addressing the learning needs of the neglected groups like the disabled.

The importance of technology in the classroom is evident from the way it has transformed learning in the classroom. It has altered student's engagement in learning activities, task completion, format of the learning materials, and demonstration of the activities (Borg, Larsson, & Östergren, 2011). Conversely, technology is changing how educators design as well as deliver classroom or learning experiences while equally playing a significant role in the design of instructional materials. In retrospect, the role of assistive technologies in improving learning

capabilities is best understood by examine the need of their learning difficulties and those with learning disabilities. students with learning difficulties refer to learners experiencing difficulties in achieving their learning goals (Lee, 2014). Learners with disabilities are students who have chronic or severe academic problems. In most cases, such students are diagnosed with dyspraxia, dyslexia, dysgraphia, dyscalcula among other neurological conditions (Abedi, 2014).

Different types of assistive technology can help students with learning disabilities. For instance, the physically disabled can use positioning equipment such as side lying frames, chair inserts, walkers, beanbag chairs, and standing aids (Borg et al., 2011). Others include special switches, key guards, and head pointers. Students with hearing problems can use hearing aids, closed-captioned TV, and personal FM units (Lancioni et al., 2012). Technology can also help students with vision impairment by using screen readers, magnifiers, screen enlargers, audio books, scanners, and braille. The aim of this study is to explore the perception that teachers have on the general effectiveness of assistive technology in improving learning outcomes of student with disabilities. In addition, the study explores the various ways through which educators can successfully implement the different types of the assistive technologies to help students with learning disabilities, how teachers perceive the effectiveness of the technologies, major hindrances in addition to their perception on the necessary support during the implementation of the technologies.

Rationale for the study

The study seeks to explore the perception of teachers enrolled in a graduate education program on the effectiveness of implementing and applying assistive technology for learners with disabilities

Insufficient knowledge exists from the teachers' perspective on the technology's effectiveness in improving learning outcomes. It is believed that teachers are reluctant to use technology because of hindrances such as lack of training and support. Few studies have focused on exploring the attitudes that teachers have towards using the technologies in classroom context, especially when learners with disabilities are mixed with the abled learners.

Research Aims and Objectives

- To explore the teacher's knowledge on different types of assistive technologies
- To identify the perceived comfort of using assistive technology
- Identify the obstacles to implementing assistive technology in learning
- To make recommendations on the needed support in the use of assistive technology

Research Questions

- What are the teacher's perceptions of assistive technology on learners with disabilities?
- What do teachers perceive as the learning benefits and difficulties for the students with learning disabilities in using assistive technologies?
- What are some of the alternative assistive technologies teachers identified for use with students with disabilities?
- Do teachers perceive that the integration of assistive technology in classroom situations as beneficial to students with learning disabilities and learning difficulties?

- What do teachers recognize as some of the major hindrances to the successful implementation of assistive technology especially with learners with disability?
- What recommendations do participants have to help in the use and implementation of assistive technology with students with learning difficulties and disabilities?

Chapter 2: Literature Review

Definition of Assistive Technology

Saraceno (2013) defines assistive technology as the services and devices that instructors use in increasing, maintaining or improving the capabilities of learners with disabilities. According to Borg et al. (2011), assistive technology has been used to denote computerized and computer devices on many occasions, but the assistive technologies can be very-low tech, such as the example of pencil-grips. In particular, assistive technologies are used to aid learners with disabilities and they include such technologies like tablet applications and computer programs since they translate texts to speech, like the Kurzweil or change speech to text, like Dragon NaturallySpeaking (Nuance Communications, Inc.) (Saraceno, 2013). Other assistive technologies, according to Lancioni et al. (2012), include word prediction capabilities especially WordQ® (Quillsoft, Ltd) and graphic organisers like Inspiration® (Inspiration Software Inc.).

Edyburn (2013) considers assistive technology to be the umbrella term comprising the adaptive, rehabilitative and assistive devices used to help individuals with disabilities and as such include processes used to select, locate and use the devices. On the other hand, Parmelee (2014) defines assistive technology as the term that refers to “any equipment, system, be it commercial or available off the shelf, customized, or modified used in increasing, maintaining and improving the capabilities of disabled individuals” (p. 34). Moreover, Reichle (2011) maintains that assistive technology can be homemade, customized for individual use and available in local stores or commercially developed to meet the needs of learners with disabilities.

Parmelee (2014) posits that the assistive technologies are low or high tech like switches, ramps, communication boards, dycem, and switched-operated toys among others. High tech assistive technologies include software, computers, electronic communication devices and extended keyboard (Reichle, 2011). Most of these high tech assistive devices have found their uses in learning environments especially helping students with learning disabilities (Reichle, 2011; Saraceno, 2013; Edyburn, 2013). Peterson-Karlan (2011) offers a more detailed definition of assistive technology as a term used to denote any tool that aids students who have disabilities to improve their speed of executing tasks conveniently without any assistance. Services that accompany assistive technologies include assistive technology evaluations, demonstration, training, technical assistance as well as equipment maintenance (Peterson-Karlan, 2011). For this study, assistive technology is defined as any device (computer-mediated) that improves the interactions between the learner and the teacher and helps the students in achieving learning goals.

History and Origin of Assistive Technologies

Some literature work gives an account of the history of assistive technology. As noted by Edyburn (2013), assistive technology emerged through three periods namely the foundational, establishment and the empowerment periods. The Foundation period can be traced back to the Stone Age when man tried to use a stick to assist with an injured leg. Primates used wooden legs and metal hooks to help them walk with straight gestures (Peterson-Karlan, 2011). Braille, which was introduced in the 19th century, marked a significant milestone in the development of assistive technology and its integration into the process of learning. Braille focused on assisting disabled (blind) students. In another innovation that also heralds the use of assistive technology to help disabled students, development of phonography enhanced learning among deaf students

(Peterson-Karlan, 2011). From the beginning of 20th century to 1972, there was a remarkable improvement and innovations in assistive technology, which necessitated the enactment of laws and policies guiding the application of technology in learning this was the basis of the process of establishing institutions focused on developing assistive technology (Edyburn, 2013). In the same period, different legislative frameworks that provided models for financial support on different aspects of assistive technology since the world identified the importance of supporting the disabled people within the society.

General Effectiveness of Assistive Technologies

Goldrick et al. (2014) compared assistive technology with other learning interventions and argued that assistive technologies are crucial in helping disabled students in their progress towards their learning goals as outlined in the individualised educational plans. They further explain that assistive technology helps students with disabilities in two ways; to complete learning tasks and to overcome areas of learning difficulty. Abedi (2014) refers to the example of a student who decides to listen to a digital book and bypassing or better coping with difficulty in learning, like reading. When the student is exposed to a computer screen and the highlighted words read aloud, he or she has the chance of learning unfamiliar words. Assistive technologies are also helpful because they provide students with the opportunity to identify their mistakes since they use spell check to identify grammatical errors as opposed to hand editing (Abedi, 2014).

Varieties of Assistive Technologies and their Effectiveness

Parmelee (2014) refers to the example of computers and various tablet devices and explores how they are beneficial to students with disabilities. A classic example, according to Parmelee (2014), is the student who has writing difficulties who can take notes on a

computerized device like an iPad or a laptop; this has prospects for improving the quality and the quantity of the taken note. Bausch, Ault, and Hasselbring (2015) explained that using word processors help students in completing work in a more organized manner and as such, is advantageous since the taken notes will be free from errors otherwise common with the handwritten assignments.

Chen and Chung (2012) explored assistive technologies like the computerized-assisted instruction and defined this approach as the use of applications and software designed specifically for providing instructions as well as opportunities for learning practices on various devices like laptops, mobile phone technology, computer and iPad. Abedi (2014) referred to the effectiveness of the computer-assisted instructions by postulating that they provide immediate and dynamic feedback to learners, implying that students have the opportunity to benefit a great deal from the nonjudgmental computerized practice.

Goldrick et al. (2014) confirmed that there is enough evidence substantiating the effectiveness of computerized-instructions in helping students with compromised learning abilities especially on their expression and spelling skills because the particular learning software reduce distractibility. On the other hand, Lee (2014) noted across that the computerized instructions help students to learn how to read and as such improves their overall academic success or outcome. Chen and Chung (2012) argued that computerized-assisted instruction is the most effective approach to helping learners with compromised learning abilities especially math drill practices and referred to study results that confirmed that assistive technology helped the students to memorize the math more easily while developing positive attitudes towards the subject as opposed to the student who did not use the computer-assisted instructions.

Other literature referred to the software functions and how they help students. For instance, Chen and Chung (2012) posit that assistive technologies have the potential for improving the writing skills of learners with various disabilities because the technologies help them overcome the problem of practical writing. Reichle (2011) postulated that using grammar and spell check features helps students to put an emphasis on the communication of their ideas with the result that their confidence is boosted and their spelling will be checked, making it easy to identify the necessary changes. Assistive technology, according to Reichle (2011), is effective as it provides a student with the ability to submit assignments in an organised and neat way, which further improves their self-esteem.

According to Baker (2015), people barely pay attention to the usefulness of default functions of word processors despite being a major breakthrough for learners with disabilities. Functions like spell checks and the text-to-speech are useful in composing as well as decoding words. In particular, Baker (2015) referred to the effectiveness of assistive technology like text-to-speech that reads the printed or digital texts aloud, for example, the Kurzweil 3000 software. Reichle (2011) also supports that the invention is quite beneficial to learners with disabilities as it helps students to better decode meanings when the software reads unfamiliar words. Moreover, Reichle (2011) stated that text-to-speech software have positive impacts on word recognition and decoding, besides aiding in reading comprehension and fluency (Coleman, Kildare, Bell, & Carter, 2014). In addition, Baker (2015) supported that text-to-speech as an important assistive technology because it is useful for students who retain more information through the process of listening than when reading texts. Text-to-speech software helps students in monitoring and revising typed works because by hearing the text read aloud, a student catches the grammatical errors that may not be easy to notice in conventional learning (Coleman et al., 2014).

Coleman et al. (2014) reviewed some critical literature and reported the effectiveness of text-to-speech technology in improving the decoding abilities and sight-reading among students with learning disabilities. Baker (2015) supported the above statement by suggesting that the technology improves a student's reading comprehension especially if the student experiences phonological processing deficit because the individual learns to decode words when they have been read out aloud. Nonetheless, teachers have also established that assistive software, such as the Kurzweil 3000® improves students, perception of their work and ability to engage in expressive writing (Saraceno, 2013). On the other hand, Baker (2015) speculated that programs like the Kurzweil 3000 reduces the negative emotions that learners associate with reading thus providing students with a complete text comprehension. As Saraceno (2013) recommended, it is necessary to use text-to-speech programs alongside other research-supported intervention practices in helping students with reading difficulties.

Another equally important technology in helping students with learning disabilities that entails using low-level skills of transcription like spelling, handwriting, grammar besides high-level skills of composition including generating content, revising, and planning (Shadieff, Hwang, Chen, & Huang, 2014). Hwang, Shadieff, Kuo, and Chen (2012) defined speech-to-text assistive technology as the software that transcribes spoken words into computer text, enabling students to overcome challenges of typing words or having to engage in handwriting of texts resulting in the opportunity to compose longer and more complex stories with fewer errors. The challenge of speech recognition, according to Hwang et al. (2012), as an aspect of assistive technology is overcome by having the user improve over time, which might be frustrating to the learner. Nonetheless, Hwang et al. (2012) stated that speech-to-text software improves word recognition, reading comprehension and spelling especially for learners with disabilities. For

instance, Shadiev et al. (2014) carried out a study whose results indicated that the students whose essays had been dictated using speaking software sounded better and that better results were further achieved when the essays were dictated using a scribe. The findings of the study noted the potential benefits of technology in removing the barriers that disabled students experience in classroom contexts (Hwang et al., 2012).

The Required Support

It is important to prepare both students and teachers on the different approaches in utilising assistive technology before integrating such technology into the learning environment (Hwang et al., 2012). In support of the need for preparing teachers and students, Siu and Morash (2014) highlighted that training enhances efficiency of the technology when learning. Powell, Wallace and Wild (2013) emphasized the need for support during the implementation of assistive technology; for instance, integrating training as part of assistive technology services. They stated training may include a separate service from the technology providers aimed at supporting students with the special education program.

Siu and Morash (2014) referred to the extent to which teachers are integrating assistive technologies in their classroom and reported that teachers have confirmed the usefulness of assistive technology in helping students improve their writing and reading skills especially those with learning disabilities. Furthermore, the study reported that a considerable number of teachers believed that they are barely prepared for assistive technology while others are not comfortable with the technology due to lack of technological experience. Conversely, Powell et al. (2013) noted teachers' concern in that they were ill-equipped with the approaches to adopt when using assistive technologies when teaching. They further noted that only a small proportion

experienced problems integrating technology and the evaluation of its efficiency. Nonetheless, Courduff et al. (2014) suggested that although it is necessary to provide training to teachers and students on how to utilise technology, there is little knowledge on helping as well as supporting educators in gaining more knowledge and experience on how to effectively implement assistive technology in learning.

Siu and Morash (2014) suggested that effective implementation of assistive technology in the learning environment is best achieved if there is collaboration among stakeholders. In this regard, there is a need to involve all the faculty members involved in special education during the implementation of assistive technology. Shadieff et al. (2014) referred to the numerous benefits brought about by general collaboration of all faculty members of special education to the implementation of the assistive technology. The collaboration will ensure that special education teachers will teach and work with their general colleagues regarding how to use assistive technology. As all, the knowledge exchange is important for tutors to help in learning the best approaches to the effective implementation of the assistive technology. Coleman and Cramer (2015) also referred to a study that sought to highlight the importance of knowledge exchange between special program teachers and other general program teachers. The results indicated that the special program teachers taught the general program teachers how to use assistive technology while the general program teachers taught the former how to use multimedia in learning as an indication that collaboration is necessary for the effective implementation of any learning approach. Shadieff et al. (2014) recommended that there is also a need to use multimedia as an intervention approach to guiding teachers on how to effectively implement assistive technology, especially the use of videos and other instructive media to help educators incorporate assistive technology in their learning environment.

Hindrances to Achieving Efficiency in the Application of Assistive Technology

Funding and costs of assistive technology are a major hindrance to the successful implementation of assistive technology in learning, an indication that alternative technology can sometimes be too expensive and are prohibitive to individuals, institutions and trainers with financial constraints (Saraceno, 2013). Equally, the funding options for implementing assistive technology are seemingly locking out a section of learners. However, Abedi (2014) recommended an apt solution to the problem and suggested that the implementation would have been better if parents and teachers became aware of the importance of including assistive technology as part of Individualized Education Plan for the students. Nonetheless, Parmelee (2014) stated that various national laws compel the institutions to include assistive technology as part of learning provisions for students though the institutions never welcome such recommendations especially when it becomes too costly during the implementation stage. Other barriers to the successful implementation of assistive technology stem from the fact that most of the institutions do not consider that the devices should be acquired in time. Some institutions refute the presence of funding for assistive technology thus putting a financial constraint to parents who may not be in the best financial position to cover the expenses of such supports. (Parmelee, 2014). Katsioloudis and Jones (2013) suggested a practical solution to the cost barrier and recommended that learning institutions consider acquiring the low-cost assistive technology in the short run and replace with the expensive and effective assistive technologies later.

From the perspective of teachers or educators, a crucial challenge in the implementation of assistive technology is taking into consideration the needs of users as a crucial factor during computer-human interaction. Therefore, it is quite a challenge to implement use of assistive technology because most of designers of the technology barely address user-interface by

assuming that needs of users are similar. In this regard, Coleman and Cramer (2015) recommended that it is necessary to understand the needs of users as a prerequisite to providing the most effective assistive technology. Nonetheless, Bausch et al. (2015) highlighted the importance of considering the requirements and capacity of the users as the knowledge is useful in designing the best assistive technology for an individual with a particular learning impairment. Thus, the designers not only need to consider the functional ability of users but should also identify the social impacts or implications when using assistive technology. However, there is also a bigger challenge when a user of an assistive technology has various learning disabilities. In such circumstances, it becomes difficult for designers of the technology to devise the most appropriate assistive technology to meet the needs of the particular user. According to Katsioloudis and Jones (2013), a personalized approach may be necessary when assistive technology is designed specifically to meet the demands of particular learners with disabilities such as students with autism.

Katsioloudis and Jones (2013), stated that a major hindrance to the effective implementation of assistive technology in the learning environment exists because most institutions fail to provide opportunities for professional development for the teachers, families and the students. Edyburn (2013) confirmed that most of the special and general educators do not receive the necessary pre-service as well as in-service training they need for the effective implementation of assistive technology. Moreover, Katsioloudis and Jones (2013) confirmed that when the opportunities for professional development are provided, a major problem arises especially when the services entail providing too much information or in some instances, providing too little information spontaneously.

In addition, Saraceno (2013) reasoned that personal access to assistive technologies especially laptops and computerized devices are some of the major hindrances to the implementation of assistive technology since they reduce the level of engagement and as such, derail academic success. Borg et al. (2011) also inferred that laptops and other assistive technology like computerized devices are sometimes too distracting to students who may not be using the devices but are in the same classroom. Nonetheless, Lee (2014) identified this training gap as an hindrance to the implementation of assistive technology and suggested that there is the need to train students and teachers so that they can implement assistive technology or the devices in a manner that does not distract others during the learning period.

Chapter 3: Methodology

Research Approach

For this study, a mixed methods approach was employed as it would provide the opportunity to engage in a deeper exploration of assistive technology and the constructs being measured. The first phase was a qualitative questionnaire (similar to a structured interview) with subsequent quantitative analysis of themes extracted from that data.

Qualitative Questionnaire

Bryman (2012) defined qualitative research as an approach focusing on generating data about human groups within natural or social settings. The simplicity of a qualitative design informed its use and application in this study because, as Stuckey (2013) noted, a qualitative design does not lead to the introduction of treatments or manipulation of variables or the imposition of the operational definitions of the researcher on participants (or, at least, to a lesser degree than in a quantitative design). The qualitative research design lets the meanings emerge from the participants, and is more flexible and adjustable within the study setting. This includes the potential to adjust the tools, instruments, and methods for collecting data (Bryman, 2012). Therefore, given the open-ended and exploratory nature of the research questions, this study deemed a qualitative set of surveys questions to be more appropriate for seeking the views and perceptions of teachers about assistive technology.

The Glaserian Inductive Approach

The Glaserian grounded theory approach was employed. It is an inductive qualitative approach or methodology where the researcher identifies the inherent concerns of a group, and then uses inferences to describe the pressing concerns (Artinian, Giske & Cone, 2009). In return, the research expresses the understanding of the concerns of the individuals by adopting phrases

or words that express or capture the experience of the participants. For this study, the views and perceptions of the teachers regarding the use of assistive technology, the efficiency of that use, the needed support for that use, and their recommendations were explored. A key focus was the ability of assistive technology to be tailored to meeting the learning needs of the students with disabilities or other conditions. However, a concern for this approach is that the data needs to move from the descriptive level to a more conceptual level or approach that captures the recurring themes.

Quantitative Analysis

To better understand the emerging theme, simple descriptive statistics were used to summarize the views of participants within categories and general themes. Analyses were limited to the counts and percentage of responses. Percentages are more useful because they provide an inference to the expected percentage of the population that would share similar views.

Online Survey Questionnaire

An online survey questionnaire with 10 open-ended questions was developed for this study. The survey was completed anonymously, but some non-identifying demographic information was collected. An online questionnaire as a survey tool was preferred in this study for various reasons. For one, it provides respondents with the ability to provide their input at time of their convenience in a place of personal comfort (Bryman 2012). In addition, it is efficient in terms of time and resources. The survey would also lead to addressing the research goals, while its administration is easy and convenient because, in research, administration of the data collection process should not compromise the entire research process. However, major inhibiting factors for the use of questionnaires in general, include the issues of survey completion, response rate, and response bias (see Bryman, 2012, for more discussion). For example, an online survey,

even if open-ended, may not elicit the same level of detail that could be obtained in a face-to-face interview, which provides the opportunity to probe responses more deeply. Low response rates may be an issue because they imply that insufficient breadth of response has been obtained. As such, there is the concern that important information may be missed. Related to the issue of response rate there is response bias which is more of a concern. There is a question of *who* responds to an online survey – and whether or not those respondents fairly represent the population of interest. For example, the general population of interest may contain a vocal minority that does not truly represent the views of the silent majority. However, when compared with face-to-face interviews, an online questionnaire provides the opportunity to collect information from a larger sample. Thus, an online survey provides more breadth of input, at a slight cost of depth. An open-ended online survey seemed to be an appropriate compromise. The open-ended nature of the survey makes the survey similar to a structured interview (but lacking the ability to probe more deeply). An open-ended survey minimizes the impositions on participants, which enables more participants to provide input (i.e., increased sample size).

The questionnaire was open-ended and sent to the teachers completing a graduate degree in the education of learners with diverse and exceptional needs at MSVU. The questionnaire contained 10 items that could be grouped in to 4 sections. The most important items appeared first to ensure that the most important information was obtained in the first few minutes. Four items collected information about their use of, comfort with, awareness of, and the specific use with students with disability of various types of technology in supporting learners in classrooms (Use). Two items sought information about the perceptions of teachers on their readiness, preparation, and the extent to which they integrated various types of technologies to support learning (Utility). A set of three items gathered information about their knowledge of the

available supports (including professional development) and the barriers to their use of various types of technologies (Support). One additional item asked about the support that is needed (Support Needed). Finally, one item implored any recommendations useful for the government, teacher education programs and school boards regarding the use of assistive technology.

The questionnaire also contained 5 demographic items (gender, age range, educational background, years of experience, and teaching level). The questionnaire is provided in Table 1 (see also Appendix B: Research Questionnaire).

Table 1.
The Full Questionnaire, Organized by Sections.

Section	Item
Use	1-Tell me about some of the different types of technology you use in your teaching? 2-How would you describe your comfort level with using these types of technology? 3-While some technologies are used by most students and teachers, others have specific purposes. Please share with me your knowledge of different technologies, computer programs, or technology adaptations that can be used when working with students with learning disabilities or other conditions? 4-Have you used these different technologies when working with students with learning disabilities or other conditions? If yes, tell me how you felt about using these assistive and adaptive technologies.
Utility	5-Please share with me how students reacted to these different technologies, computer programs, or technology adaptations? 6-Overall, how would you describe the usefulness or impact these technologies and computer programs have had on students and their learning?
Support and Obstacles	7-Please tell me about the support you received that has helped you when using assistive technology in your classroom? 8-Please identify some of the obstacles that have hindered the successful use of assistive technology in your classroom?
Supports Needed	9- What supports do you feel should be in place to help teachers address the assistive technology needs of all students, as well as those with learning disabilities or other conditions?
Recommendations	10-What recommendations, relative to assistive technology, would you offer to school boards, government, and teacher education programs?
Demographics	What is your gender? (Female Male] What is your age? [age groups] Please List all Degrees Completed. Have MED Other Teaching Cert Teaching Experience: [years groups] Currently Teaching: [Secondary, Elementary]

Note that the responses to items are not (were not expected to be) mutually exclusive. For example, a response to Item 1 might overlap with a response to Item 2. Responses about

recommendations might mention technology not included in responses about awareness (Item 2). Information relevant to each research question was gleaned across all items.

Recruitment

For pragmatic reasons, the participation in this study was restricted to the current students enrolled in graduate education programs at MSVU that dealt with supporting learners with diverse needs and aptitudes. Graduate students in education at MSVU received emails inviting them to complete the online survey (see Appendix A: Recruitment Letter). There were two additional inclusion criteria. The study was restricted to those 21 years of age. This ensured that participants would have completed their undergraduate degrees. The second inclusion criterion required participants to have had prior experience teaching and contact with students with disabilities. An analysis of the demographics was conducted to ensure that the data was more-or-less representative of the teaching community. Questionnaires were completed anonymously and all responses were treated as confidential. However, given the nature of the sample pool, anonymity could not be guaranteed (i.e., the demographic information collected may have allowed the possible identification of participants). Nonetheless, the questionnaire itself was anonymous, which served to provide a measure of security for participants. In addition, the primary researcher did not have direct contact with participants. Rather, data collection was conducted within the auspices of the Faculty of Education at MSVU. Recruitment was limited to their distribution lists. A cover letter and the research questionnaire was sent by the department to all potential participants. The primary researcher did not have access to the confidential information contained in the distribution list. If they agreed to participate, the graduate student

anonymously completed the questionnaires on-line. Three repeated attempts were made to include all potential participants.

The Study Process/Data Collection Process

After obtaining research ethics approval, a permission to recruit was requested from the Faculty of Education, and then recruitment material was sent to potential participants. Participation was voluntary, and recruitment followed the principle of full disclosure. The purpose, approach, collection of data, risks and benefits, as well as the anticipated analysis were explained to participants. Indeed, given the nature of the sample and the questionnaire content, the participants would have been able to determine the purpose. However, once a participant completed and submitted the questionnaire, the information could not be changed, though they could withdraw from the study. Participants were provided with contact information should they desire to see the results or follow the progress. The research did not specifically collect any identifying information and confidentiality was assured. The Lime Survey software was used to conduct the online surveys. This is a professional package housed on servers in Canada. Privacy of the data was ensured by storing the data in a password-protected laptop. For the online survey, Lime Survey provides privacy (see <https://www.limesurvey.org/>) and the data was backed up to a password protected Dropbox account.

The Online Survey Questionnaires

Accompanying the request was a covering letter and research questionnaire to the current students in the graduate program, but restricted to their distribution lists. The approach was one of the many measures employed to provide for the confidentiality of the data, as the researcher

would not access the confidential information contained in the distribution list. Therefore, the graduate students anonymously completed the questionnaires on-line.

Participants

Care was taken to avoid any gender bias. The students were mainly chosen to comprise graduate students from various programs in Nova Scotia. In addition, to ensure validity, the inclusion criteria entailed recruiting participants who have had prior experience and contacts in teaching students with learning challenges.

For the final sample, there were 23 participants out of a possible 80: 19 females and 4 males. The sample was 82.6% female: However, after eliminating those that were not sufficiently complete, the sample was reduced to 15. For the 15, there were 12 females and 3 males. The sample was 80.0% female: This is a bit higher than that of the educational industry as a whole which is 74.2% (Statistics Canada, 2011 [National Household Survey]), but it did not deviate significantly from expected ($\chi^2(1) = 2.95, p < .086$). As such, it can be considered representative.

Of the 15, 10 (66.7%) participants taught at the elementary level and 5 (33.3%) taught at the secondary level. Table 1 presents the breakdown by age. The distribution is basically flat. Figure 1 presents the same information graphically.

Table 2.
Ages of Participants

Age Range	Number	Percent
21 to 30	5	33.3
31 to 40	4	26.7
41 to 50	5	33.3
> 50	1	6.7

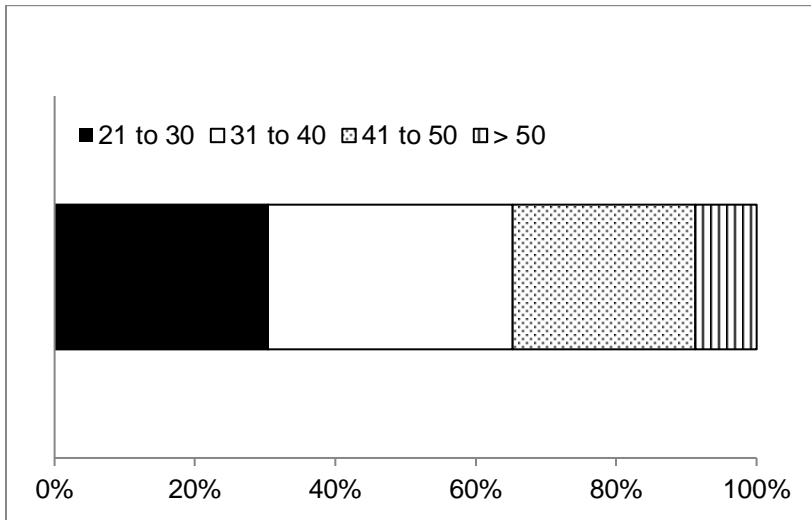


Figure 1: The distribution of ages.

Table 3 presents the breakdown by highest degree obtained. Participant reporting of educational background was somewhat heterogeneous. Given the recruitment, all participants had completed a Bed. Some mentioned this, others did not. Some detailed their current Med programs. Most (8) reported other undergraduate degrees (e.g. BA, BSc, one reported a “Grad D (technology)” – a graduate diploma in technology). The important observation is that, at the time of data collection, some had completed an M.Ed. The category MEd includes the Masters in Curriculum Studies. One individual reported completing a second M.Ed. Two participants reported a TESL certificate.

Table 3.
Highest Degree Obtained for Participants.

Degree	Number	Percent
Masters	4	26.7
Bed	11	73.3

Finally, Table 4 presents this breakdown by years of experience. The distribution is relatively flat, capturing the full range of experience. Figure 2 presents the distribution graphically.

Table 4:
Age of the Study Participants in yrs.

Experience (Yrs.)	Number	Percent
1 to 5	2	13.3
6 to 10	6	40.0
11 to 15	4	26.7
16 to 20	2	13.3
>20	1	6.7

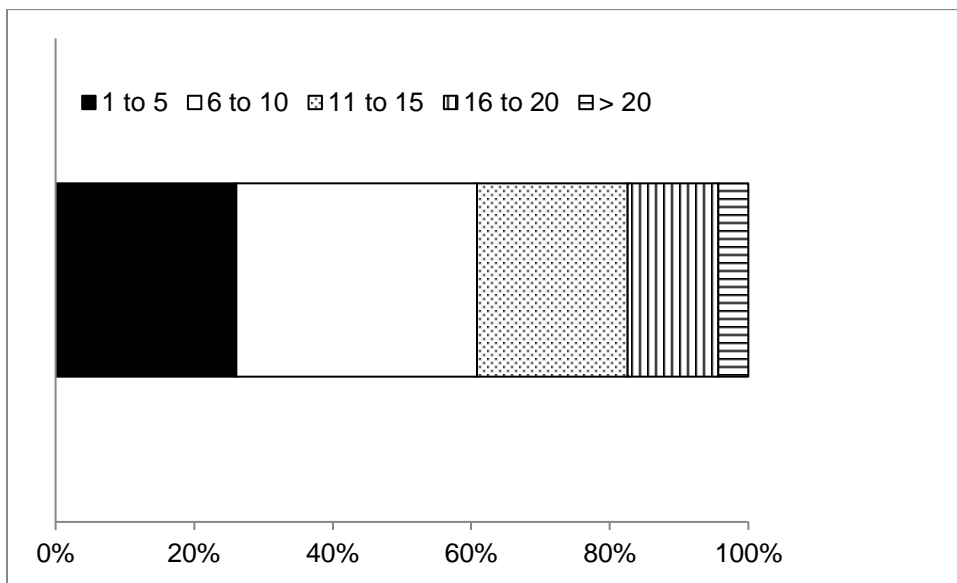


Figure 2: The distribution for experience

Relationships between the demographics were assessed using simple two-way χ^2 tests. However, due to the small sample size, for these analyses, Age was reduced to 2 levels (21–40 yrs. and > 40yrs) and Experience was reduced to 2 levels (≤ 10 yrs. and > 10 yrs). This was to

ensure that there were sufficient counts per cell. There was no relationship between Gender and Age ($\chi^2(1) = 3.444, p > .064$) or between Gender and Experience ($\chi^2(1) = 3.823, p < .051$) though some would call these “marginal”. There was no relationship between Gender and Degree ($\chi^2(1) = 0.085, p < .770$). However, there was a relationship between Gender and Teaching Level ($\chi^2(1) = 8.333, p < .044$). Thus we can assume that genders were appropriately distributed over age, degrees and experience, but all males were associated with the secondary school system. Age and Education were associated with $\chi^2(1) = 13.042 (p < .005)$, Age and Experience were associated with $\chi^2(1) = 4.861 (p < .027)$, and Age and Teaching Level were associated with $\chi^2(1) = 9.521, (p < .023)$. Education and Experience were not related with $\chi^2(1) = 3.823 (p < .051)$ though it was “marginal”, but Education and Teaching Level were with $\chi^2(1) = 4.545 (p < .033)$. Finally, Experience and Teaching Level were not related with $\chi^2(1) = 3.488 (p < .065)$. Generally, the pattern of associations is as would be expected for the given population. Hence, one can assume that the sample is representative.

Table 5.
Relations within Demographics.

	Gender	Age	Education	Experience	level
Gender	-	Marginal	ns	Marginal	Sig
Age		-	Sig		Sig
Education			-		Sig
Experience					Marginal
Level					-

Analysis

The Glaserian approach to qualitative analysis of the data was employed. The Glaserian approach is an inductive model that identifies patterns and then uses that information to arrive at the best recommendations for addressing the concerns (i.e., the use of assistive technology with

students with learning challenges). The inductive reasoning entails categorizing the responses into sets, and then drawing conclusions. A thematic coding was used, with each response being coded within multiple categories. The categories would provide the basis of sub-themes as the analysis proceeded.

For the current study, the responses to each item were transcribed. Then, for each item, the responses of the first participant were coded into categories. Thereafter, the responses of the second participant were coded. If the response of the second participant fit within the pre-existing categories it was coded as such. If the response of the second participant did not fit within the pre-existing categories, a new code was recreated. This process continued for all participants. The result was a list of codes for each item. In the main analysis, responses to each item were only associated with the item. However, there was some degree of overlap in the responses (e.g., Items 1, 3, and 4 all asked about knowledge of assistive technologies). This overlap is included in the general summary.

For a comprehensive analysis, the 10 items were then organized into themes including Use (4 items), Utility (2), Support and Obstacles (3 items), Support Needed (1 item), and Recommendations (1 item). Note that Support Needed serves in some sense, as a bridge between Support and Obstacles and Recommendations.

For each item, some basic descriptive statistics are provided (the number and percentage of participants endorsing each coded response) but the main analysis is qualitative. Representative quotes are provided to provide a more accurate sense of the themes. These are cited as P# where # could range from 1 to 27 because ID numbers in the final sample were not contiguous.

Chapter 4: Findings

In this section, the responses to each item are provided and discussed. Each item is, for the moment, treated in isolation. However, it must be noted (again) that the responses to different items could overlap. The creation of, and assignment of comments to, categories required a degree of assessment because the content had to be interpreted. For example, a response to Item 6 (“Overall, how would you describe the usefulness or impact these technologies and computer programs have had on students and their learning?”) could be a statement like “In this day and age you need to have technology built into your everyday lessons. For the most part it is beneficial to the students’ whole learning environment.” had to be coded in reference to a scale labeled as “Useful” or “Somewhat Useful” or “Not Useful”.

Technology Use

Item 1: Tell me about some of the different types of technology you use in your teaching? :

The participants’ use of technology was gleaned from Item 1 (see Table 6). Table 6 identifies the number and percentage of the respondents who indicated their familiarity with different technological devices. From the percentages, the findings showed that a large percentage of teachers were familiar with the use of the iPad and other tablets in classroom settings. In total, 66.7% of participants were aware of these devices. Following this, then next highest category was the 53.3% of the respondents who were well-versed with Google classroom. An almost equal percentage of respondents (46.7%) pointed out their familiarity with mimeograph and note book or computer. The use of the basic screen projector was also cited as a major technology used by the teachers (40%). Twenty percent indicated having used technologies like scanners or

cameras. Interestingly, about 20% of participants claimed to have “use everything” (encompassing all the available assistive learning technologies).

Table 6.
Number and Percentage of Teachers Indicating Their Use of Different Types of Technology in Teaching.

Category	Number	Percent
iPad or tablet	10	66.7
Interactive Web	2	13.3
Google docs	1	6.7
Google classroom or read, write	8	53.3
Mimeograph	7	46.7
personal website	1	6.7
personal website with feedback	1	6.7
screen projector	6	40.0
scanner/photocopier, doc camera	3	20.0
notebook, computer	7	46.7
Talktyper	1	6.7
"everything'	3	20.0
Kahoot ,	1	6.7
PowerSchool	1	6.7
Speech recognition, Dragon	1	6.7
PEC (picture exchange communication system)	1	6.7
Social Media	1	6.7
Translators	1	6.7

At the individual level, participants cited between 1 and 7 different type of assistive technology that they had used. The mean was 2.68 (SD: 2.08).

The results showed that teachers relatively few used technologies such as PowerSchool, Social Media, Translators, Kahoot, Talktyper, and the generic interactive web.

Item 2: How would you describe your comfort level with using these types of technology?

The survey also asked participants about their level of comfort when using assistive technology. Based on comments, the responses were coded as “not comfortable” (1), “little” (2),”medium” (3), “comfortable” (4), or ”very comfortable” (5). After coding, the mean level of comfort was

4.1 with the standard deviation at 0.8 (see Table 6 for the distribuion). The data implied that most participants are comfortable with the use, and that the range only dips to “medium”. No participant reported being uncomfortable with the technology, though one specifically stated “I am comfortable with what I am using but not so comfortable with other technologies available at my school; hence why I don't use them as often.” (P21).

Table 7.
Distribution of Comfort Levels.

Comfort Level	Number	Percent
no	0	0.0
a little	0	0.0
medium	4	26.7
comfortable	5	33.3
very comfortable	6	40.0

When responding to this item, a number of participants provided additional comments (see Table 8), particularly with regard to support. Two individuals (accounting for 13.3% of the respondents) stated, “I am comfortable, however, I would love more professional development on this or an index I could go to so I could quickly look up technology that would help my students. Instead I am constantly asking others and googling.” (P5), and “I ... could definitely use support with others to answer my questions.” (P19). The second major comment (13.3%) lamented the currency of the software as, for example, “... many schools do not have the money to purchase apps that cost money, usually we don't get the full license or version of certain technologies.” (P5), and “I ... would like to see access to technology within the last decade for more of the school.” (P26). Three participants (20% of the participants) indicated their willingness to try new technology: “Love to try new apps and devices and find the usefulness (or not!) for the classroom” (P16), and “Also willing to try anything new as along [sic] as it's

beneficial to the student” (P17), and “I ... became more comfortable from exploration and personal development after school hours” (P19).

Table 8.
Comments Associated with the Degree of Comfort.

Category	Number	Percent
cost and financial support	1	6.7
try new apps	3	20.0
seeking personal help	2	13.3
seeking online help	1	6.7
want more PD	1	6.7
not comfortable with “other” technology	1	6.7

Item 3: While some technologies are used by most students and teachers, others have specific purposes. Please share with me your knowledge of different technologies, computer programs, or technology adaptations that can be used when working with students with learning disabilities or other conditions?

Item 3 was about awareness, and not use per se (i.e., a teacher may be aware of technologies that they do not use and have never used). Table 9 shows some of the technologies that the participants identified could be used for the students with learning disabilities. Google read was the main technology identified by 40% of participants. Other technologies identified included text-to-voice, microphone, talk typer, iPad app, and speech-to-text. Other technologies like Google translate, Educational Web, IXL math, math app, talking calculators, non-electric, and Ed web were not cited as frequently. Note that Braille was only cited by one, but one would reasonably expect all to be aware of it. As such, participants are only likely reporting those that are most salient at the time of the survey. The actual awareness may be higher. Furthermore, it must be remembered that teachers work within a community that shares such knowledge. In this

regard, the results pointed to a myriad of technologies that teachers know are available for assisting learners with disabilities or other compromising conditions.

Table 9.
Knowledge of the Different Types of Technology that Could Be Used.

Category	Number	Percent
Speech to text	4	26.7
Google translate	1	6.7
text to voice	3	20.0
microphone	3	20.0
reading software	4	26.7
google, read write	6	40.0
Educational Web	2	13.3
Talk typer	3	20.0
Ipad App	3	20.0
IXL math, math App	1	6.7
Talking calculators	1	6.7
Braille note D	1	6.7
Non electronic	1	6.7
sensory Technology	2	13.3
Imprinters	2	13.3
Co- writet	2	13.3
Kurswel	1	6.7
ED Web	1	6.7

At the individual level, participants cited between 1 and 11 different type of assistive technologies that they were aware of. The mean was 2.32 (SD: 2.90).

As noted with Item 1, the familiarity of the participants with different assistive learning technologies implies that the lack of knowledge of what exists is not the major factor in their use, and that the current sample has some awareness of what is available to help students with learning disabilities.

Item 4: Have you used these different technologies when working with students with learning disabilities or other conditions? If yes, tell me how you felt about using these assistive and adaptive technologies.

The final ‘use’ question probed the respondents more deeply about their experience with using assistive technologies with students with disabilities. From the comments, a coding was generated using the categories of “Excellent”, “Good” “Minor Issues” “Minimal Use” and “No use” Note that there was no need for a category of “Bad” or “Poor”. First, 40% of the respondents confirmed that they had excellent experiences with the assistive technologies, with 20% agreeing to have ‘good’ experience with the technologies (Figure 3). This implies that 60% indicated that assistive technologies are effective in improving the teaching and learning experience. However, 13.3% reported no use of such technologies (considered insufficient to have an opinion). Two participants specifically commented, “I believe technology can help us unlock what the student knows as opposed to traditional methods that do not fit specific learning styles of our students” (P12) and “Students are much more engaged when using technology and it give them more independence having these tools to help them along the way” (P17).

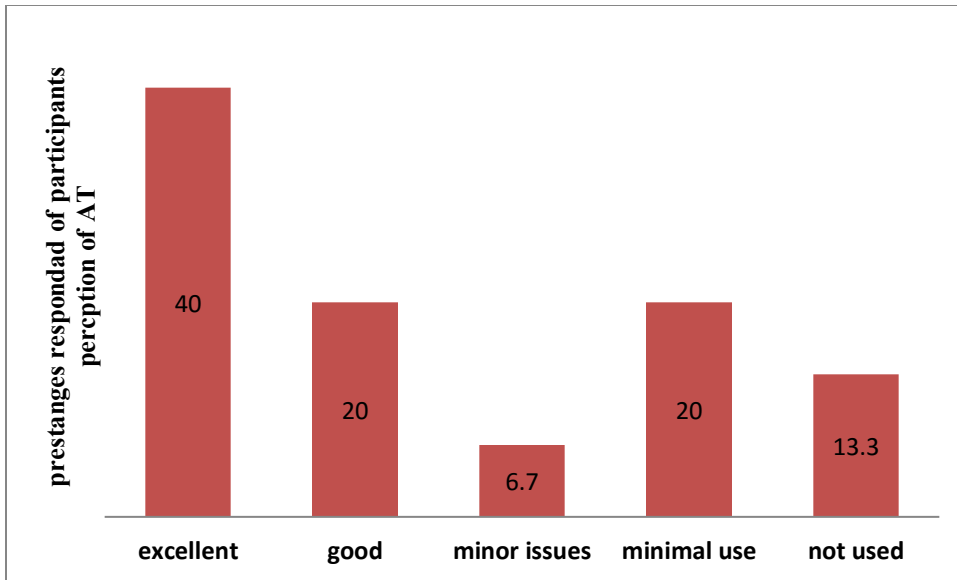


Figure 1: Participant Perceptions of “Assistive Technology”

However, though generally positive, two commented about the frustration around learning time: “... I have felt overwhelmed and frustrated with high tech programs that are unfamiliar to me... it takes many attempts and lots of exploration to become comfortable ...” (P19) and “Once introduced, and with a chance to practice/play with each, I was quite comfortable .. Unease over the unknown is a strong barrier to some people trying new technologies” (P16). One comment continued with the admonishment to be patient with students: “I feel, as educators, we need to be patient when exposing students to technology.” (P19). Again, the issue of stability was raised: “... Sometimes, I just get use to using one program and then there is another to replace it-- frustration comes to mind here.” (P19). Finally, there were comments to the effect that students are often quite comfortable with new technology: “ ... many students pick up programs naturally and can navigate through them quickly and efficiently.” (P19).

Usefulness

Two items probed the utility of assistive technology. The first focused on the (teachers' perceptions of the) students' experience and the second focused on the teachers' perceptions of utility.

Item 5: Please share with me how students reacted to these different technologies, computer programs, or technology adaptations?

Of the 15 participants, all who provided comments, 86.7% (or 13) stated that the students had a positive experience. No participant stated that students had a negative experience. In fact, nine participants (60%) specifically indicated that student like to use technology with comments such as “[students] felt positive towards them so they could keep up with their peers.” (P5), “It definitely helps with their finished product.” (P15) and “They feel better about themselves, it's more freedom for them as they feel they do not need one on one [sic] attention all the time. They feel more included with their classmates” (P17). However, there were some minor negative caveats layered on top of generally positive opinions such as the “... frustration getting Google R & W to work on computers not updated, and with the microphone” (P16) and “they [students] are often shy or insecure about using something that the majority of students in the classroom are not.” (P19).

Table 10.
Students' Reactions to these Different Technologies, Computer Programs, or Technology Adaptions

Category	Number	Percent
Positive reacted	13	86.7
Students like or engaged	9	60.0

Item 6: Overall, how would you describe the usefulness or impact these technologies and computer programs have had on students and their learning?

The teachers were also asked to comment on the usefulness of the technologies for students. Based on my interpretation of their comments, each participant was coded have the perception that AT was “useful”, “somewhat useful” or “not useful”. As Table 10 indicates, 87% ascertained the usefulness of the assistive technologies, confirming that the technologies are “useful”. Other categories in Table 11 reflect the specific comments of participants.

Table 11.
Teacher Comments on the Utility of Assistive Technologies, Converted to General Ratings

Category	Number	Percent
Useful	13	86.7
Somewhat Useful	1	6.7
Not Useful	0	0.0
useful in read, write	5	33.3
teacher benefit	2	13.3
student knowledge	4	26.7
student assessment	2	13.3
useful AT	4	26.7

One commented, “Some students would not be able to be in a classroom setting or progress their learning if it wasn't for technology.” (P5) and another stated, “All of these technologies have had positive impact on the students and their learning, but are most effective when supported in the regular classroom (when possible) and at home.” (P15). No one stated that the technology was not useful, although one individual commented “Only somewhat useful. Students often need support when using the technology. They are often not independently using it with proficiency which makes it difficult for the teacher to instruct others while supporting

those students.” (P19). That is, this individual had noted that the technology actually adds to the workload of the teacher.

Other comments implied that the technology was most useful in the reading and writing category (33%). The technology was also cited as useful because it benefited the teacher. For example, one wrote, “These technologies are crucial ... in order to do my job.” (P5), “Technology is very useful in helping teachers understand what they students know” (P10), and “Google Classroom ensures that every student can see exactly what they might have missed on any given day.” (P11). Many commented that such technologies are the norm or standard of society: “We are now in a technology age and most kids now have exposure to these technologies as toddlers. This is now their normal and not something foreign.” (P5), and “In this day and age you need to have technology built into your everyday lessons.” (P16). Table 8 provides a general summary.

Support and Obstacles

The current research aimed to capture teacher perceptions of the support that teachers receive when using assistive technology, especially support that has helped teachers to use assistive technology during the teaching sessions. As well, teachers were asked to identify the obstacles that have been encountered. In some sense, the lack of support creates obstacles. That is some obstacles are fundamentally created by a lack of sufficient resources to meet all demands (e.g., budgets are limited). On the other hand, obstacles may also be caused by a genuine lack of tools or knowledge to solve a problem (real obstacles). For example, before the invention of Braille, teaching the blind to read was impossible. There was no technology to do it. Finally, there is a third category: Obstacles may be created by the fact that the existing knowledge or power is not in the hands of those who need it.

Item 7: Please tell me about the support you received that has helped you when using assistive technology in your classroom?

Table 12 presents the general results. It is important to note that the most cited form of support is “self-support” at 40%. As well, a further 26.7% stated that they had no support. Self-support is really no support at all: Teachers depend on their self-efficacy in using technology. For example, two individuals commented, “I have attended [PD] days that have introduced me to certain assistive technology. However, it was daily use, exploration and collaboration with fellow users that abled me to deliver and teach the programs” (P19), “Sometimes it is trial by error of myself exploring apps, etc. :” (P5), “learned on my own through use in the classroom and at home.” (P6), “I have ... worked over lunch hours to develop my understanding of these programs” (P19) and “None really, I am self-taught ...” (P27). This raises a serious concern about the lack of support provided to teachers and the risks this entails for the use of technology.

Table 12.
Supports Identified by Participants.

Category	Number	Percent
Professional support	3	20.0
collegial support	2	13.3
self-support	6	40.0
school board support	2	13.3
school support	3	20.0
None	4	26.7
ATC: Assistive Technology Consultant	1	6.7
Minimal	1	6.7
PD (professional development)	2	13.3
Online resources	1	6.7

Other categories that were frequently cited (see Table 12) included school support (by 20%), school board support (by 13.3%), professional support (by 20.0%), collegial support (by

13.3%), and professional development support (by 13.3%). Note that none of the values are high implying no consistent source of support. Furthermore, as noted, 26.7% claim no support at all. Hence, the findings indicate that there is a *lack* of consistent support. Excluding self-support, the number of cited supports per participant ranged from 0 to 4 with a mean of just 0.95 (SD: 1.08).

Item 8: Please identify some of the obstacles that have hindered the successful use of assistive technology in your classroom?

Participants were also asked to identify some of the obstacles hindering the successful implementation of assistive technology in their respective classrooms. Table 13 shows the obstacles that the teachers identified. The main obstacles concerned limited access to devices (endorsed by 67.7% of participants), dated technology (cited by 26.7%), leaning time (cited by 33.3%) and training (cited by 20%).

Table 13:
Perceptions of Obstacles Encounter for the Use of Assistive Technology.

Category	Number	Percent
WIFI Connectivity	4	26.7
Access to the <i>working</i> devices	10	67.7
Dated Technology	4	26.7
Lack of Training	3	20.0
Limited Time to Learn	5	33.3
Class size	1	6.7
Funding	1	6.7
Student Issues	4	26.7

Comments about access included “Having access to an iPad for students/having an extra computer in the classroom” (P5), “Technology can often not work when you want it to.” (P12), “Sharing devices with colleagues.” (P13), “technology used by many different teacher returned broken or not plugged in the charge.” (P6), “The availability of the technology as there is not

enough in the school.” (P6), “The lack of the technology. 1 iPad for 22 kids. Chrome books are shared between 4 classrooms.” (P15), “making sure your classroom is set up for using technology” (P17), and “When technology does not work such as the internet being down or the site has been withdrawn.” (P26). Access to the internet was also a commonly cited problem (26.7%) with comments like “WIFI CONNECTION! This is a growing battle, connecting to the internet.” (P5) and “Slow or intermittent internet,” (P6). Comments about dated technology included “Out of date hardware that does not support the new apps.” (P16) and “old technology that will not recognize or run new apps.” (P25). Another related problem is funding (cited by 6.7%). Comments about training and or learning time included “Also knowledge and P.D. on the technology.” (P21) and “No teacher time to learn about the program from a professional” (P10). Having sufficient time to learn was a related concern cited by 46.7% of participants (e.g., “Too little time usually to get comfortable with it before using it with students.” [P16]). Note that more training would mitigate the need for more personal time to learn.

However, there were other issues as shown in Table 13. A general category was Student Issues which encompassed comments like “Students staying on track while using technology (not using a gaming app or looking up something else online)” (P5), “Students do not always want to look ‘different’. Sometimes hard to find ways around that.” (P16), “Students ability to type in passwords” (P19) and “lack of knowledge or independent ability of the students,” (P20). Having sufficient time to learn was cited by 46.7% of participants. Relative to class size, one participant commented, “Class size not conducive to one student using speech to text (too loud for mic to pick up only his voice)” (P16). Note that this is not class size per se but likely more of an issue of “crowding”. The number of cited obstacles per participant ranged from 0 to 4 with a mean of 1.43 (SD: 1.26).

The results point to the problems of availability (of modern equipment and the internet) and support. These are obstacles created by the current structures. A second is training and time to learn. Other issues revolve around student behavior.

Support needed

Central to this research was the identification of the types and levels of support needed to ensure that students and teachers are efficient or effective in the implementation of assistive technology.

Item 9: What supports do you feel should be in place to help teachers address the assistive technology needs of all students, as well as those with learning disabilities or other conditions?

Table 14 outlines the supports that were identified as needed. Training (73.3%) and access to sufficient quantities of modern working technology (40.0% for sufficient and 40.0% for new).

Table 14.
Participants’ Perceptions of Needed Support.

Category	Number	Percent
Training	11	73.3
Access to Sufficient Working Technology	6	40.0
New Technology	6	40.0
Time to Learn	4	26.7
Classroom support (more teachers, more technical support)	4	26.7
Funding	1	6.7

With respect to Training, the comments were quite direct such as, “Proper training” (P15), as well as “New technologies should be introduced with training” (P6), “a staff member on site to help train and support teachers and students” (P21), and “Lots of PD” (P26).

Comments about access included “making sure things are up to date” (P9). “There should be enough technology for each student to have what they need” (P21), “access/knowledge to

more programs that assist with cognition and development of ideas” (P13), “not old equipment that crashes when you try to use it!” (P16), “Newer technology to use rather than older computers, laptops etc. that freeze frequently.” (P20), and “New technology and lots of it!” (P25). Related to this is the issue of funding cited by one participant, “Again, funding is key and also making sure things are in place ahead of time. Not having to waiting months because then student will begin falling behind” (P17).

Technical and other support were commonly cited (26.7%) with comments like “In-servicing” (P10), “Schools need to operate learning centers devoted to assisting all needs, not just the most extreme.” (P16), “... be able to support the implementation.” (P16), “there should be a staff member on site to help train and support teachers and students using the technology” (P21), “More human resources in a room of 28-30 students; all having different levels of need.” (P16), “support teachers” (P19), and “More in class support from those trained specifically in the technology. Technology is great if you know what you are doing and if it works.” (P20).

Finally, time to learn and explore the technology was a commonly cited concern (26.7%), with comments like “Allow time for exploring the new technologies” (P16), “time to practice” (P20) and “opportunities to network with colleagues” (P26).

The number of supports needed that were cited per participant ranged from 0 to 4 with a mean of 1.63 (SD: 1.31).

It is important to note that the support needed largely mirror the obstacles encountered. However, there is more emphasis on training and less on the details of access to equipment (e.g., internet connectivity).

Recommendations

Finally, the research focused on some of the recommendations required for assistive technology directed to the school boards, teacher education programs and government.

Item 10: What recommendations, relative to assistive technology, would you offer to school boards, government, and teacher education programs?

From Table 15 it is clear that the main recommendation centered on Training (endorsed by 40.0%). Comments were similar to those cited previously. The other previously cited categories included Time to Learn (13.3%), Access to Modern Working Technology (33.3%), Internet Access (6.7%), Technical Support (13.3%), and Funding (20.0%). The amount of endorsement is similar to that of previous items. One participant summarized the issues nicely “Invest in the classrooms, make sure we are up to date with technology which can be hard because it's always changing but this is the way in which education is heading. Make sure teachers are qualified to properly use assistive technology and implement it into their lessons.” (P17).

Table 15:
Recommendations by Participants for System Improvements.

Category	Number	Percent
Equity	2	13.3
Training	6	40.0
Time to learn	2	13.3
Internet Connectivity	1	6.7
Access to Sufficient Modern Working Technology	5	33.3
Technical Support	2	13.3
Funding	3	20.0
Human Resources (Teachers EAs)	1	6.7
Assess Student Needs	1	6.7
Communication between Stakeholders (teachers, students, parents, others)	1	6.7

However, what emerged as a new theme was Equity Across Schools. One participant wrote “Schools should all have an equal chance to use these technologies. Schools are very unequal when it comes to resources and technology.” (P5), and another wrote, “Teachers are working [sic] with little [sic] to no access in many schools. I am in a priority school and these kids have almost no equipment for teachers to use assistive technology. It is disgraceful.” (P26).

A second new theme was “communication”. One participant wrote “I recommend getting to know students first before suggesting assistive technology and programming. I feel teachers need to work with students and have a chance talk, share information and ideas with parents and specialists. Communication between home, school and outside agencies is essential.” (P19).

Finally, on the issue of support, one participant noted, “If you want us to use it, more money needs to be spent in human resources - special education teachers, expand the duties of EA's to include academics and provide more Educational Assistants to support the full range of needs, and in the technology itself.” (P16).

Across the board, the number of recommendations cited per participant ranged from 0 (one participant stated “I am satisfied with our technology supports” [P12]) to 3 with a mean of 1.63 (SD: 1.31).

General Summary

Across all items, there were several general observations. First, there is general knowledge about technology and the degree of comfort with its use is moderate. There are issues, but the issues regarding use are manageable. For example, there is a recommendation that one must simply “dive in” and learn the tools.

There is a general perception that the technology is beneficial to students and that it is beneficial to the teachers. Again, there are minor issues such as the comments that students may feel shy, or not want to be seen as different.

However, the key problem cited repeatedly is the lack of support. In particular, there is a need for more training, more modern equipment, and improved stable internet access. Training or Time to Learn was cited by 14 of the 15 participants (93.3%) at one time or another (i.e., Items 8, 9 or 10). Issues with access to technology (including internet access) were cited by 13 (86.7%) at one time or another. Beyond that, the need for more staff, and more support staff, was cited by 5 (33.3%) participants at one time or another. Interesting, the need for more funding was only specifically mentioned by 3 (20.0%) participants (Table 15).

Chapter 5: Discussion

Use of Assistive Technology

The findings from the research confirm the prominence of assistive technology in the classroom learning environments. While the number of participants was small, the findings confirm how participants were well informed about the myriad of assistive technology available including iPad, tablets, google classroom, note book or computer, mimeograph, screen projector, scanners and cameras. The results align with the current literature evidence indicating that assistive technology is common in the modern classroom. For instance, the research findings on the use of assistive technology concur with Borg et al. (2011) as the authors refer to assistive technology as a term encompassing computerized and computer devices, including very low and high tech devices.

The present study also identified the assistive technologies with respect to their usability among students with learning disabilities. The research seemed to support the knowledge that assistive technology as used with students with learning disabilities is not restricted to a narrow range of technologies such as tablet applications, and computer programs like speech-to-text (Saraceno, 2013). Lancioni et al. (2012) referred to technology that has word prediction capabilities and graphic organizers as some of the common assistive technologies. Generally, assistive technology is widely used in the classroom learning contexts, especially with students experiencing learning disabilities.

Jerome Burner introduced the constructivism theory of learning supposing that learning is a process of active engagement between the teacher and the learner (Duffy & Jonassen, 2013). From the perspective of the participants in this study, assistive technology aligned with this theory because they create an environment that promotes healthy inclusive interaction, allowing

for the easy construction of meanings. Technology provides an active learning environment. As teachers engage directly with the students, there is practical learning. In this sense, the findings of this study leads to the supposition that assistive technology is useful for students with learning disabilities as they provide active learning and as such, enhance their construction of meaning.

The findings of the study also build on the existing knowledge about the availability and use of assistive technology. Participants indicated having used various technologies like Translators, Social Media, PowerSchool, Talk typer, Kahoot, and Interactive web-based learning among others. The level of familiarity confirmed by the subsequent research findings concurs with the assertion that assistive technology has become useful and common in the current educational and learning settings (Parmelee, 2014).

Nonetheless, educators and students have different levels of comfort in using assistive technology. For the level of expressed comfort, teachers are well conversant with using and applying assistive technology. However, the level of comfort differs among teachers because of the inherent gaps that need to be addressed through proper training. This study indicated that teachers seek different types of support such as online help while others would prefer professional development to improve their efficacy in using assistive technology. The findings reflected the knowledge in the current literature, especially supporting the suggestion that some teachers require assistance as they are barely prepared for handling the technologies (Siu & Morash, 2014). On the other hand, a larger percentage of the participants reported having no concerns or issues with using assistive technology in implementing and disseminating instruction. For this case, the results approve the inference that teachers and educators are experiencing least problems with integrating assistive technology in their classrooms and teaching contexts (Powell et al., 2013).

Different assistive technology for learners with disabilities has been documented and as such, an implication arising from the findings is that teachers have a lot of option in their quest for easy dissemination of instructions through technology. Participants in the study outlined the most common technologies they use with their students such as Google read, text-to-voice, talk-typer, iPad app, and speech-to-text. Equally important and vital technologies as confirmed by this research included Educational Web, Google translate, math app, IXL math, talking calculators and Ed web. Based on the current research, it is accurate to infer that there are varieties of assistive technology available for students with disabilities. Conversely, the findings link with the current available technologies including tablet devices, iPad, laptops, as their effectiveness lies in their portability (Parmelee, 2014). Technologies for word processors, speech-to-text and talk-to-speech are equally vital as assistive technologies (Bausch, Ault, & Hasselbring, 2015). In this regard, a major conclusion from the study is that varieties of assistive technology are available to help learners with disabilities. Thus, for educators, government, school boards, a major task is choosing the best and most appropriate technology that suits the particular learning context.

Most importantly, teachers and educators have different experiences with using assistive technologies. As the present study asserts, a greater percentage has excellent experiences in using assistive technologies with only a few experiencing problems in using and implementing the assistive technology (i.e., Item 5). Despite the concerns, the effectiveness of assistive learning technology stems from the enhancement of technical skills, like memorization of math skills and as such, aides in helping students to develop positive attitudes towards technical subjects in comparison (Chen & Chung, 2012).

Most important, there are different reasons as to why assistive technology are used with learners with disabilities. However, of great importance is the effectiveness that the technologies present when used alongside other instructional materials. For this study, the findings indicated that participants were largely receptive of assistive technologies. A larger percentage agreed to the effectiveness of assistive technologies (73%). In this regard, the study concluded that assistive technologies are effective with students because they have sound utility and when properly designed, presents the advantage of sound user experience. The positive perception that the participants have towards assistive technology is attributed to the benefits of using the technologies. The current study aligns with the argument that assistive technology invokes positive feedbacks from learners, as an implication that students are supported in the challenge of dealing with the judgmental traditional classroom contexts (Abedi, 2014). In addition, by noting the positive attitude and perception that participants have towards assistive learning technology, the study conforms to the general knowledge that computerized instructions help students with learning disabilities in self-expression and spelling skills (Goldrick et al., 2014).

The data gained from this study builds on the existing research that has confirmed that assistive technology improves writing skills for learners with physical impairment as they overcome the challenge of having to engage in practical writing (Chen & Chung, 2012). Support like grammar and spell checks that have boosted the confidence of students as with regards to spelling errors (Reichle, 2011). The effectiveness that assistive technologies like speech-to-text and text-to-speech provides spell Kurzweil 3000 software and the overall support for students (with learning disabilities) as they improve their reading, writing, decoding and technical skills (Coleman et al., 2014).

Support; Support for Teaching and the Needed Support

When using assistive technology, teachers and educators refer to different forms or sources of support to enhance their effectiveness and efficacy in applying the technologies. From the current research, a major insight was identified with regard to the support that teachers employ when using assistive technologies. A larger percentage of the participants reported that they relied on their self-support using and applying the technologies. In addition, the study indicated that while some obtained support from the school, the school board, other professionals, colleagues and ATC, others confirmed required limited support. From this evidence, the study confirms to the necessity of support when using assistive technologies. The findings of this study reflect the current literature that faults the education sector for its failure to provide the necessary support to teachers when implementing assistive technology. Specifically, the findings confirm the inference that little attention has been directed towards supporting teachers in disseminating instructions when using assistive technologies (Powell, Wallace, & Wild, 2013). The larger percentage of participants who depend on self-support shows how there has been limited emphasis and attention towards ensuring collaboration when implementing technology in the learning environment. A lot has also been documented in the current literature as with regard to the necessity for collaboration with the stakeholders in the education sector. Some of the respondents indicated seeking support from the school boards, professionals and other colleagues. In this sense, the study adds to the current and existing research that argues for the implementation of a collaborative or an all-inclusive framework when using assistive technology (Siu & Morash, 2014).

A notable aspect or fact about the findings is that some of the participants go for online help, seek professional advice, or consult new apps or technology when using the current assistive technology. In retrospect, this information conforms to this suggestion as Powell et al. (2013) argued that teachers have been concerned about their preparation and being ill equipped to use technology.

Equally important is the needed support that teachers recommended as necessary when using assistive technologies. From this study, the participants identified various areas that require support including training, professional development, knowledge support, enough technological equipment or device support and human resource. A larger percentage of the respondents indicated that training is necessary for effective implementation of assistive technology. In this regard, the findings build on the knowledge and recommendations on the necessity of training.

Training should not be restricted to teachers, as students should be equally supported to embrace the different technologies before such is integrated into the learning environments. Although this study did not explore the importance and reasons why training is necessary, training is argued to be essential in enhancing the efficiency in using technology during teaching (Siu & Morash, 2014). As Powell et al. (2013) pointed out, providing the training services should be done separately from the actual technological services. Therefore, since the study recommends the need for training, it is equally imperative and necessary for schools to acquire training services after acquiring the technological services.

Another important provision when implementing or adopting assistive technology is the provision of modest and updated technologies. Current technology like multimedia services has become common in most of the learning environments to supplement the current assistive technology (Powell et al., 2013). These research findings recommended the necessity of using

modest intervention approaches or guidelines like multimedia. These the results align with the current recommendation that intervention approaches like multimedia are useful in guiding teachers on how they can effectively implement technology in learning (Shadiev et al., 2014).

Effective or sufficient professional support is equally necessary for the effective implementation of assistive technology. These findings seem to align with the recommendation on the necessity to ensure sound collaboration among faculty members, especially for the special education (Shadiev et al., 2014). Collaboration or professional support ensures that knowledge exchange exists, as the special education teachers exchange experiences, efficacy and help others on how to implement some of the assistive technologies including effective approaches for using the technology in teaching. In addition, the current study pointed towards the necessity for knowledge exchange among special program teachers thereby improving the efficacy in implementing learning approaches as pertaining to assistive technology (Coleman & Cramer, 2015).

Obstacles to Adopting Assistive Technology

Despite the success of assistive technology in improving the ability and capability of learners with disabilities, numerous obstacles were noted by the participants regarding their ease of use, accessibility, training, and internet connectivity. In addition, the study found that problems like limited knowledge, class size, and the ease of use, and funding are equally impeding the successful implementation of assistive technologies.

Funding or cost has been a major drawback in implementing assistive technology. Although the results from the current study do not identify the main reasons behind costs as a major impediment, it suggests otherwise that the expensive nature of the technology lock out many individuals, trainers and institutions, as argued by (Saraceno, 2013). Costs are broad and

extensive and as such, may include such considerations as the implementation costs. Although the research does not identify the approaches to addressing such a challenge, Abedi (2014) asserted that integrating assistive technology, as part of the individualized education plan would be useful in overcoming the cost constraints. Another strategy to help with cost could be to establish national laws compelling the inclusion of assistive technology in the curriculum (Parmelee, 2014). Conversely, low-cost assistive technologies would also address the cost constraints (Katsioloudis & Jones, 2013).

As identified in the current research, most of the participants noted excluded of or limited knowledge or experience in technology. In retrospect, the challenge is attributed to the failure of the developers of the technology to consider computer-human interaction as a factor and as such, develop product with friendly user-interface. Hence, with the challenge of limited knowledge on use, it is imperative to acquire assistive technologies that align with the needs and user experience or expectations of both students and teaches (Coleman & Cramer, 2015). A major consideration should be on the acquisition of personalized assistive technologies (Katsioloudis & Jones, 2013).

From the participants, limited or lack of professional development was equally cited as a major hindrance or impediment towards the effective implementation of assistive technologies. In this context, the study pointed to the fact that professional development is equally an imperative factor and a necessity in implementing assistive technologies. The study confirmed the current proposition that for most learning institutions, limited opportunities for teachers to develop their professional capabilities and efficacy in using assistive technology is majorly impeding their effectiveness in using or implementing assistive technologies (Katsioloudis & Jones, 2013).

Limited or lack of training hinders the use of assistive technology. As the current study confirms, a larger percentage of the participants identified lack of training as a major factor while also recommending training as being vital when using assistive technology. Therefore, the study identified special educators receive limited pre-service and in-service training necessary for the effective use of assistive technologies (Edyburn, 2013). In this respect, the study pointed to the necessity to engage in detailed training, and providing special program teachers with the much-needed knowledge on how to use and integrate assistive technologies in their lessons.

The study confirmed that a larger percentage agreed to have problems with accessing technological devices necessary for teaching. These findings concurred with Saraceno (2013) who argued that challenges with the personal accessibility to technology tended to reduce the level of engagement among students and teachers while at the same time derailing academic success. The distractibility of some technological devices like laptops have been identified as detrimental to adopting assistive technology, more so when a section of students is using them while others are not.

Recommendations

From the research, the participants identified some of the vital recommendations to improve the adoption of assistive technology. A major recommendation from this study is on training as the participants indicated this was vital in the successful implementation of assistive learning technology. Sourcing for new technologies also was equally imperative because teachers and students need to keep up to date with the current developments as well as advancements in assistive technology to improve their knowledge. The study also identified a new and important information that warrants further consideration; internet connectivity.

Implications of the Research and Conclusions

The research has some profound implications. For one, it contributes to the existing studies concerning the best methods and approaches to implementing assistive technology. Of great importance is that the study found it compelling to integrate assistive technology in the education curriculum especially for students experience learning disabilities or impairments. A major part of the research focused on identifying teacher perception on using assistive technologies for learners with disabilities. A classic example has been given on the need for professional development to improve the way teachers interact with the technology. In addition, a gap has been identified in the sourcing and resource allocation for the technology devices. Therefore, the study has shed some light on resource gap as some educators have limited chances or choices for assistive technologies thereby compromising their efficacy of using the technology. The study has also implied that assistive technologies bring about profound benefits to students.

The study also has policy implications for schools, stakeholders and the government. Part of the recommendations from the teachers is that collaboration is particularly beneficial to effective implementation of assistive technology. Therefore, the study is informative for schools and the government regarding the necessity to collaborate to implement assistive technologies. For instance, schools can use the findings from this research to cultivate collaborative work environments whereby special education teachers exchange knowledge and experience on using assistive technologies. As the research highlights, some of the teachers seek help from others and this professional reference is essential for enhancing their efficacy in using assistive technology. In addition, for school boards and governments, proper funding and allocation of technological devices and services have been identified as crucial when using assistive technologies. Hence,

the study implies that policy formulation and strategies should be put in place to ensure proper funding and resource allocation to improve the application of assistive technology on students with learning disabilities. Moreover, the study has implications concerning the necessity to provide training and professional development.

Another implication for future research is the need to explore better ways of implementing assistive technology. The information collected herein can inform future research on the development of a sound framework for implementing assistive technology. In addition, some of the concerns of teachers and students have outlined regarding the use and perception or reception of assistive technology (e.g., increased workload for teachers; making a student feel different).

Limitations of the study

The current study was not devoid of drawbacks, as common to most studies. Online questionnaires were used for collecting information and these may have had an impact on response rates and depth of information shared by participants. In retrospect, the preferred approach might have been to conduct interviews or focus groups to enable deeper insights and understanding of the perspectives of teachers. In addition, current findings were based on a sample from one location and as such, might not generalize to all teachers. Online questionnaires were used for collecting information and these may have somehow impacted response rates and depth of information shared by participants. In retrospect, the preferred approach might have been to conduct interviews or focus groups to enable deeper insights and understanding of the perspectives of teachers.

Recommendations for future research

For future research, it will be imperative to outline how best to provide an integrated approach to implementing assistive technology in learning. The integrative approach should consider the collaboration of all stakeholders including teachers, governments and school boards. The implication is that obstacles like lack of training, limited knowledge and experience, cost or funding constrains are better addressed when an all-inclusive approach is adopted when implementing assistive technology in learning. Future research should also explore the perceptions of students, especially the best technologies that suit their needs and as such, ensure that that a subject approach is used in studying the effective of assistive technology on learners with disabilities.

Conclusion

The study showed that educators are receptive of assistive technology in their classrooms. In this case, assistive technology improves the dissemination of instructions, enhances communication between teachers and students, and at best, serves as an enabler for better learning outcomes for students. Secondly, teachers commended the positive perception that students have of assistive technology as the devices have aided them in improving vital skills like writing, reading, and math. Thirdly, a myriad of technology exists for learners with disabilities including speech-to-text, text-to-speech, iPad, scanners, photocopiers, notebook, PowerSchool, speech recognition, picture exchange systems, and translators among others. Implementation of assistive technology benefits from a variety of devices, applications and programs that teachers can use on students with disabilities.

Fourth, despite the availability of the devices, teachers are still faced with the challenge of support, as the study outlined that most of them get support from themselves or largely, fellow professionals. Training and professional development are needed, especially creating a work environment where teachers exchange knowledge and ideas concerning how they can use and implement assistive technology.

Finally, technology is a dynamic field with new development emerging each day and educators are required to adapt to the new changes and development to enhance their efficacy in using and implementing technology in their teaching. Sufficient resources in the form of technological devices are necessary to support improved opportunities for all.

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Appendix A: Recruitment letter

Dear Student,

My name is Eman Alaltheeb, and I am currently enrolled in the Master of Arts (Curriculum Studies) program at MSVU. As part of my degree requirements, I am conducting research exploring teacher's awareness, knowledge and use of various types of technology to support learners in their classrooms. The findings should have practical implications for teachers working with diverse learners and should result in recommendations for improved supports, practices and policies particularly in school boards, government and teacher education facilities.

I am requesting that you click on the link below and complete the attached questionnaire. The Research Questionnaire contains a few demographic items such as age range, gender, education, and teaching experience as well as some opened-ended questions on participants' perceptions of their comfort, knowledge, and use of technologies for their students. Other questions deal with the additional supports, professional development and/or aspects that may have limited/assisted with their use of the different types of technology available to them. Estimated time for completion is 20-30 minutes.

Participation in this research is completely voluntary. You do not have to answer any questions that cause you discomfort. All information will be anonymous and no identifying information will be required on any measure. The focus is on group results. The data will be collected and stored on a password protected computer. To allow time for dissemination of the information through conference presentations and published articles, the electronic data will be backed-up in a password-protected Dropbox account and kept for five years following the thesis defense. After five years, Dropbox account will be deleted from the computer.

If you choose to participate in this research, please complete the following survey. If you choose not to participate, just disregard the email. The process should take approximately 20-30 minutes. A summary of the results of this study will be sent to all students initially contacted.

Please remember that completion of the enclosed Research Questionnaire indicates that you have consented to participate in this research. As questionnaires are completed anonymously, there is no way for the researcher to identify individual questionnaires, so they cannot be withdrawn.

Should you have any further questions regarding this study, please contact me, at my email or my thesis supervisor, Dr. Frederick French, email. If you have any questions regarding how this study is being conducted, you may contact the University Research Ethics Board (UREB) c/o MSVU Research and International office via e-mail at research@msvu.ca

Thank you for considering my research project. If you are willing to participate, please click on the following link (link to questionnaire)

Appendix B: Research Questionnaire

Please answer the following questions. You do not have to answer any question which causes you discomfort.

Gender:

Female

Male

Other

Age in Years:

21-30

31-40

41-50

>50

Education:

List all Degrees Completed

Teaching Experience:

1-5 years

6-10 years

11-15 years

16-20 years

>20

Currently Teaching:

Elementary

Secondary

Open-Ended Questions

1. Tell me about some of the different types of technology you use in your teaching.
2. How would you describe your comfort level with using these types of technology?
3. While some technologies are used by most students and teachers, other have specific purposes. Please share with me your knowledge of different technologies, computer programs, or technology adaptations that can be used when working with students with learning disabilities or other conditions.
4. Have you used these different technologies when working with students with learning disabilities or other conditions? If yes, tell me how you felt about using these assistive and adaptive technologies.
5. Please share with me how students reacted to these different technologies, computer programs, or technology adaptations?
6. Overall, how would you describe the usefulness or impact these technologies and computer programs have had on students and their learning?
7. Please tell me about the support you received that has helped you when using assistive technology in your classroom.
8. Please identify some of the obstacles that have hindered the successful use of assistive technology in your classroom?
9. What supports do you feel should be in place to help teachers address the assistive technology needs of all students, as well as those with learning disabilities or other conditions?
10. What recommendations, relative to assistive technology, would you offer to school boards, government, and teacher education programs?