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Teacher Use of Assistive Technology for Students with High Incidence Disabilities in Small Rural Schools

Heather Wood
Walden University

Walden University

COLLEGE OF EDUCATION

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Heather Wood

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Dr. Michael Jazzar, Committee Chairperson, Education Faculty
Dr. Susan Koyzis, Committee Member, Education Faculty
Dr. Paul Englesberg, University Reviewer, Education Faculty

Chief Academic Officer

Eric Riedel, Ph.D.

Walden University
2015

Abstract

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Heather B. Wood

MA, Plymouth State University, 2000

BA, University of Colorado, 1997

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

A significant achievement gap between students with disabilities and their peers without disabilities has led to increased inclusion of students with disabilities in the general education classroom. Assistive technology (AT) has the potential to improve access to the curriculum for students with high-incidence disabilities. Teachers are challenged with learning about, recommending, and implementing AT; yet little is known about how teachers in New Hampshire use AT or the needs for professional development (PD) in AT utilization. The purpose of this intrinsic case study was to understand how teachers in small rural New Hampshire schools utilized AT with students with high-incidence disabilities and teachers' needs for PD in AT use. Data were collected via semistructured interviews of 5 general and 5 special education teachers from 6 small rural middle and high schools. Using levels of AT literacy as a conceptual framework, data were coded and analyzed to identify common themes. Findings showed that teacher awareness and working knowledge of AT varied. Independent use of AT in reading and writing provided access to the general curriculum, allowing students to be included with their peers. Teachers reported wanting to learn more about the AT available and how to universally integrate AT into the general classroom. Findings informed the design of PD workshops and a learning network created to improve teacher knowledge and skills in AT integration. This study has the potential to decrease the achievement gap by improving access to the general curriculum for students with disabilities through improved teacher use of AT.

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Dedication

I would like to dedicate this project study to my mother. Thank you, Mom, for your unwavering support and friendship throughout my life. I appreciate your patience and encouragement while I worked on completing my doctorate degree. You have played a large role in helping me and my family to achieve our goals.

I would also like to dedicate this project study to Kate. I am so proud of the young lady you have become. I hope that my educational journey is an inspiration for you. You have a bright future ahead, and with hard work and dedication, you can achieve anything! I love you with all my heart.

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Thank you, Matt, for encouraging me to begin this process and standing by my side, supporting me throughout the entire journey. I hope I can offer you the same. You are a soul mate and I am so fortunate to have you as a comrade personally and professionally.

I would also like to thank my committee chair, Dr. Michael Jazzar, my second committee member, Dr. Susan Koyzis, and my university research reviewer, Dr. Paul Englesberg, for your advice and support. I appreciate you all being readily available to offer guidance.

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Section 1: The Problem

Introduction

This project study sought to better understand how teachers use assistive technology (AT) with students with high-incidence disabilities in small rural schools in New Hampshire and the AT professional development needs of teachers. This section describes the local problem including its rationale and significance in the context of the larger educational setting. A review of the current literature regarding teacher use of AT is also described. The problem, research question, and conceptual framework described guided the development of this qualitative case study. The methodology and results are described in Section 2. Section 3 describes the development of a professional development project based on the findings of the study and Section 4 includes reflections and conclusions. The complete professional development project can be found in Appendix A.

Definition of the Problem

In the United States, 13% of the school age population is identified as having a disability, and there is a significant achievement gap between students with disabilities and their peers without disabilities (U.S. Department of Education, National Center for Education Statistics, 2013). This gap can be seen in standardized test scores as well as graduation, college enrollment, and employment rates (McLaughlin, 2010; Newman et al., 2011; Wei, Lenx, & Blackorby, 2012). In working to close this gap, federal lawmakers have put in place a series of laws designed to ensure that students with disabilities have access to opportunities to reach the same level of achievement as their

nondisabled peers. The No Child Left Behind Act of 2001 held schools accountable for assuring students with disabilities participated and made adequate progress in the general education curriculum and the Individuals with Disabilities Education Improvement Act (IDEA) of 2004 guaranteed every child with a disability a free and appropriate education in the least restrictive environment. As a result, students with high-incidence disabilities such as attention deficit hyperactivity disorder, speech and language disabilities, and specific learning disabilities are now included in the general education classroom where they are expected to meet the same curriculum standards as their nondisabled peers (McLeskey, Landers, Hoppey, & Williamson, 2011).

Despite being included in the general education classroom, many students with disabilities lack the skills needed to access the general curriculum and encounter unique challenges and barriers. On the 2013 8th grade National Assessment of Educational Progress (NAEP) reading assessment, only 9% of students with disabilities scored proficient or above, and 61% scored at a below basic level (National Center for Educational Statistics, 2013). These students who lack basic reading skills often struggle to read and comprehend content area texts, making it difficult to access the general content curriculum. On the 2011 NAEP writing assessment, only 5% of students with disabilities scored proficient or above, and 60% scored at a below basic level (National Center for Educational Statistics, 2011). These students who lack basic writing skills have difficulty expressing their knowledge and understanding in writing. Educators are faced with the challenge of finding ways to support and meet the needs of students with high-incidence disabilities within the general education classroom and curriculum.

By compensating for a lack of skill that could otherwise inhibit participation in learning activities, AT can provide a vehicle for students with high-incidence disabilities to access and function independently within the general curriculum (Messinger-Willman & Marino, 2010). For example, text-to-speech software can provide a means to compensate for print disabilities allowing students who struggle with reading to access the same textbooks as their nondisabled peers. Speech-to-text software can provide a means to compensate for writing disabilities allowing students to express their ideas in writing. Recent advances in both hardware and software have resulted in more AT options such as screen readers, voice recognition, word prediction, and study skill software that are more readily available, versatile, mobile, commonplace, affordable, and user-friendly than previous options that often required expensive and socially stigmatizing devices (Berkeley & Lindstrom, 2011; Bouck, Shurr, et al., 2012; Douglas, Wojciik, & Thompson, 2012). When appropriately integrated into the general education classroom, these devices and software have the potential to provide means to compensate for a variety of high-incidence disabilities, reducing barriers to learning, enhancing access to the general education curriculum, improving the achievement of students with disabilities, and ultimately reducing the achievement gap between students with disabilities and their peers without disabilities.

The IDEA (2004) requires Individualized Education Plan (IEP) teams to "consider whether the child needs assistive technology devices and services" in the "development, review, and revision" of IEPs for every student with an identified disability (§§ 300.324). This means that IEP teams are required by law to consider

whether each child with a disability needs AT devices and services at least annually as part of the IEP review process. The IDEA (2004) defined AT devices as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability" (§§ 300.5). Schools are also responsible for providing AT services for those students who need them. The IDEA (2004) defined AT services as "any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device" (§§ 300.6) and includes evaluation, equipment acquisition and personalization, service coordination, and training for the child and professionals who work with the child. Because the law mandates that AT be considered for every student with a disability, including those with high-incidence disabilities, it is essential that educators have the expertise in AT devices and services necessary to make informed decisions and effectively integrate AT into the classroom.

The state of New Hampshire is comprised of many small rural schools (Johnson, Showalter, Klein, & Lester, 2014). Due to their small size, these schools are unlikely to employ AT specialists; however, they still need to comply with the laws requiring consideration of AT for every child with a disability and the provision of AT devices and services. When faced with the challenge of planning AT services for students with low-incidence disabilities (rare disabilities accounting for less than 1% such as blindness or significant developmental delay), many small rural schools will contract external professionals for help (Ault, Bausch, & McLaren, 2013); however, when making decisions regarding AT for students with high-incidence disabilities (more common

disabilities such as learning disabilities or speech and language impairments), small rural schools in New Hampshire usually rely on in-house expertise. In small rural schools that do not employ AT specialists, general and special education teachers are responsible for learning about, recommending, and implementing AT.

Researchers have shown that students in small and rural districts tend to use fewer AT devices compared to all students, suggesting that teachers in these districts may not be providing opportunities for students with high-incidence disabilities to utilize AT (Ault et al., 2013; Davis, Barnard-Brak, & Arredondo, 2013). Researchers have found that teachers report not having the knowledge and skills to effectively recommend and implement AT (Alkahtani, 2013; Ribeiro & Moreira, 2010). The rapid development of technology places a significant demand on both general and special education teachers to continuously learn about new devices, software, and applications in order to effectively select, acquire, implement, and integrate AT. Special and general education teachers in small rural schools in New Hampshire need to have a working knowledge of the range of AT. However, little is known about how teachers in small rural schools in New Hampshire learn about, recommend, and implement AT for students with high-incidence disabilities or the AT professional development needs of teachers.

This study focuses on the population of general and special education teachers currently working at small rural middle or high schools in New Hampshire. These schools have an enrollment fewer than 600 and are located in an area defined as rural (U.S. Department of Education, 2013). The racial diversity of students in New Hampshire is limited, with 88% of students White, 4.9% Hispanic, 3.1% Asian or Pacific

Islander, 1.9% Black, Non-Hispanic, 1.9% Multi-race, and 0.3% Native American or Alaskan Native (New Hampshire Department of Education, 2014d). Only 1.5% of students are limited in English proficiency (New Hampshire Department of Education, 2014e) and 28.7% of students are eligible for free or reduced lunch (New Hampshire Department of Education, 2014b). Over 15% of school-aged children in New Hampshire are identified as having a disability (New Hampshire Department of Education, 2012b) and the vast majority of those have high-incidence disabilities. In 2013, 9,943 children in New Hampshire were identified as having a specific learning disability, accounting for just over one-third of all disabled school-aged children (New Hampshire Department of Education, 2013).

While 42.2% of New Hampshire teachers have bachelor's degrees, 56.5% have master's degrees, and 1% of teachers have a postgraduate degree (New Hampshire Department of Education, 2014a), higher levels of education do not ensure that teachers have the necessary skills and knowledge to effectively utilize AT. Minimal data have been collected regarding teacher use of AT in New Hampshire, and that which has been collected suggests that teacher use is minimal (Hazel Associates, 2010; Stanley Freeda, personal communication, February 24, 2014). In her experiences working with schools throughout the state, Diana Petschauer, a certified AT professional, has found that general education teachers often don't have a lot of knowledge of AT. She has found that teachers often don't recognize the AT needs of students with high-incidence disabilities until they see the technology demonstrated and realize how it can provide support to struggling students (personal communication, January 17, 2014). Mary Lane, an

education consultant of the New Hampshire Bureau of Special Education, specializing in accessible materials and technical assistance, has been working to "get the word out there" to schools regarding AT and universal design for learning (UDL) and wants to know more about the current knowledge and professional development needs of educators (personal communication, July 31, 2014).

The problem in small rural schools in New Hampshire is that little is known about how teachers use AT with students with high-incidence disabilities or the professional development teachers need in order to use AT more effectively. A better understanding of how teachers learn about, recommend, implement, and integrate AT and the AT professional development needs of teachers may help to inform professional development. Professional development can lead to changes in teacher practice (Bellanca, 2009). An increase in teacher knowledge and skill in integrating AT may result in improved access to the general education curriculum for students with high-incidence disabilities, ultimately decreasing the achievement gap.

Rationale

Evidence of the Problem at the Local Level

The achievement gap between students with disabilities and their nondisabled peers is apparent in New Hampshire state data as well as national data. On the 2013 statewide achievement assessment, 35% of students with disabilities scored proficient or above on the reading assessment, while 85% of students without disabilities scored proficient or above. On the mathematics assessment, 20% of students with disabilities scored proficient or above compared to 73% of students without disabilities, and on the

writing assessment, 14% of students with disabilities scored proficient or above compared to 65% of students without disabilities (New England Common Assessment Program, 2013). While the New Hampshire statewide graduation rate was 86%, the graduation rate of students identified with disabilities was only 69% (New Hampshire Department of Education, 2012a). With this significant achievement gap between students with disabilities and those without, it is important that teachers consider how to improve access and achievement for students with disabilities within the general education classroom.

Recent changes in educational policies have resulted in a greater emphasis on students with high-incidence disabilities being included in the general education classroom and meeting the curriculum standards (McLeskey et al., 2011). In 2012, 73% of students with IEPs in New Hampshire were educated in the regular class for 80% or more of the day. Only 8% were in the regular class for less than 40% of the day. New Hampshire administers an annual assessment designed to measure whether students have met the grade level standards and 98% of students with IEPs participated in this statewide assessment (New Hampshire Department of Education, 2014c). As the state of New Hampshire implements the Common Core State Standards, which call for an increase in text complexity (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010b), it is especially important to consider whether students have equal access to content area texts without AT such as text-to-speech applications. The Common Core State Standards explicitly acknowledge that students with disabilities may need additional supports such as AT devices and services in order to

access and participate successfully in the general education curriculum (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010a). Recognizing the value of AT, the Smarter Balanced Assessment Consortium has designed assessments of the Common Core State Standards that allow students with disabilities to use AT such as spell check, color contrast, text to speech, and speech-to-text during testing (Smarter Balanced Assessment Consortium, 2014). These AT accommodations need to be utilized by students who benefit from them not only on annual assessments but during learning activities embedded in the general curriculum throughout the year.

In an inclusive classroom, both special and general education teachers work with students with disabilities and need to be able to integrate AT into their instruction; however, minimal data have been collected regarding teacher knowledge and use of AT in New Hampshire. Likewise, little is known about the professional development New Hampshire teachers need in order to effectively use AT with students with high-incidence disabilities. In a state-wide evaluation of the New Hampshire Elementary and Secondary Education Act Title II Grant, fewer than 10% of teachers surveyed reported having used AT applications in their instruction with students (Hazel Associates, 2010). This number is surprisingly low considering most teachers work with students with high-incidence disabilities who are included in the general education classroom (McCaffrey& Buzick, 2014). This raises the question of whether teachers are aware of the AT options available and if teachers have the skills and knowledge necessary to recommend and implement AT.

The New Hampshire Department of Education does not collect any data on teacher use of AT (M. Lane, personal communication, February 27, 2014). Recognizing that individuals with disabilities who may need AT do not always know about it or how to request it, the US grant funded New Hampshire Protection and Advocacy for Assistive Technology (PAAT) program has made it a priority to advocate for ensuring availability of AT devices and services to children and adults who require them (Rehabilitation Services Administration, 2013). The PAAT program identified another priority issue: Inadequate or inappropriate policies and practices often result in the denial of AT services in New Hampshire. Although researchers have examined the AT practices and needs of teachers in small rural schools in other states (Ault et al., 2013; Davis et al., 2013), a review of the literature revealed no such studies conducted in the state of New Hampshire.

With increased inclusion, higher standards, and rapidly developing technology, it is a key time to explore how AT is being used with students with high-incidence disabilities in today's classrooms of small rural New Hampshire schools and the AT professional development needs of teachers. Due to their small size, rural schools in New Hampshire often have to share resources. Investigating the AT practices of teachers in multiple schools as opposed to a single school may provide insight into how educators can share AT resources and engage in collaborative professional learning. This study explores and describes teachers' common experiences and professional development needs regarding the use of AT with students with high-incidence disabilities in small rural schools in New Hampshire.

Evidence of the Problem from the Professional Literature

Researchers have found that teacher use of AT with students with high-incidence disabilities is minimal (Bouck, Maeda, & Flanagan, 2012; Flanagan, Bouck, & Richardson, 2013). In a survey of general and special education teachers from different geographical regions, Alkahtani (2013) found that 94% reported not using or requesting an AT evaluation for their students, and less than 2% of teachers reported being adequately prepared to provide AT services. Many researchers have found that teachers tend to lack expertise in AT (Alkahtani, 2013; Bausch, Quinn, Chung, Ault, & Behrmann, 2009; Flanagan et al., 2013; Okolo & Diedrich, 2014; Ribeiro & Moreira, 2010). With limited access to AT specialists, teachers in small rural schools may face unique challenges in delivering appropriate AT services to students with high-incidence disabilities.

Ault et al. (2013) analyzed data collected from ten states in the National Assistive Technology Research Institute's Status of AT Use Survey and State Case Study to investigate AT service delivery in rural school districts. Rural schools tend to face unique challenges (Sutton, Bausmith, O'Connor, Pae, & Payne, 2014). Ault et al. found that students in rural schools used significantly fewer devices per student compared to students in all districts. Meeting notes from rural districts showed that AT specialists were present at only 18% of IEP meetings, and AT decisions were led primarily by special educators who felt they had only moderate levels of AT knowledge and expertise. Teachers discussed the lack of teacher training as a barrier to using AT with students who needed it. While 9% of teachers identified training, particularly from AT specialists, to

be a strength, 31% reported needing more training on devices available and how the devices could be used. Lack of funding and time to explore and work with AT were also identified as barriers. The authors described a need for future research on AT service delivery in rural schools and recommended finding ways to increase accessible AT professional development for teachers in rural areas.

In a study of AT decision-making and implementation practices in Texas, Davis et al. (2013) found that rural locations had an indirect effect on AT implementation due to lack of training, limited access to devices, and lack of collaboration with expert practitioners. They found enrollment size and locale to be significant predictors of AT use with small rural schools tending to use fewer devices than larger urban and suburban schools. Assistive technology specialists were reported as the least frequently included member of IEP teams when making AT decisions in rural schools. Sibon-Macarro et al. (2014) also found that rural schools lacked access to trained AT specialists partly due to the long distances required to travel. With a scarcity of AT professionals and lack of expertise on IEP teams, Davis et al. found that decisions were most commonly based on the user-friendliness and previous experience with devices. The authors noted that relying on personal experience in a rapidly changing field may result in IEP teams overlooking the most appropriate AT solutions. In discussion of their findings, the authors noted that future research should identify practices of other states and explore challenges unique to rural districts.

Minimal reported use of AT (Hazel Associates, 2010) suggests that teachers in small rural schools in New Hampshire may be faced with similar challenges. The

purpose of this study was to better understand how teachers in small, rural, New Hampshire schools are using AT with students with high-incidence disabilities and the professional development teachers need in order to more effectively implement AT.

Definitions

Assistive technology device: any item that is used to help an individual with a disability to function (IDEA, 2004, §§ 300.5).

Assistive technology service: any service that helps an individual with a disability to select, access, or use AT including evaluation of student needs, device acquisition and maintenance, and training for both the student and professionals (IDEA, 2004, §§ 300.6).

High-incidence disabilities: for the purpose of this study, high-incidence disabilities include emotional and/or behavioral disorders, learning disabilities, mild intellectual disabilities, high-functioning autism, attention-deficit disorder, and speech and language impairment (Gage, Lierheimer, & Goran, 2012).

Low-incidence disabilities: low-incidence disabilities are those that generally do not exceed 1% of the school-aged population at any given time and include disabilities such as blindness, deafness, multiple disability, and significant developmental delay among others (National Center on Accessible Instructional Materials, 2010).

Small rural school: for the purpose of this study, a school will be considered small and rural if it has fewer than 600 students and is located in a school district with an urban-centric locale code identified as rural by the National Center for Education Statistics (U.S. Department of Education, 2014).

Universal design for learning (UDL): a framework for meeting the needs of all learners, both those with disabilities and those without, by allowing for various means of presenting information, representing knowledge, and engaging in learning (Higher Education Opportunity Act, 2008, § 103a, 24).

Significance

This study sought to better understand how teachers use AT with students with high-incidence disabilities in small rural New Hampshire schools and the professional development teachers need in order to use AT more effectively with this population of students. By adding to the AT knowledge base, this study has the potential to inform professional development, resulting in improved professional practice and access to the general education curriculum for students with high-incidence disabilities, ultimately decreasing the achievement gap between students with disabilities and their peers without disabilities. The challenges and barriers encountered in the general education classroom by students with disabilities can lead to frustration, low self-esteem, and lack of motivation (Messinger-Willman & Marino, 2010; Meyer & Bouck, 2014). Students with learning disabilities are less likely to attend college and more likely to drop out compared to their peers without disabilities (Newman et al., 2011). Nationwide assessments continue to show a significant achievement gap between students with disabilities and those without (National Center for Educational Statistics, 2013). Technology exists that has the potential to help students compensate for their disabilities, thus reducing barriers to access and resulting in greater independence and achievement, but little is known about if and how teachers are using these technologies with students with high-incidence

disabilities in New Hampshire or the professional development teachers need in order to use AT more effectively.

Teachers in small rural schools in New Hampshire are placed in situations where they are expected to recommend and implement AT for students with high-incidence disabilities, yet they may lack the knowledge, skills, and/or resources necessary to do so effectively. With little understanding of how teachers in small rural schools in New Hampshire are using AT with students with high-incidence disabilities, it is difficult to address the situation. It was important to collect data exploring how teachers in small rural schools in New Hampshire use AT and the AT professional development needs of teachers. Identification of gaps in practice and professional development needs related to AT use may help administrators, institutes of higher education, and organizations to provide appropriate resources, professional development, and support networks to improve practice. As a result of this study, both special and general education teachers may gain a better understanding of the possibilities and issues associated with AT use, stimulating interest in further learning. Results of this study have the potential to inform improvements in the way New Hampshire teachers learn about, recommend, access, and implement AT to improve inclusive learning opportunities resulting in academic, social, and long-term benefits for students with high-incidence disabilities.

Guiding/Research Questions

AT has the potential to help reduce the achievement gap by providing students with a means to compensate for disabilities and improving access to the general curriculum for students with high-incidence disabilities, yet little is known about the AT

use and professional development needs of teachers in small rural schools in New Hampshire. Researchers have found that a number of factors can impact teacher use of AT including device cost, access, and ease of use and teacher awareness, knowledge, experience, and training (Bouck & Joshi, 2012; Davis et al., 2013; Flanagan et al., 2013). Although some states have investigated teacher perceptions, practices, and needs regarding AT use, New Hampshire has collected minimal data regarding how teachers learn about, recommend, and implement AT. A better understanding of how teachers in small rural schools in New Hampshire use AT with students with high-incidence disabilities and the professional development teachers need in order to more effectively use AT may help to improve teacher practice. Improvements in teacher use of AT with students with high-incidence disabilities in small rural schools in New Hampshire may help to reduce the achievement gap between students with disabilities and their peers without disabilities.

Open-ended research questions guided the study while remaining open to what emerged from the data (Bogdan & Biklen, 2006). Subquestions helped to further focus inquiry (Stake, 1995). In alignment with the research problem and purpose, the following guiding research questions were posed:

1. How do teachers use assistive technology with students with high-incidence disabilities in small rural schools in New Hampshire?
2. What professional development do New Hampshire teachers need in order to more effectively use AT with students with high-incidence disabilities?

Aligned with Edyburn's (2003) levels of literacy as described in the next section, the following subquestions help to answer these two guiding questions:

- To what extent are teachers aware of the potential uses of AT with students with high-incidence disabilities?
- What are teachers' experiences with using AT with students with high incidence disabilities?
- How do teachers learn about AT?
- How do teachers make decisions regarding the usage of AT?
- How do teachers integrate AT into the classroom?

Review of the Literature

Introduction

The following section is a review of the literature as it relates to the use of AT with students with high-incidence disabilities. In the first part, cognitive load theory is described as a theoretical framework for understanding the effects of AT, and levels of AT literacy are described as a conceptual framework for understanding teachers' knowledge and skills in AT use. The next part provides a comprehensive review of current scholarly literature specifically and broadly related to the problem and research questions including teacher awareness, use, training, decision-making practices, and classroom integration of AT. Search engines and databases including Google Scholar, EBSCO Host, ProQuest, SAGE journals, ERIC, and Educational Research Complete were used to locate and access scholarly writings published within the last 5 years using search terms including assistive technology, self-help devices for people with disabilities,

and accessible instructional materials as well as related terms such as high-incidence disabilities, learning disabilities, text-to-speech, speech-to-text, and broader terms including technology integration, inclusion, and special education technology. The literature was reviewed and critically analyzed until saturation was reached. The information was then synthesized and organized it into themes and concepts influencing teacher use of AT. The following literature review describes the current scholarly conversation regarding teacher professional development in and use of AT with students with high-incidence disabilities.

Theoretical/Conceptual Framework

Sweller's (1988) cognitive load theory provides a framework for understanding the effects of AT (Paas, van Gog, & Sweller, 2010). According to Sweller's theory, an individual's working memory is limited. This has implications for instructional design in that when new information is presented in a manner that overloads one's limited cognitive resources, learning does not occur (Chandler & Sweller, 1992; Paas & Ayres, 2014). As students develop basic reading skills, the lower-level cognitive process of decoding text becomes automatic and more cognitive resources are available for the higher-level skill of comprehending (Kendeou, Broek, Helder, & Karlsson, 2014). Students with weak basic reading skills may reach their cognitive capacity decoding words and may not have enough working memory available to comprehend what they read. When students are able to use AT to listen to text instead of (or while) reading print, they can utilize their working memory to comprehend. Used in this manner, AT can free up the working memory during learning by eliminating the need to perform tasks

that are not yet automatic (Marino, 2009). Speech-to-text and word prediction software can assist students while writing, eliminating the need to focus on spelling. These are only a few examples of how technology can be used to lighten cognitive load during learning tasks.

Built upon Sweller's (1988) cognitive load theory, Mayer's (2009) cognitive theory of multimedia learning suggests that instructional materials should be designed to limit extraneous processing, manage essential processing, and foster generative processing. When considering if AT can reduce cognitive load, educators must take into account the student's abilities and the cognitive demands of the task at hand. The student, environment, task, and tools framework (SETT) developed by Zabala (1995), is widely used to inform collaborative decision-making regarding AT (Bouk, Flanagan, Miller, & Bassette, 2012). This framework is built on the premise that the student, the environment, and the tasks required to be an active participant in the learning environment need to be considered along with potential tools when planning for and implementing appropriate AT services. In order to recommend and consider AT, educators need to understand the curriculum demands and the student and need to be well versed in cognitive load theory and AT literacy.

Applying theories of change and models of adoption of innovation, Edyburn (2003) described three levels of the change process teachers go through in developing AT literacy (Jost & Mosley, 2011). This process begins by gaining awareness of the possibilities and ends for most with a working knowledge of the technology. For some, their thinking and behavior will be fundamentally transformed allowing for seamless

integration of AT into the general education classroom. The lowest level, awareness, involves understanding the possibilities of AT and an interest in learning about AT. This includes:

- recognizing performance problems
- understanding AT policy
- distinguishing between AT devices and services
- having hands-on experience using AT
- knowing how to access AT devices, services, resources, and expertise

Before teachers can recognize the potential of AT, they must recognize student performance problems such as how particular tasks may present a barrier by demanding excessive levels of cognitive processing. Teachers need to understand and comply with policy regarding AT devices and services. Teachers benefit from having hands-on experience with AT in order to understand how it can be used within the curriculum. In order to continue learning about how new technologies can meet the needs of students, teachers need to know where to go to access devices and information.

Those at a working knowledge level are able to assume responsibility for AT decision-making by engaging in the process of AT recommendation, consideration, evaluation, and location (Edyburn, 2003). Maintaining a working knowledge of classroom applications requires an ongoing commitment to learning about new technologies. The highest level of AT literacy involves transformation of one's thinking and behaviors. Transformation may include advocating for accessibility for all, measuring the benefits of AT, and employing universal design for learning (UDL).

Edyburn's levels of AT literacy provide a conceptual framework for describing teachers' knowledge and skills in AT use.

Current Research Literature

Awareness of assistive technology possibilities. Assistive technologies have the potential to improve access to the general curriculum by providing students with the means to compensate for difficulties caused by disabilities. Students with deficiencies in reading, writing, and listening comprehension are at a disadvantage when attempting to learn in the traditional middle and high school content area classroom. Adolescents have been found to benefit from technologies that assist with reading, note taking, organization, spelling, and writing, allowing students to focus on engaging in higher level thinking and problem solving (Boyle, 2012; Chiang & Liu, 2011; Dunn, 2011; Horney et al., 2009; Izzo, Yurick & McArrell, 2009; Lange, Mulhern, &Wylie, 2009; McClanahan, Williams, Kennedy & Tate, 2012; Simmons & Carpenter, 2010; Wollak & Koppenhaver, 2011). By assisting with tasks that are not automatic for the learner, AT can streamline the learning process allowing students to focus on the goals of the learning task (Marino, 2009). For example, text-to-speech software reads digital text aloud in computer-generated natural-sounding voices while the words are highlighted on the screen. This type of software provides independent and efficient access to grade level texts for students with learning disabilities, improving their comprehension (Floyd & Judge, 2012; Meyer & Bouck, 2014). Today's generation of K-12 students have grown up in a world embedded with technology and when AT is naturally embedded into the reading curriculum, all readers can be empowered and achieve independence (Ruffin, 2012).

Providing students with poor spelling ability with both supplemental evidence-based spelling instruction and AT enables them to convey their ideas in writing without being hindered by spelling (Simmons & Carpenter, 2010). Barnard-Brak, Thompson, Wei, and Richman (2014) found that students with autism spectrum disorders who had access to assistive technology were more likely to participate in general assessments as opposed to alternate assessments. Assistive technology can also serve as an intervention helping students to meet IEP goals (Watson, Ito, Smith & Andersen, 2010).

While there is evidence that students with high-incidence disabilities benefit from using technologies to compensate for difficulties and capitalize on strengths, research on AT is limited (Batorowicz, Missiuna, & Pollok, 2012; Edyburn, 2013). One of the reasons for this is the rapid development of software. By the time a study of the effectiveness is conducted and published, the software is often out of date. New software and applications are continuously being designed to perform particular tasks, allowing for a reduction in the cognitive load for students with disabilities. The research base regarding the effectiveness of AT has not kept up with the rapid growth and development of these technologies (Peterson-Karlan, 2011). Some may argue that without empirical evidence that meets evidence-based practice demands of the No Child Left Behind (2002), teachers should not be using AT (Dalton & Roush, 2010). Bouck and Joshi (2012) discussed a "technology implementation paradox" (Parette, Peterson-Karlan, Smith, Gray, & Silver-Pacuilla, 2006, p. 20) in that without teachers implementing technology, it will not be possible to build the needed research base. Dalton and Roush (2010) argued that although the evidence base is limited in scope and rigor, this is not a

reason to discount technology and teachers need to use the most rigorous evidence available to inform their practice.

Researchers have suggested that access to AT may have a long-term impact on the success of students with high-incidence disabilities including positive post-secondary outcomes. Bouck, Maeda, et al. (2012) analyzed data from the National Longitudinal Transition Study-2 comparing the postsecondary outcomes of students with high-incidence disabilities who reported receiving AT in high school to those who reported not receiving AT. Of those students who received AT, 99.8% graduated while only 79.6% of those who did not receive AT graduated. 80.9% of students who received AT attended a postsecondary institution while only 40.1% of students who did not receive AT attended. 80% of those who received AT had a paying job after high school while only 50.8% of those who did not receive AT had a paying job. However, only 7.8% of students with high-incidence disabilities reported receiving AT in high school. This percentage is surprisingly low considering the potential benefits.

Unlike some physical disabilities, the cognitive difficulties experienced by students with high-incidence disabilities are not highly visible and it is possible that teachers are not aware of the struggles and barriers students encounter. In an attempt to increase teacher awareness of the difficulties encountered by students with dyslexia, Passig (2011) used virtual reality to simulate the experience of trying to read with dyslexia and found it was more effective in improving teacher awareness than simply watching a video about dyslexia. In a survey of 19 education professionals enrolled in a master's degree in special education program, Ribeiro and Moreira (2010) found that

100% of teachers surveyed believed that technology could contribute to full inclusion by helping students to overcome obstacles imposed by learning disabilities. Although 89% believed that AT had the potential to increase motivation and participation for students with learning disabilities, teachers felt they lacked the skills to take advantage of this potential. Jost and Mosley (2011) found different perspectives in their survey of 224 pre-service and in-service teachers when 23% of the educators reported believing that AT had "little or no potential to provide access to the curriculum" (p. 9). They attributed a lack of teacher use of AT to the fact that teachers were rarely exposed to a variety of AT. It is possible that teachers are not even aware of the AT options that exist, and even when teachers are aware of the technology, they tend to have a low level of working knowledge (Jost & Mosley, 2011).

Teacher experience using assistive technology. Despite the potential for AT to provide students with high-incidence disabilities with access to the general curriculum, teacher use of AT is minimal (Bouck, Maeda, et al., 2012; Flanagan et al., 2013). In a survey of 127 general and special education teachers from different geographical regions, Alkahtani (2013) found that 93.7% do not use AT or consider AT when planning IEPs. In analyzing the results of an AT use survey administered to 60 school districts across 14 states, Quinn et al. (2009) found that few students with high-incidence disabilities participated in the study thus raising the question of whether AT is being considered for these students. This and the fact that 40.47% of the participants received services in a self-contained setting raised the concern that AT may not be readily available to students in the general education classroom.

In a survey of middle school special education teachers from 61 different schools in a Midwestern state who were responsible for teaching literacy to 7th grade students with high-incidence disabilities, Flanagan et al. (2013) found that the AT commonly reported in the literature as being effective such as screen readers, word prediction, and text-to-speech software were most often reported as never used. Teachers reported that their own knowledge and prior experiences determined how effectively AT was used in instruction. Kurth and Keegan (2014) looked at how 31 special and general education teachers from California and Arizona adapted instruction for students with disabilities who were included in the general education classroom. They found that AT was one of the least used adaptations with 67% of teachers having never used it while the two most frequently used adaptations were lowering reading levels and reducing the length of an assignment. Using a questionnaire to evaluate the AT skills, knowledge, and practices of 42 special education professionals, Marsters (2011) found that current AT practices did not meet quality indicators for assistive technology (QIAT) recommendations, and educators reported not having the necessary depth of knowledge or skills in AT.

Learning about assistive technology. Alkahtani (2013) found 75% of the 127 general and special education teachers surveyed reported being poorly prepared and 18% reported being not at all prepared to provide AT services for students in their school. Less than 2% reported being adequately prepared. In a survey of 19 special education professionals, Ribeiro and Moreira (2010) found that only 5.3% of teachers felt they had the ICT skills necessary to respond to the needs of students with special needs. In an analysis of AT policy documents from ten states, Bausch et al. (2009) found that five

states acknowledged that school personnel lacked expertise. Researchers have found that teachers perceive AT to be an effective support for students with high incidence disabilities, but they lack training in types of AT and how to use AT in instruction (Flanagan et al., 2013). Nevertheless, teachers have a high degree of interest in learning about AT (Jost & Mosley, 2011; Okolo & Diedrich, 2014).

Teachers who took college level courses in AT reported higher levels of AT knowledge and use (Bell, Cihak, & Judge, 2010; Van Laarhoven & Conderman, 2011). Yet in a national study of special education teacher preparation programs, Judge and Simms (2009) found that only one-third of undergraduate and less than a quarter of master's degree special education teacher licensure programs required AT coursework. Ribeiro and Moreira (2010) found that 84% of teachers surveyed had no AT training. Alkahtani (2013) found that 93% of teachers surveyed reported never having attended a workshop or training on AT yet 84% were very interested in receiving professional development in AT. Even if teachers have extensive pre-service training in AT, the development of technology demands ongoing in-service training.

Recognizing teacher training as a barrier to AT integration, Puckett, Judge, and Brozo (2009) established a summer professional development institute to train teachers in the integration of AT into content literacy. Despite the short duration, participants in this institute found the hands-on and collaborative format of the training to be beneficial in that it increased their AT awareness, knowledge, confidence, and intentions of use. Providing AT professional development can be especially challenging in rural areas as most teachers do not want to drive over an hour, and there is a lack of access to devices

for trial and assessment (Davis et al., 2013; Keramidas & Collins, 2009). It is often up to teachers to seek out AT training and this requires time outside of instruction. Teachers may not want to commit their personal or instructional time to learning about technologies that may not be available in their school yet and that have the potential to benefit only a small number of students. In a survey of 1,143 Michigan educators, Okolo and Diedrich (2014) found staff knowledge to be the top barrier to more widespread use of AT, followed by access to technology, funding, and implementation issues. The number of trainings attended by teachers has been found to be significantly related to teachers' ability to choose and implement AT (Flanagan et al., 2013).

Making decisions regarding assistive technology. Although the IDEA (2004) requires that AT devices and services be considered when developing IEPs, limited guidelines exist for making AT decisions, and policies and procedures tend to vary between districts (Dalton & Roush, 2010). The National Assistive Technology Research Institute conducted an analysis of the AT practices and procedures of ten states. In a review of documents, 60% of the states made no mention of requiring a person knowledgeable about AT to be present at IEP meetings when AT decisions were being made (Bausch et al., 2009). Only 50% of the states required consultation with an AT specialist if the students' needs were beyond the knowledge of the IEP team. Two states recommended outsourcing AT professionals when the team lacked the expertise to make informed decisions but also noted a lack of recognized AT certification or credentials. In a study of decision-making practices of schools in Texas, Davis et al. (2013) asked schools to report who was involved in making IEP team decisions regarding AT and

found that an AT specialist was the least reported IEP team member. Small rural districts that do not employ AT specialists tend to rely on teachers to build their own AT expertise and make recommendations and decisions regarding AT (Ault et al., 2013). It is important that these teachers have the AT knowledge necessary to make informed recommendations.

Bausch et al. (2009) found that 80% of states expected professionals to make collaborative AT decisions during IEP meetings yet did not provide criteria for those decisions. The Quality Indicators for Assistive Technology (QIAT) community has developed research-based tools for evaluating and improving the development and delivery of quality AT services (QIAT Leadership Team, 2012). Focus groups have developed quality indicators for eight areas including "consideration of AT needs, assessment of AT needs, AT in the IEP, AT implementation, evaluation of effectiveness of AT, AT in transition, administrative support for AT, and AT professional development" (QIAT Leadership Team, 2012, Quality Indicators, para. 1). In addition to the indicators, the QIAT Community has published intent statements, lists of common errors, and self-assessment matrices. The QIAT suggest using systematic procedures for considering a range of AT devices and services within collaborative IEP teams including gathering and analyzing data about the student, access to curricular and extracurricular environments, IEP goals, and progress and tasks in the general education curriculum (QIAT Community, 2012). While the QIAT serve as a resource, there are no standards for AT use at the national or state level (Dalton & Roush, 2010).

Rapid and innovative advancements in technology impact how AT is used in the classroom as well as how AT decisions are made. Innovation and the marketplace often drive technology use in schools (Edyburn, 2013). Commonplace, commercially available devices such as smartphones and tablets are often an appealing option to provide support to students with high-incidence disabilities. Unlike previous devices used in special education, these devices are user-friendly, nonstigmatizing, motivating, customizable, mobile, age appropriate, practical, versatile, and provide fast access to information (Douglas et al., 2012). These devices have built-in accessibility options and run a wide variety of applications designed to promote participation and engagement in academics (Dove, 2012; Gray, Silver-Pacuilla, Overton, Brann, 2010; McMahon, 2014). These every-day devices and applications are inexpensive compared to devices designed for people with disabilities. In their analysis of AT policies of ten states, Bausch et al. (2009) found that 50% of states reported considering a range of low-tech to high-tech devices. This model of considering AT on a low-tech to high-tech continuum is based on the premise that high-tech devices are expensive (Edyburn, 2009). With the recent boom in technology, this is no longer the case and technology is more a part of children's every-day lives. Technology consideration practices may need to change.

Commercial technologies marketed for the general public have the potential to support students with high-incidence disabilities when selected appropriately, and special educators may need to rethink how AT decisions are made (Bouck, Flanagan, Miller, & Bassette, 2012). In an experiment with secondary students with autism spectrum disorder, Bouck, Savage, Meyer, Taber-Doughty, and Hunley (2014) found that using an

iPad mobile digital tablet for self-monitoring was more effective at increasing independence than traditional paper and pencil and students preferred using the tablet. Douglas et al. (2012) argued that inexpensive applications allow for more flexibility and fluidity of choice regarding AT, and IEP teams are no longer required to choose tools that will be used for the long term. Teachers and students are free to experiment with applications in order to find the ones that work best for particular students in particular environments. However, with the vast array of devices, software, and applications available, finding the right ones to support a student's needs can be overwhelming. In a survey of special education directors, Davis et al. (2013) found that prior experience with the technology and perceived user-friendliness of the device were the factors most commonly associated with AT decision-making. The authors pointed out that relying on previous experience to make recommendations and decisions may result in overlooking more appropriate technologies.

Integrating assistive technology into the classroom. When IEPs designate that AT will be available to particular students, teachers are faced with the challenge of finding ways to seamlessly integrate AT into classroom instruction. This requires teachers to accept new technology and make changes in their instructional practice. Models for explaining teacher acceptance and use of technology in general may be helpful in understanding the factors effecting how teachers integrate AT into the general education classroom.

Teacher acceptance of technology. Teachers experience a range of emotions in response to change that impact the use of new instructional practices, and professional

development efforts need to focus on emotional dimensions as well as teacher behaviors and beliefs (Saunders, 2013). Making the changes necessary to integrate new technologies requires teachers to take risks. Howard (2011) found that teachers perceived the same risks related to technology integration but had differing views regarding the acceptability of those risks. A positive affect towards technology use lead to teachers finding the risks of technology integration to be more acceptable. Some schools allow teachers more autonomy and flexibility than others, making it less of a risk to experiment with new technologies.

According to the technology acceptance model (TAM), first proposed by Davis (1989), decisions as to how and when technology will be used are influenced by perceptions regarding how easy the technology is to use and the usefulness of the technology (Holden & Rada, 2011). Moses, Wong, Bakar, and Mahmud (2013) found perceived ease of use to be a predictor of perceived usefulness. Teachers tend to perceive technology to be useful when it is easy to use. Adiguzel, Capararo, and Willson (2011) added a dependability factor to the TAM after surveying 45 special education teachers and finding that the degree to which the technology is dependable without technical support staff intervention had a significant effect on teacher perceptions regarding usefulness and ease of use, and intentions to use technology.

Teo (2012) found that the TAM integrated with the theory of planned behavior (TPB) was useful in explaining the intentions of preservice teachers to use technology. The TPB, first proposed by Ajzen (1991), has been used to predict behaviors based on intentions which are influenced by the individual's attitude towards the behavior and the

subjective norms. This theory suggests that people are motivated not only by their own feelings but also by their perceptions of other people's feelings about the behavior and their perceptions of the level of control they have (how easy the behavior would be to carry out and facilitating conditions). Teo (2012) found that among all the constructs of the two models, attitude toward technology use had the greatest effect on intention. The facilitating conditions factor had a small effect but was not enough to motivate technology use alone, suggesting that teachers benefit from support in technology implementation but teachers need to believe that the technology is going to fulfill a need before they will use it.

Teo (2013) conducted another study comparing four models that could be used to explain teachers' intentions to use technology including the TAM, the TPB, the unified theory of acceptance and use of technology, and the theory of reasoned action. The unified theory of acceptance and use of technology, proposed by Venkatesh, Morris, Davis, and Davis (2003), identifies performance and effort expectancy, social influence, and facilitating conditions as key constructs determining intentions to use technology. The theory of reasoned action, proposed by Fishbein and Ajzen (1975), identifies the individual's attitude (positive or negative affective response towards the behavior) and subjective norm as the key constructs determining intentions to use technology. In analyzing survey results from 673 teachers, Teo (2013) found that the theory of reasoned action was the best model of the four for predicting technology acceptance.

Teacher acceptance of technology may be different from that of students. Using surveys of 2161 students and 249 teachers in Shanghai, Gu, Shu, and Gou (2013)

examined the differences between the technology acceptance of K12 teachers and students. They found that for both teachers and students, personal factors were the most important in information and communication technology (ICT) usage. Students reported significantly higher self-perceptions of ICT than teachers and held higher expectations for the integration of ICT into the classroom, with younger students having even higher expectations. This generation of students, often referred to as "digital natives," reported using much more technology outside of school than in class and have likely already developed ICT habits therefore having expectations for ICT use in the classroom. Teachers perceived self-efficiency and ICT competency as the most important factors in the adoption and integration of ICT.

Teacher integration of technology. Even when provided with access to technology, ongoing support, and professional development, teachers integrate technology differently. In a study of 22 teachers participating in a 4 year program designed to improve technology integration, Kim, Kim, Lee, Spector, and DeMeester (2013) found that "teacher's beliefs about the nature of knowledge and learning and beliefs about effective ways of teaching" (p. 81) were correlated with teacher technology integration practices. The technological pedagogical content knowledge (TPACK) framework first described by Mirsha and Koehler (2006) provides a model for understanding teacher knowledge of technology integration (Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, (2013). The TPACK framework describes the complex interactions between teacher knowledge of pedagogy, content, and technology which have been found to predict teachers' self-efficacy beliefs regarding technology

integration (Abbitt, 2011). It can be difficult to measure the TPACK domains separately due to their interrelated nature (Archambault & Barnett, 2010). Ertmer, Ottenbreit-Leftwich, Sendurur, and Sendurur (2012) argued that in order to change teachers' technology implementation practices, teacher beliefs, self-efficacy, and culture needed to be considered along with knowledge of pedagogy, content, and technology. Professional development tends to address first order barriers to technology such as access and knowledge but intrinsic barriers such as teacher beliefs about sources of knowledge and the speed of learning, which are highly correlated with the integration of technology, may be overlooked.

Wing Fat Lau and Hoi KauYuen (2013) studied the effects of training workshops on mathematics teachers' perceptions of technology integration and found that training resulted in improved perceived efficacy but senior teachers did not report changes in their beliefs regarding the benefits of technology in education. Supportive supervision can help teachers to become aware of their personal inhibiting beliefs and patterns leading to more effective learning and changes in classroom behavior (Hoekstra & Korthagen, 2011). Avidov-Ungar and Eshet-Alkakay (2011) found that along with high levels of TPACK, a school's culture as a learning organization can result in positive attitudes toward changes regarding the implementation of innovative technologies. In a review of literature on teacher professional development related to technology, Twining, Raffaghelli, Albion, and Knezek (2013) identified the need for professional development to be collaborative, experimental, and reflective, and noted that effective professional

development in the digital age requires changes in the educational system at several levels.

Integration of assistive technology into the general education classroom. Integrating AT into the classroom requires teachers to have a learner-centered focus. In a survey of 74 teachers enrolled in a master's degree program, Dunn and Rakes (2010) found that learner-centered teachers with a high sense of efficacy were more likely to be concerned with the effects of technology on learner outcomes. In a survey of 126 teachers in Texas and Arkansas, An and Reigeluth (2012) found that teachers had positive attitudes toward integrating technology with a learner-centered focus and identified lack of technology, time, and assessment to be the major barriers to effective integration of technology. Learner-centered teachers maintain high expectations for all students while considering the unique academic, social, and emotional needs of each student. Teachers found that creating learner-centered classrooms in which students were provided with individualized learning experiences, supports, and assessments was challenging yet rewarding.

As teachers make changes to integrate AT into everyday activities, they benefit from ongoing support from experts through consultation, collaboration, and coaching (Reed & Bowser, 2012). Bouck (2011) found that while teachers recognized that students and themselves benefited from AT, they reported being overwhelmed by time constraints and the technological challenges. Not only did teachers need to find the time to learn about new technologies, but they had to find the time to use the technology during instruction. This took away from their planning, delivering instruction, or

personal time. Although integrating AT into the classroom was time consuming initially, teachers saw how it could save time in the long run. Teachers reported that ongoing support was essential to the sustained use of AT. Students often needed support while using technology and would stop using it if the support was not available. Nam, Bahn, and Lee (2013) expanded the TAM by including facilitating conditions (such as access to help and support), self-efficacy, and result demonstrability as antecedents of AT use.

In a survey of middle school special education teachers, Flanagan et al. (2013) found that the most reported factors hindering AT use were cost, the need for additional training, and the difficulty of using the AT during instruction. Teachers reported that AT was ineffective if it resulted in more frustration than benefit. Technology can take too long to set up or cause students to become confused or distracted. Teachers found that AT was most effective in supporting instruction when students liked and wanted to use the technology, the technology met student needs as well as the instructional goals of the teacher, and the teacher had previous experience using the technology. Fortunately, these conditions are more likely to be met as software becomes more user-friendly, and commonly used devices, with which students and teachers already have experience, become options for AT. The distinction between every-day, assistive, and instructional technology is not always clear. By incorporating technology that meets the needs of a variety of learners into the curriculum design process, teachers can minimize the need for unique individualized AT systems, allowing the teacher to focus on instruction (Schaaf, 2013).

Benton-Borghi (2013) discussed how the UDL and TPACK models can be merged to create a comprehensive theoretical model to effect change in how teachers use technology to meet the needs of diverse learners. Universal design for learning provides a scientifically valid framework for integrating AT into the general education classroom (Messinger-Willman & Marino, 2010; National Center on Universal Design For Learning at CAST, 2012). The UDL framework,

> provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient. (Higher Education Opportunity Act, 2008, § 103a, 24)

First conceptualized by architects designing features such as curb cuts, universal design was applied to education by Rose and Meyer in 2000. Universal design for learning continues to appear in educational laws and standards including IDEA (2004) which requires IEP teams to consider UDL principles. Approaching the use of AT from a new literacies stance and embracing multimodality in the design of curriculum may help teachers to recognize how AT allows not only physical, but also intellectual and social access (Naraian & Surabian, 2014). Fully integrating AT can provide a wide variety of students with access to the general curriculum but requires teachers to continuously learn

about new technologies and consider how they can be utilized within the context of their classrooms.

This study sought to explore how teachers in small rural schools in New Hampshire are using AT with students with high-incidence disabilities and the professional development teachers need in order to do so more effectively. Current research literature justifies investigating teacher use of AT with students with high-incidence disabilities as a worthwhile scholarly endeavor. A better understanding of teacher knowledge, skill, and professional development needs may inform future professional development aimed at increasing effective teacher use of AT to provide more students with access to the general curriculum.

Implications

Findings from this study helped to identify current AT practices and professional development needs of teachers and informed the design of future professional development initiatives and support networks for small rural schools in New Hampshire. A better understanding of how teachers currently learn about, consider, and implement AT can help to identify strengths that can be built upon and expanded amongst schools as well as weaknesses that can be addressed through training and/or support networks. Based on the findings of the study, professional development was designed to address the specific needs of teachers in small rural schools. Professional development, focused on improving teacher capabilities to recommend and implement AT, may result in improved access to the general education curriculum for students with high-incidence disabilities. Results of this study have the potential to stimulate interest in developing effective

collaborative approaches to ongoing improvement of teacher knowledge and skills in AT. This study can create positive social change by improving access to learning opportunities for students with high-incidence disabilities, ultimately decreasing the achievement gap between students with disabilities and students without disabilities.

Summary

There is a significant achievement gap between students with disabilities and students without disabilities which has led to increased expectations for students with high-incidence disabilities to be included in the general education classroom and meet increasingly rigorous standards (McLaughlin, 2010; McLeskey, Landers, Hoppey, & Williamson, 2011; Newman et al., 2011; Wei, Lenx, & Blackorby, 2012). New developments in technology have the potential to provide a means to compensate for disabilities by reducing cognitive load, thus improving access to the general curriculum (Messinger-Willman & Marino, 2010). IDEA (2004) law requires teachers to consider AT devices and services for all students with disabilities; however, little is known about how teachers use AT with students with high-incidence disabilities or the AT professional development needs of teachers in New Hampshire. A review of the literature revealed that integrating AT in the classroom for students with high-incidence disabilities in small rural schools is a complex issue. A lack of AT specialists in rural schools leads to a reliance on in-house expertise to make decisions regarding AT, yet teachers report having insufficient knowledge and skills to effectively recommend and implement AT. Recent innovations in technology have resulted in more versatile and readily available AT options. This rapid development of technology requires teachers to

continually learn about new devices, software, and integration strategies. Edyburn's (2003) levels of AT literacy provide a conceptual framework for exploring and describing teachers' levels of AT literacy.

This study sought to answer the questions of how teachers are using AT with students with high-incidence disabilities in small rural schools in New Hampshire and what professional development teachers need in order to more effectively recommend and implement AT. A better understanding of how teachers are currently using AT with this population and the AT professional development needs of teachers has the potential to result in positive social change by improving access to the general education curriculum for students with high-incidence disabilities through the use of AT, ultimately decreasing the achievement gap. Due to the complex nature of this issue, a qualitative case study was used to explore answers to the research questions. Teacher interviews provided insight into teacher AT use and professional development needs. The next section describes the research methodology in detail including the design, selection of participants, ethical considerations, data collection and analysis, and the findings.

Section 2: The Methodology

Introduction

The first section describes the problem of minimal knowledge about how teachers use AT with students with high-incidence disabilities and the AT professional development needs of teachers. The purpose of this study was to better understand how teachers use AT with this population of students in small rural schools in New Hampshire and to better understand the AT professional development needs of teachers. This section describes the research methodology that was used to explore answers to the research questions along with the findings.

A qualitative case study design was used to gain a deeper understanding of how teachers use AT with students with high-incidence disabilities and the professional development teachers need in order to use AT more effectively. Semistructured interviews were used to collect data from general and special education teachers at small rural middle and high schools in New Hampshire. Data from each interview was analyzed individually to identify common themes. The following describes and provides justification for the research design, selection of participants, data collection, and data analysis. Findings are reported as they relate to the research questions.

Research Design

A qualitative case study design was used to explore teachers' perspectives regarding the use of AT. This case study was explanatory in nature as it sought to answer the question of how teachers are using AT with students with high-incidence disabilities. A case study involves an in-depth exploration of a system bounded by time or place

(Creswell, 2011). This study entailed an examination of a bounded population of general and special education teachers currently working at small rural public middle or high schools in New Hampshire.

A quantitative design would not have been able to provide the same depth and breadth of understanding. Quantitative studies can answer questions about the prevalence of a phenomenon, but the research question in this study asks how a phenomenon occurs and case studies are best suited for answering how questions (Yin, 2009). Although quantitative experiments and surveys can also answer how questions, they limit the number of variables analyzed while qualitative methods allow for more open exploration of a phenomenon.

Yin (2009) described a case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 18). Use of AT is associated with the resources available in the school such as the expertise and collaboration among personnel and the technological access, infrastructure, and support. Because the situation is highly pertinent, teacher use of AT is best understood within the context of the particular case. The purpose of an intrinsic case study is to better understand the particular case (Stake, 2005). The purpose of this case study was to better understand the use of AT with students with high-incidence disabilities by teachers in small rural schools in New Hampshire and the AT professional development needs of these teachers. The studied phenomenon and the research questions align appropriately with the case study methodology. Because this study sought to better understand the

phenomenon of teacher use of AT with students with high-incidence disabilities within the context of small rural New Hampshire schools through an in-depth exploration of teacher perspectives, a qualitative intrinsic case study was the most logical design for this project study.

Participants

Participants were current special education and content area teachers from six small rural middle and high schools throughout New Hampshire who volunteered to participate. The participants in this case study were purposefully selected using a maximal variation technique. This selection method allowed me to explore perspectives from multiple sites representing the complexity of the phenomenon (Creswell, 2011). Participants included five special education teachers and five general education teachers. The general educations teachers included current teachers of social studies, science, and language arts. Both the special and general education teachers were certified to teach in their content area by the State of New Hampshire, and had been responsible for teaching students with high-incidence disabilities within the last 5 years.

Qualitative interview studies aim to reach saturation of information, at which time, no new information is being discovered (Seidman, 2006). In this study, interviews were conducted until data analysis revealed that the same themes were being replicated with no new ideas emerging. In a review of the literature, Mason (2010) found that minimal sources provided guidelines estimating samples sizes for qualitative interviews and these sample size guidelines ranged from five to 25. A total of ten interviews were conducted in this study which resulted in common themes.

According to Maxwell (2005), the most important consideration in selecting participants for a qualitative study is purposeful selection of those individuals who can provide the information needed to answer the research question. I contacted the principals of schools identified as small and rural via email, explaining the study and asking for permission to contact a teacher within their school. I received a letter of cooperation from the principal of each school granting permission and asked each of them to provide the names of teachers who might be able to provide the information sought. I also used faculty contact information on school websites to identify potential participants. I then contacted teachers via email to explain the study and ask if they would be interested in participating.

As recommended by Seidman (2006), I engaged in an initial contact discussion via email or phone with each teacher interested in participating during which I described the purpose of the study, the criteria for participation, the expectations of participants, and the content of the informed consent form. I presented the actual consent form and asked the participant to sign it before each interview. Current students at the college where I am a professor were not eligible to participate in the study in order to ensure I did not hold a supervisory position over the participants.

Ethical implications of the study were carefully considered and steps were taken to protect the rights of participants. It is important to protect the anonymity of participants (Creswell, 2012). The identity of both the participants and schools remained confidential and any descriptions that could lead to the identification of participants or sites were withheld from data reports. The risks and benefits of participation were

explained in the consent form. Approval from the Walden University Institutional Review Board (IRB) was obtained prior to engaging participants in the study. IRB approval required demonstration that the benefits of participation outweighed the risks and that appropriate steps were to be taken to protect participants from harm. The Walden University IRB approval number for this study is 02-05-15-0318180. Participation in the study was voluntary and participants were reminded that they could terminate participation at any point without cause or consequence. Participants did not receive compensation for participation; however, a $5 gift card was provided to each participant at the end of the study as a thank you.

Data Collection

I collected data through one-on-one semistructured interviews using the open-ended questions included in the interview protocol in Appendix B. Open-ended questions often begin with exploratory words, such as how or what, and allow the participants to "voice their experiences unconstrained by any perspectives of the researcher or past research findings" (Creswell, 2012, p. 218). A semistructured interview allowed for the collection of comparable data across subjects (Bogdan & Biklen, 2006). Interview questions and probes were designed to gain an understanding of how teachers currently use AT with students with high-incidence disabilities and the professional development teachers need in order to more effectively use AT. I began each interview by asking the participant to tell me about their experiences using AT with students with high-incidence disabilities. I then asked some more specific questions and ended by asking if there was anything else the participant thought would be helpful for

me to know regarding AT. Creswell (2012) recommended asking an ice breaker question at the beginning, followed by five or so subquestions, and ending with a wrap-up or summary question. I used probes as necessary to prompt for more elaboration or clarification.

Each participant identified a convenient time during noninstructional hours and a private and comfortable place for the face-to-face interviews. The interviews occurred in a conference room or classroom, and one interview was conducted via telephone. The data collected via telephone was consistent with data collected face-to-face. Each interview lasted 20 to 30 minutes. I digitally recorded and then transcribed all the interviews. Audio recordings were stored on a password protected device. Transcripts were saved on my password protected computer and backed up onto an external drive that was stored in a locked and secured location.

After a brief, casual conversation to begin establishing a rapport, I reviewed the purpose of the study and the letter of informed consent with the participant and asked him or her to sign a copy. Beginning with small talk around a topic of common ground can help to build a relationship and put the participant at ease (Bogdan & Biklen, 2006). I then reminded the participant that the interview would be recorded and that he or she could end the interview at any time. No participants requested to end the interview. Yin (2009) described interviewing as "both a research methodology and a social relationship" (p. 95). I formed a respectful interviewing relationship with the participants by establishing a rapport while maintaining a focus on listening to the participants' experiences and perceptions. I explained to the participants that I would be asking some

questions and that my role as a researcher was to listen and to learn. Asking participants to share details of their experiences requires a high level of trust, so it was important to establish a rapport of mutual trust and respect (Creswell, 2012). Recordings were transcribed and data were analyzed prior to the next interview.

I personally conducted all of the data collection and analysis in this study. My experiences in education include teaching physics and math and tutoring students with disabilities at a private high school for 3 years and working as a reading specialist and special education teacher/case manager at a public elementary school for 10 years. I am currently a professor of education at a community college where I also teach online math courses. With my current and former roles and experiences in education, it was important that I reflected on my own potential biases. I kept a reflective journal throughout the study where I identified emerging themes and made note of redundancies and contradictions.

Validity of the study was enhanced through the use of multiple cases and member checks (Merriam, 2009). I sent participants a draft of my findings via email and asked them to reply to me within a week with any concerns or feedback. Four of the participants replied stating that they agreed with the findings. Respondent validation is the most important way to avoid misinterpretations of what participants say (Maxwell, 2005).

Data Analysis

Transcripts of interview recordings were analyzed to identify patterns and themes. The data were coded by hand using both typological and inductive analysis. Themes that

emerged from the data helped to describe how AT is used and the professional development teachers feel they need to more effectively implement AT.

Following transcription of the interview recording, the data from each interview were coded typologically. Hatch (2002) recommended dividing data into predetermined categories based on theory or research objectives. The typologies used include:

- Awareness of AT
- Experiences Using AT
- Learning about AT
- Making Decisions Regarding AT
- Classroom Integration of AT
- AT Professional Development Needs

The typologies selected were based on factors commonly found to impact teacher use of AT in my review of the literature and Edyburn's (2003) levels of AT literacy. The change process teachers go through in developing AT literacy begins by gaining awareness of the possibilities, develops into a working knowledge of the technology, and ultimately results in a transformation of practice allowing for seamless integration of AT into the general education classroom. These levels of AT literacy served as a framework for describing teacher knowledge of AT.

A number of factors have been found to impact teacher ability to develop a working knowledge and effectively implement AT. Personal experience with using various technologies and formal training have been found to impact teacher use of AT. Another factor in AT use is AT decision-making which involves when, how, and by

whom recommendations are made for AT devices and services. Coding interview data into these typologies helped to organize the information.

The next step as recommended by Hatch (2002) was to read the data by typology looking for subthemes. I used inductive analysis to identify themes within each typology. Words or phrases representing the topics and patterns that emerged were used to label units of data such as sentences and paragraphs. Some units of data were placed in more than one category (Bogdan & Biklen, 2006). A sample page of a coded transcript can be found in Appendix C. Coding occurred throughout the data collection process as new themes emerged. Once all the data had been collected, I synthesized the information by coding patterns, looking for relationships among patterns, categorizing themes, and writing generalizations. I then drafted a summary of my findings to be sent to participants for validation.

A number of strategies were used to address validity. I kept a research journal to clarify bias, record emerging themes, make connections, and reflect. Hatch (2002) recommended keeping track of impressions, reactions, and interpretations in a research journal. Reflectivity is important in qualitative research in order to create an open and honest interpretation (Creswell, 2009). Member checks were used to determine the accuracy of findings. I examined discrepant data in detail and reported them in the findings, allowing readers to draw their own conclusions (Maxwell, 2005). Themes were consistent across the interviews and no particular interview was determined to be a discrepant case. I acknowledged and included all perspectives in the data and used rich quotes from the interviews to support the findings (Creswell, 2009).

Findings

I analyzed the data collected through semistructured interviews to answer the research questions of, how do teachers use assistive technology with students with high-incidence disabilities in small rural schools in New Hampshire and what professional development do New Hampshire teachers need in order to more effectively use AT with students with high-incidence disabilities? I report the findings by typology as they answer the research questions and subquestions posed in part 1. Although the experiences of participants were very different, common themes emerged through the data analysis. I describe these themes and subthemes below.

Awareness

Teachers demonstrated a range of levels of awareness of AT devices and uses. Most teachers reported not knowing what was available and feeling that it was difficult to stay up to date with new technology as it emerged. A middle school special education teacher reported that a student was using word-prediction software at home but the school did not want him bringing the CD in to install on school computers. She said, "So I had to look for an alternative which was a little bit frustrating because I had no idea what was out there." This teacher was aware of the student's need for AT but was not aware of the possible technologies that could meet that need. When asked what technologies might help students to access the content area curriculum, a participant replied, "That's my issue. It's I don't know enough of what is out there to find something that works better or is more user friendly. So I feel like that is my frustration."

It was also apparent that some teachers were not aware of how some of the devices students currently had access to could be used as AT. For example, one special education teacher discussed how her school used minimal paper and textbooks and students accessed many of their learning materials via websites on their own devices, but when asked about whether students ever used their device to speak some of the text, she said she was not even aware it was possible. A high school special education teacher discussed how difficult it was to find an audio option for textbooks. This teacher was likely unaware of New Hampshire Accessible Instructional Materials (NHAIM), a state service available to assist schools with acquiring text in electronic or audio format in a timely manner for students with print disabilities. Texts can be obtained from the National Instructional Materials Access Center (NIMAS) or scanned from an original print copy and then converted into a variety of file formats for students to access with screen readers or other AT. Only one teacher mentioned accessing texts through Bookshare, a free online library of accessible texts for students with print disabilities, but felt she did not know enough about the different options for playing the audio.

Even a special education teacher whose students used AT extensively in a school with one-to-one devices stated, "It's always hard staying on top of everything that is out there." Another participant pointed out that "It keeps coming out and even if you are up to date now, you won't be next year." Both special and general education teachers felt a need to become more familiar and knowledgeable about not only what technology is available, but also how it can be used.

A few schools reported very minimal to no use of AT, suggesting that staff may not be aware of the possibilities of AT. It is worthwhile to note that at one of the schools where I received permission to contact potential participants, I was unable to find any volunteers. An administrator at this school had stated that although the special education teachers may be able to help me, it was doubtful that the general education teachers even knew what AT was. The special education teachers replied to my invitation to participate telling me that they would not be able to help me with my study because they did not use any AT in their school. Because I was unable to interview these teachers, it is unknown if this is the case, or if their comments were based on a different interpretation of the definition of AT. Nevertheless, this response suggests a lack of awareness of AT.

Experiences

All of the teachers interviewed discussed the use of AT with reading and writing. Students with writing difficulties used speech-to-text software and recorded teacher lectures and their own responses. For example, a high school teacher discussed how it was "impossible" to read the handwriting of a particular student with weak writing skills, but the student recently began using Dragon Dictation and "it is making things go quicker for him and allowing teachers to read his responses." Another teacher discussed how AT allowed students to convey their competency when they may not have been able to do so while limited to traditional pencil and paper assessments claiming "I do believe that technological devices, whatever they may be, do take away some of the obstacles." Students who had difficulty keeping up with note taking during class used recording devices. One student would record lectures and then a paraprofessional would write

notes from the lectures later. Another student used a digital pen to audio record lectures while he was taking notes so that he could go back and listen to any part of the lecture later.

Students with reading difficulties listened to text. Some schools provided students with subscriptions to Learning Ally where they could download audiobooks including a large number of high school textbooks. Schools also purchased audiobooks on CD or through audible.com. Some schools used e-books that included an audio option along with other interactive visuals and videos that can engage students who struggle with reading. Other schools used Read&Write Gold software which reads aloud text on the screen. Teachers reported that the students using screen readers found the computer generated voices to be just as useful as recorded books. The extent to which these technologies were used varied. Teachers also discussed the use of online calendars and databases for storage and submittal of documents to assist students with organization. Visuals were used to assist students with memory by displaying pictures associated with key vocabulary and having students create their own vocabulary "cards" with pictures.

Teachers discussed how AT they previously used such as Kurzweil text-to-speech had recently been replaced by more easily accessible applications. A middle school special education teacher discussed how students did not use many applications or programs since they instituted one-to-one iPads because the device has many AT features such as voice-to-text built in:

> They just highlight the text and it just spits out whatever the text says. It reads it back to them. And they can do that with what they write and what they are reading. So it has been extremely helpful actually.

Teacher experiences and working knowledge of AT varied significantly by school. At schools where all students were provided with one-to-one devices and universally designed content area lessons, AT was used extensively. At other schools where students had minimal access to technology, AT was used minimally. Nevertheless, the same themes emerged regarding teachers' experiences with using AT with students and the integration of AT into the general education classroom. These themes include independence, leveling of the playing field, and inclusion.

Independence. AT can help students to become independent learners. Teachers found that students were much more independent when they had access to technology tools on-demand. The ability to self-manage the use of these tools led to greater independence and confidence.

A social studies teacher explained how technology enhanced the ability of his students to create flashcards, leading to improved self-esteem:

> I am seeing flashcards created by students who if it was the old fashioned way, they would have a hard time but they are doing things on their flashcards that are just phenomenal. Right down to pictures, charts and graphs that they are putting on their flashcards because they can cut and paste it. It shows you how something as simple as a hand written flashcard versus what can be done with a piece of technology can enhance the learning comfortability [*sic*] and enhance overall

> happiness. Which now you have a student whose self-esteem is better, whose confidence is better, and all of a sudden they say "I can do this" and that is where technology I think across the board has helped everybody.

The ability to successfully complete work more easily and independently leads to confidence as a middle school teacher explained:

> They are able to touch a pad much easier than they are able to use a pen or pencil on a piece of paper and the turnaround time for their work is much quicker. They feel more confident about what they are doing.

When preparing students for college, it is important to provide them with the tools and skills that allow them to be independent learners. A high school special education teacher explained her experience and concerns as follows:

> The students that I use AT with have learning disabilities in reading and writing. They've got a long history of support in reading and writing. When they get to the high school, because of the academic demands, a lot of the direct service that they get tends to disappear in favor of you need three credits of math and four years of English. So they are kind of left to figure things out before they go to college. But I am starting to worry because the third trimester of their junior year is coming up. We have next year and then they are off on their own and they are going to be assigned to write a research paper and that is a scary thought. So do they have the tools to be successful?

This teacher's goal was to "wean away a lot of the supports except the technology."

The degree to which teachers encouraged independence varied. Some students depended on a paraprofessional to complete tasks such as reading aloud or writing. This was especially the case in schools where students did not have access to 1:1 devices. A special education teacher in a high school that did not provide all students with universal access to devices explained how she was trying to get students to move towards using technology to increase their independence:

> My biggest struggle now is getting kids away from depending on someone to write for them or depending on someone to read the questions for them or to edit their paper to you need to do this on your own next year or the year after. So use technology and increase your independence so you are more successful in college.

Teachers reported concerns that students would become too dependent upon paraprofessionals. It can be faster and easier for a student to ask an adult to complete tasks for them. This can result in students being reluctant to try using technology. This same teacher explained why she was having difficulty transitioning students away from relying on a paraprofessional:

> They have just been so used to, in grades K-10, being able to just say what your answers are, and a para writes them down for you, and puts the capitals and periods in the right spots, and spells everything right.

Another participant who taught social studies at a school where all students were provided with one-to-one devices experienced a different phenomenon. He found that students were so used to independently using technology to complete tasks, that when the technology was not available, students had to reluctantly turn to paraprofessionals for

help. He explained that when he decides to "become a bad guy and say we are not going to use technology today" in order to "teach some of the old fashioned skills in terms of listening and note taking", he has found that

> Instantly, that challenged student who may have an aide in the room is looking for one-on-one assistance and now the whole idea of fitting in and being one with everyone else is now out the window because they are now being put in a spotlight so to speak.

Participants reported that students tend to want to do things independently if they can. A middle school special education teacher described how most of his students tend strive for independence:

> They only want so much assistance which is better. Sometimes there are kids that just rely on way too much assistance and they don't want to ever access anything without it, they don't want to get anything wrong. They don't even want to attempt it without having someone sitting next to them. But for the most part, our population, they want to go about it on their own as much as they can.

Teachers reported that if students have access to technology that allows them to perform tasks independently without the assistance of a person, they will usually prefer the technology. However, there are times when the adult can help to get things done more easily and faster. One special education teacher discussed how she was trying to get students to work independently using dictation software, but sometimes it was better to help students organize their thoughts and do the writing for them. At the same time, she was concerned that it would not prepare students with the skills they would need for the

statewide Smarter Balanced assessments which have speech-to-text and text-to-speech tools embedded. Another special education teacher explained that achieving the balance between students getting assistance from another person and becoming dependent "is a constant process of seeing what they can do and knowing what they can do and expecting it from them and not expecting anything less than that." Data suggested that students would use AT if it allowed them to be both independent and successful.

Leveling the playing field. Teachers reported that AT can "level the playing field" for students with disabilities by allowing them to show what they know in different ways and access more complex grade-level content. A middle school special education teacher explained how an initiative to provide every student with a Chromebook "leveled the playing field a lot with students' access to technology and also providing different opportunities for them to show what they know other than traditional ways." She explained how with Read&Write Gold on their devices, "students that have writing disabilities can show what they know by using the speech-to-text."

Students might alternatively show what they know through voice recordings. A middle school teacher described how students were able to send their English teacher an audio recording of their reading responses. Because this assignment was just a way for the teacher to check if students were comprehending their choice reading books, the audio recording was a more accurate measure of student understanding than a written response would have been.

For students with writing disabilities, written assignments can be a barrier to engaging in the curriculum and demonstrating their knowledge, making it difficult for

teachers to accurately assess their skills and knowledge and provide instruction accordingly. A high schools special education teacher provided an example of a student who struggled with writing but was able to demonstrate his knowledge orally:

> He can write a sentence but a paragraph is a real struggle. But when he can dictate- He loves chemistry and he will just go on and on about iron and gold and platinum. And it really reveals to the teacher just how much he really does know as opposed to looking at his writing and saying, "Oh no, he doesn't know anything."

A participant recounted a special education director's story of "one student moved into the district who they initially thought was very limited. But once they started using technology, they found out that student can do much more than they initially thought."

Similarly, AT can allow students with reading disabilities to access the same content as their classmates by listening to the text. A middle school special education teacher explained how listening to text allowed students to still access text with a high level of complexity:

> Sometimes a student is reading at a second or third grade reading level if they are reading it on their own. Their listening comprehension might be on grade level, so they are still getting that complexity of the content without having to have the content at the third grade level. So that is huge.

A social studies teacher explained how students with varying skills were able to complete the same learning tasks when AT

> advances their performance levels in a way I do believe makes the heterogeneous grouping. And it just makes them feel more of a part, to look around the room and see …that they are doing, moving the same as all their other classmates.

AT allowed students to access the same learning opportunities as their classmates, and be included with their peers.

Inclusion. Data suggested that students tend to want to be included and want to access the same information and do the same things as their peers. Teachers explained that students are concerned with how they are viewed by their peers and do not want to be different. As a middle school special educator said, "my students want to be as normal as possible." Some teachers reported that AT allowed students to be included. A middle school special education teacher explained that for the most part, if he installed an electronic or audio version of a text on a student's device, the student would listen to it. "For the most part, our students want to be included. They want to know what the rest of the class is doing so they will listen to it."

At other schools, teachers reported use of AT coming with a social stigma that prevented students from feeling included. An English teacher explained that listening to text was not socially acceptable in her classroom. She wanted to move students away from that, but felt that it was difficult with children at the middle school age:

> They just don't want to be different. We encourage it in being aware that we all have different learning needs and goals. But I do encourage it. I have a whole list of them. But the Bookshare would be ideal. But that requires the students to be okay with that.

Inclusion was the same motivator that, at some schools, encouraged students to use AT and, at other schools, discouraged students from using AT. It became apparent in the data that students were more likely to use AT if it involved using technology devices that all students were using.

Factors Impacting the Integration of AT into the Classroom

Teachers discussed how a number of factors impacted the integration of AT into the general education classroom including universal access and student choice, one-to-one devices, encouragement to use AT, teacher comfort with AT, ease of transitions while using AT, access, time, appropriate use, and curriculum demands. Although data showed that teacher success with integrating AT differed, special and general education teachers at various schools reported the same factors as impacting the integration of AT into the general education classroom.

Universal access and student choice. Teachers who made AT available to all students and gave students the option of choosing to use what worked for them based on their own learning needs found that universal access reduced the stigma associated with using AT. Teachers reported nondisabled students benefiting from the same technologies as students with disabilities. Many of the tools teachers reported students using as AT are available to and used by the general public. Teachers discussed how students with disabilities were more likely to use AT in an environment where all students had universal access to the same technologies. A middle school special educator explained how students look to their peers for acceptance of AT:

> We highly suggest that they use different things and then they are given the choice if they want to use them or not. A lot of the accommodations that they have, they don't like to use for whatever reason. So when they find out how easy it is or when they see their regular ed. peers using the same exact accommodation that we said "Why don't you use it?", then it becomes more likely for them to use it.

Another participant explained how students are more willing to use AT when they do not appear to be different from their peers: "It is nice that the technology kids might be using for AT is the same technology all kids are using. Having a Chromebook in front of you is no different from what another kid is doing." At a school where all students were provided with universal access to devices, a teacher discussed how students who did not have disabilities would use many of the same tools that might be considered AT:

> That's the beauty of it. A lot of different students use it. We still have some of my students with disabilities take notes not digitally, but by hand. Some students still want to do that. But the big piece is that it taps into multiple intelligences. So it is good for every kid.

Some teachers allowed flexibility and provided students with choices of how to access information and respond. In schools where all students were provided with universal access to technology, general content area teachers reported that they were changing the way they taught and providing students with more options. For example, a participant explained how teachers would allow students to choose to write a traditional book report, audio record their response, make a movie, or create a digital poster. E-

books provided all students with the option of listening to text on their own devices and students could choose how they accessed information depending on their personal learning needs. Although this type of universal design for learning was only implemented at some schools, most teachers discussed the potential benefit. A middle school teacher thought many of her students would benefit from having AT universally available:

> For kids in the general class, [listening to text] would probably be a benefit for most of them to be able to mix it up a bit. To be able to hear it and then other times read it. That would be nice.

Another participant discussed how it was important for general education teachers to learn how AT can be mainstreamed:

> So that way it is not just the special ed. students using it, but all of the kids using it. Because what ends up happening is that one child that has to use the speech-to-text – he feels different. So it's like a stigma for him. He feels like, well nobody else has to do this. So he sometimes refuses to do it because he is the only one. So if we could embed it into everyday learning more for everybody, it would be huge.

Teachers reported that when students were given opportunities to try different technologies, they could determine what worked best for them. When students were provided with choices, some would opt to use technology and some would opt to use more traditional methods.

One-to-one devices. Teachers explained that they found AT to be most efficient and effective when it is on a one-to-one device. A one-to-one device would be one that is solely designated to a particular student so that it can travel from class to class and home with the student and is configured with appropriate settings and software. A middle school science teacher explained the benefits of a one-to-one device:

> The one-to-one has made a huge difference for them because it has leveled the playing field. You can change how you want your screen to look. So the majority of the time the stuff is right there on their devices.

Devices such as tablets, netbooks, laptops, and smartphones were used for a variety of AT purposes. The manner in which schools provided students with access to devices ranged from a special education teacher having to lend her own personally owned device to students, to schools providing every student with a device to use both at school and home. Availability and accessibility of AT in the general education classroom was a key factor contributing to the use of AT. At schools where all students had access to one-to-one devices (whether school issued or purchased by families) students used more AT. The following describes the different methods for providing students with devices along with the reported implications.

Two schools provided all students with one-to-one devices and access to cloud-based software allowing students access to AT in multiple environments including outside of school. This allowed all students to have access to AT right there on their devices throughout the day and decreased the chances of students feeling different from their peers. General content area teachers in these schools tended to incorporate AT

options when designing lessons and offered students choices in how they represented and accessed information as described in the previous section.

> A teacher at one of these schools reported the value of one-to-one devices:
>
> It is really efficient when it is on the kid's own device. I have used iPads with kids that have the speech-to-text. And we have Read Write Gold on the regular laptops but it was server based and not cloud based so there were always problems with it. So allowing the students to have it on their own is huge.

Teachers who allowed students to use their own personal mobile digital devices such as phones and tablets as learning tools found that students benefit. A special education teacher discussed how students discover ways to use their phones as learning tools:

> Some students will use their phone and record the teachers' lectures…They find their own way of doing things. Or they will take pictures of things on the smart board. We have a responsible use policy. Which is pretty cool. Students don't have to put their phones in a bin. They can use it. It is at the teacher's discretion. They can ask to use their phones.

When asked if many students own their own devices, she reported that almost all of them do. Allowing students to bring and use their own devices may have allowed students access to the tools they needed but required families to purchase devices and applications. This also required teacher knowledge of a wider array of software and applications to be compatible with multiple brands of devices. One participant discussed how she was

recently researching applications to assist a student but most of them were for Apple devices and her student owned an Android device.

Some schools had a class set of devices such as laptops or netbooks available if classroom teachers chose to use them. In many schools that did not have universal one-to-one devices or a bring-your-own device policy, the school would provide a device to students whose IEP specified the need. In some schools, devices were only available in the resource room for students whose IEPs specified the need. This limited student opportunities to discover what worked best for them and could result in students feeling different, and being excluded from the classroom. One special education teacher discussed the lack of devices in her school and how she would lend students her own personal devices:

> For my population, I wish they had their own iPad. I have to loan mine out for the student to use. They don't have their own device. Same thing with the recorder. It is my own personal device, not a school device. But for my population, there isn't a lot of technology. It would be convenient for the kids to each have their own laptop or netbook to be able to produce notes because they get caught up with the writing part of it.

Although the availability of one-to-one devices varied between schools, teachers consistently felt that students would benefit from access to a one-to-one device.

Encouragement to use AT. Teachers found that students need to be encouraged to use AT in the most beneficial way for a variety of tasks in a variety of environments. Teachers discussed how it was important that general education teachers know which

students need to be using AT and encourage that use. A high school special education teacher discussed how she seeks help with encouraging AT use from general education teachers:

> I try to tell the classroom teachers to encourage the boys to use the technology. If they see the para sitting there scribing for the student, to go over there and say "Couldn't you do that on the Google Read&Write?" I don't know if that happens but I think if the student isn't just getting the message from one person but getting it from everybody, all the teachers that they come in contact with throughout the school year, I think that would speed things up a bit for them.

Class time might not be spent teaching students how/when to use the AT and students were often left to discover it on their own. For example students often did not think to use AT for shorter assignments such as worksheets but they could easily write large and shrink it down to fit in the space, type their responses, or dictate their responses using speech-to-text.

Many teachers discussed how students need to be encouraged to follow along while listening to text. A middle school special education teacher explained the challenges she encountered:

> Trying to get them to actually do it the right way is probably the most difficult thing for the most part. We don't use class time for that to happen. It is on their own. Some of the students, depending on their certain drive or whatever, they might listen to it but they are not following along in the actual book and taking notes the way that they should. Because that would be the ideal way to do it. But

> they would rather listen to it than actually read it. Especially the weaker readers. Obviously, the comprehension is that much better.

Students were more likely to use AT when general classroom teachers encouraged its use and when they got the same message from multiple teachers. Some teachers did not recognize its potential and understand how it could benefit students in their daily work and some even felt that it would take away from the lesson.

Teacher comfort with AT. Teacher comfort with technology was a factor in how AT was integrated into the classroom. Special Education teachers reported that some teachers were afraid of students using AT in their classroom initially and need to be well trained in how it could be integrated into the classroom to provide students with access to the curriculum. When asked what factors impact the integration of AT into the general content area classroom, one special educator replied, "a big thing is teacher comfort in using it. Some teachers are more tech savvy than other teachers are." Another participant explained how some teachers have difficulty integrating AT:

> The accommodation piece is hard for some of the teachers to implement. They try their best but I think that it is hit or miss on some occasions. So them pulling in the devices is another aspect that is kind of lost. Like one of the kids has access to a computer or netbook for every period if he wants. If he is going to produce written work, that doesn't always happen. So I think that tends to be a barrier.

Some teachers allowed flexibility and provided students with choices of how to access information and respond but other teachers struggled with allowing choices for

learners. A middle school special education teacher observed differences in the flexibility of her colleagues:

> teachers fresh out of college tend to be more that way where they allow some flexibility. Whereas some of the teachers that have been doing it for a while struggle with some of that, with allowing some choice for the learners. It would be nice if we could get some workshop stuff around that.

One teacher reported that some teachers were not comfortable with being recorded and would not allow students to record their lectures. Before AT can be effectively integrated into the classroom, it is important that the general education teachers understand and are comfortable with both the technology and how it can be used to enhance student learning.

Ease of transitions while using AT. When students needed to use dictation software to write, they needed a quiet environment where they would not disturb other students and where there was minimal background noise. This usually required leaving the classroom. This had implications in that students were no longer included with their peers and it often required a paraprofessional accompanying them. When students needed to access technology outside of the classroom, time was lost in the transition of traveling, organizing materials, and starting up programs. A high school special education teacher discussed the experience of a student:

> He is not the most organized guy in the world and transitions are tough, so by the time he gets the laptop set up and opens the program a good amount of time has gone by and it cuts into the amount of time he has to actually dictate his answers. So that is a limitation using the Dragon Dictation.

When AT was readily available and accessible within the classroom, less time was lost in transition. When everything (texts, assignments, calendars, AT software, etc.) existed on one device, students could transition between and use programs simultaneously, resulting in less gaps and allowing students to produce work more quickly. A social studies teacher at a school where students have universal access to one-to-one devices explained, "everything is happening spontaneously, especially kids with ADHD issues or speech and language issues, not having the gaps of the transitional pieces of one thing to another, it does help them." Teachers explained that it was helpful when programs or applications were compatible allowing data or files to be easily transferred. Students could access and submit assignments digitally and students and teachers could collaborate online using web-based applications. The ability to upload, store, edit, and access data in a compatible format can be a limiting factor. For example teachers discussed wanting to be able to mark up documents, attach photos, upload videos and project student work in particular situations.

Access. Many teachers identified access to technology as a factor limiting the integration of AT into the general education classroom. Some schools did not have access to much technology due to budget constraints. One participant said the greatest factor impacting the integration of AT was "having access to it. With such a small school, we don't have a lot of access to the technology that is out there. The budget kind of puts us in some restraints." Another participant explained, "you don't want to remove anything because of a financial constraint. But I think sometimes that does happen because there is only so much money in the budget." A special education teacher noted that students

may have difficulty signing out the technology that did exist because it was being used by others. The cost of programs and applications can also be a limiting factor. A special education teacher discussed how she was willing to spend $4.99 on a new application to try out but hesitated to spend more than that for fear of wasting the school district's money on something that may or may not work for the student. As described previously, school provision of technology varied significantly ranging from teachers lending students their own personally purchased devices to schools providing all students with one-to-one devices and much of this depended on the school district's budget.

Students were also limited by what their family could afford to purchase. As one participant explained, "it is the haves and the have-nots." Not only does this impact student access to AT at home, but it especially has implications in schools where students bring their own devices.

Even when schools provide devices for all students to bring home, some students do not have access to the Internet. One teacher pointed out "the other thing is we live in the North Country so getting Internet is a problem. You know, the digital divide. They don't have Internet at home." Some families may not be able to afford Internet service, but many families do not have an option for Internet service due to the remote location of their homes. All schools reported having Wi-Fi access in the school buildings and one participant said the school had begun to look into getting an antenna to broadcast Wi-Fi to the local area.

Time. It takes time for students to learn how they can benefit from AT. An English teacher stated "I think one of the biggest challenges with [AT] is the time factor."

Students can be reluctant to use new technology when they are uncomfortable with it at first. A high school special educator considered how lack of patience and time might be factors in one student's reluctance to use AT:

> I can't say he is using it a lot. He is also very reluctant. And I don't understand the reluctance except immaturity and being so ingrained or in a pattern of I need to have somebody write this for me. Or I think that when you start a new program it takes time, and he's just not patient enough to take the time to make it work. Learning to use new technology requires time to practice and patience.

Dictation software can be frustrating to learn to use and requires the extra step of revision. A teacher remembered hearing students yelling at the Dragon Dictation software. Sometimes particular technologies are not appropriate for students. For example, a middle school special education teacher told of a student for whom, "Dragon was so challenging for him because his tone constantly changes that it wouldn't recognize what he was saying, so it would end up frustrating him. Behaviors would come about."

Teachers found that sometimes students would rather just get the work done as quickly as possible as opposed to striving for quality and independence. One teacher explained how time and workload are factors in how students approach assignments:

> With an adult they can usually get things done faster. In my opinion, they have so much to do that they rely more on the quantity as opposed to the quality of what they are doing and the deep understanding of what is going on. They just want to get it done.

Teachers reported needing time to be exposed to, learn about, and practice using technology. Teachers felt they needed time to collaborate with other teachers and students to figure out how AT could be integrated into the curriculum.

Appropriate use. Teachers have encountered challenges in ensuring students use technology appropriately. A teacher from a school that provided all students with one-to-one devices described how students needed to be trained to keep devices charged and to safely bring them back and forth from home. Multiple teachers reported needing to monitor students while using technology to make sure they were doing what they were supposed to be doing. A middle school social studies teacher explained his experiences:

> Probably one of the biggest challenges is making sure the students are doing what they are supposed to be and not playing games on it. Things like that. But most of the time, they are pretty engaged in what is going on so I don't see a lot of that.

In discussing the integration of one-to-one devices, a teacher recounted some issues of misuse:

> We have some students who are hard on them and we have some students who have used them inappropriately and now have to use them under the supervision of a teacher or assistant. So, seamless, I wouldn't say that but overall I think people have been really happy with the opportunities it has opened up.

Teachers explained that students can be sneaky and teachers need to maintain vigilant supervision of how students are using technology. A science teacher who had integrated one-to-one devices into his classroom discussed how the role of the aide in his classroom shifted from helping individuals with their learning to monitoring student use of devices.

Curriculum Demands. Data showed that the demands of the curriculum can impact the use of AT. At one school, many students with disabilities were not on a college preparatory level track and were placed in lower foundations level courses where there were not high demands for reading and writing skills. These students may not have needed AT in order to access this curriculum. A special education teacher from this school discussed how she had an opportunity to purchase multiple subscriptions to a source of audio books at a discount and asked other case managers if they had students who needed to listen to text. They could not come up with six students for whom "their skills were so low that they had to have this and they couldn't get through the foundations level track with the skills they had."

When a special educator at another school was asked if students listened to text such as recorded books, she replied with the following:

> In English class they do. But that's for the kids that have the modified curriculum. He, the teacher, generally does it in the classroom. He doesn't have them do it outside the class. For the kids in the general class, that would probably be a benefit for most.

For students whose reading skills were below grade level, but whose listening skills were at grade level, using AT to listen to text allowed them to access the complexity of the content without having to "water down" the curriculum. Some schools tended to modify the curriculum before using AT. Other schools tended to provide students with AT before they would consider modifying the curriculum.

A special education teacher at a school where AT is used extensively explained that for the most part, any student whose reading skills were two or more years below grade level would continue to have the accommodation of listening to text. He said "it is a team decision that is made and then it can be taken out later if they don't need it anymore. But usually those accommodations stay because the text just gets that much more difficult."

A middle school science teacher felt that more could be done to help students to access the general curriculum:

> This school does well with students with disabilities but I think we give students IEPs that allow them to be in the classroom but we don't do IEPs that allow them to meet their potential because we dumb everything down for them.

A social studies teacher expressed concerns about what would happen to students if they were placed in situations in the future where they would not have access to AT such as a military exam. He said, "I do worry about that part. I don't want to say we are making it too easy for them, but are we taking away certain skills because of it?" He discussed the importance of "having a personal dialogue with someone and having them know what their personal strengths and weaknesses are and what they want to do."

Differentiating instruction and universally designing lessons can allow a variety of students to access the curriculum. One teacher described how she has observed many colleagues differentiating instruction:

> We have a couple teachers who are wonderful at it. And especially in an area like science because it is so hands on and he might have like four different labs

going on during the same class and when you walk in there is chaos. But it takes a lot of planning and preparation.

Differentiating requires teachers to have a good understanding of their curriculum and their students. One teacher explained "you have got to really know your curriculum. You have got to know how to break it down and build it up and expand it. And I think that is just as important as all the technology pieces." A few teachers mentioned how they struggled with the traditional grading system and determining how accommodations, modifications, differentiated instruction, and universal design for learning fit in.

Decisions Regarding AT

All teachers reported making team based decisions regarding AT at IEP meetings, but did not describe a routine process that was used to make those decisions. Some teachers discussed how access to AT was written into IEPs in general terms. One special educator said, "In IEPs, I'll write it in to cover it and that is a collective decision of parents and teachers. Other than that, the teachers will offer it to whoever needs it." Another special educator explained that she would "say it's in their IEP that they will use technology to increase their independence." Sometimes families made the decision for students to begin using AT at home. Teachers provided examples of times that families decided to purchase AT devices and software for their child. Sometimes students discovered and began using AT on their own. For example, one teacher explained "the smart pen is something one student is really successful with. But the student kind of took ownership of that. It wasn't really a teacher driven accommodation." Students will let teachers know what they find works best for them.

Data showed that when the IEP team determined that a child required AT, the district would purchase the devices and software, but decisions were sometimes based on the cost and availability of technology. A middle school special education teacher explained that the IEP teams based a lot of their decisions on what they had available for devices at the time. She provided a story of how she gave a student a device of her own to use and then wrote it into the IEP:

> The recording device that I provided the student, we just recently put that in the IEP. So I've pretty much said you can have it. You know what I mean. Because it was something I previously used. I purchased it [elsewhere] and I figured, I'm not using it. I might as well let the kid use it. And he'll have it all the way through. That is not something that happens all the time. I know if we had a kiddo that needed it, I'm sure the district would find the means to get it.

Decisions to try out new software and applications were often based on the cost. Teachers accessed free trials or relatively inexpensive applications to try out themselves and with students, but were hesitant to purchase more expensive software and applications without knowing if it would benefit the student. Decisions were also based on the demands of the curriculum. Sometimes modifications or lower level tracks of curriculum were provided before AT. As described in the previous section, teams at one school considered AT for students whose skills were so low, they had trouble getting through the foundations level track. At other schools, teams considered AT when a student was having difficulty accessing the general curriculum.

How Teachers Learn About AT

According to the interview data, it was usually up to teachers to seek out professional development and teach themselves about AT. Teachers reported learning about new technologies by word of mouth from colleagues or students in their schools or by searching the Internet for solutions to problems. Although teachers attended some technology workshops, few of these were focused on AT, and teachers tended to learn how to use AT by trial and error.

Online research. Teachers reported learning about AT through research online, often just beginning with an Internet search. A middle school special education teacher reported, "for example, I had four students with speech language communication issues that have auditory memory difficulties this year so I was doing a little research to see how I could help them." Another special education teacher showed me her computer screen where she had recently been searching for AT to meet the needs of her students:

> I was just looking at some apps for students with social pieces and one of them was quick cues to help navigate, you know answering the phone, conversations with friends. That sort of thing didn't exist 7 years ago. There were not apps for kids on the autism spectrum to help them navigate through either academic or social situations and that is pretty cool. But it is all new.

Teachers expressed that it was difficult to search through all the advertised technologies and software to determine what might work. One participant explained how she had difficulty evaluating the technologies she discovered online: "there's a ton of them, but there also isn't any research on any of it. It is all anecdotal, 'my son loved this', but no

study based on whether or not it works yet." Teachers reported not having a particular online source of information for AT but rather being responsible for sifting through and evaluating the results of an Internet search.

Word of mouth. Teachers reported becoming aware of new technologies by word of mouth from co-workers. Teachers tended to share what they found and asked colleagues for ideas. Those who were in positions to support teachers such as library media specialists, literacy coaches, reading specialists, technology coordinators, and computer teachers, were often sources of information. Administrators were also good sources of information as they attend conferences more often and may be more aware of how AT is being used in other schools. One participant explained that administrators "are actually much more in tune with a lot of different things statewide or what is going on throughout the country and we kind of live in our little bubble here, and they are exposed to a lot more."

Teachers reported a technology integration specialist as being an especially valuable resource. A special education teacher discussed how she missed having a technology integration specialist on staff: "we had a technology integration person. That was her position, was to assist teachers in finding things that would support students. And that position doesn't exist anymore and I feel like that's a hole." Another school had a technology integration specialist who would send out information for teachers to explore. A special education teacher discussed how the technology team at her school served as a source of information:

> Our technology team here is really good at keeping us up to speed with the current stuff but not necessarily for the special ed. student. It's for general students like cameras and stuff like that teachers will use in their classrooms. So any kind of technology they are offering, I join because I try to just see if I can finagle it somehow to work for my kids.

Sometimes teachers learned about AT from students who discovered it on their own. A middle school special educator discussed the role of students in learning about new technologies:

> We learn from the students. There is a saying in the district that the students are digital natives and we are digital immigrants. I think most teachers here, if we don't know how to do something, we will ask the kids.

Another teacher described how asking students to teach him empowers the students, increasing their self-concept, esteem, and confidence.

Trial and error. Participants discussed how they learned to use AT through trial and error. Teachers rarely had formal training on how to use particular devices, software, or applications and often just began playing with the different features to see how they worked. Teachers, paraprofessionals, and students might sign up for a free 30 day trial to experiment with new software or an application to see if it worked for the student. One teacher said, "If I need something, I will go online and do a little research and then play with it myself." A middle school social studies teacher explained that because teachers did not have an expert to rely on for advice, they needed to be the ones to experiment with new technologies:

> We are on the front lines. Like, we are doing it with no feedback. With no expert saying "This is what we know for sure works." We are experimenting and saying, "this is what we know for sure works" because we are the ones doing it and we don't have a go-to person or a mentor.

Teachers might learn about the existence of a new technology by word of mouth or online, but were usually left on their own to figure out how it worked and how it could be integrated into the curriculum.

Workshops. Many teachers reported that their schools had staff development funds available for teachers to seek out professional development opportunities. Schools sometimes provided teachers with training on devices when they were first distributed but other times, teachers were left to figure it out on their own. Teachers attended technology workshops but reported learning little about AT from these workshops. Teachers mentioned the Christa McAuliffe workshop which is an annual three day workshop held in New Hampshire during which participants can select from a wide variety of sessions focused on technology. However, teachers found that large workshops tended to be too general, the information was outdated, or they were conducted by people with little classroom experience. A high school special education teacher reported, "I feel like personally I would benefit from one-on-one instruction to meet my specific needs or my specific students' needs because I could go to a whole day and maybe use 10 percent of what I hear."

An English teacher explained that sometimes the information presented in workshops is not readily applicable in the general education classroom:

> Sometimes we hire experts to come in and talk to us and they are very knowledgeable. But at the same time, you are thinking, as a classroom teacher, this is someone who hasn't been in a classroom. This isn't going to work.

A middle school special education teacher claimed, "typically when I have gone to trainings on specific technologies, they are usually old so I could probably teach those classes they are giving."

Another issue participants brought up was the fact that the closest workshops were typically 1-3 hours away from most small rural schools. Very few workshops offered within the state have been focused on AT. According to one teacher, "There really aren't a lot of things offered especially here in the North Country. It's really up to staff and teachers to figure it out."

Teachers consistently reported being responsible for learning about available AT, how to use it, and how to integrate it into the classroom for use by students with disabilities. Although some teachers attended technology workshops both in and out of district, these trainings were not focused specifically on AT. Although teachers had some knowledge of how to seek new information regarding AT, many reported lacking resources and experts to turn to.

AT Professional Development Needs

When asked what professional development they thought general and special education teachers would need in order to more effectively use AT with students with high-incidence disabilities, participants discussed both what they felt teachers needed and how they thought professional development should be delivered. The following section

describes what participants felt teachers needed in terms of skills and knowledge. The subsequent section describes how participants felt professional development should be delivered.

What teachers feel they need. Participant responses were consistent in terms of the types of professional development they thought general and special education teachers would need. In order to more effectively use AT with students with high incidence disabilities, teachers need to be aware of the different AT options available. Then, teachers need opportunities for hands-on practice using the technologies and strategies for integrating the AT into the classroom. Participants also expressed the need for solutions to problems as they arise.

Awareness of AT options available. Teachers consistently reported needing to be introduced to what is available for AT. As discussed previously, participant awareness of AT varied, but even teachers who reported using AT extensively with their students, felt they might be missing out on AT opportunities due to a lack of awareness. With the rapid development of devices and software, new AT options are continuously becoming available, yet participants did not feel they were well informed. Teachers expressed the need to understand the essential best-practices in AT and to be updated as new technologies become available. A middle school special education teacher described her need for more knowledge:

> I know for myself, I am probably not in the loop as to what is out there. It's the basics I know of. I'd like to know what else is available for kids and where we

> can get it, the costs attributed to getting it. Just so that I have more in my toolbox.
>
> General teachers, the same, I think a lot of them aren't aware of what is out there.

Considering how to improve teacher awareness of AT devices and software, a high school special education teacher shared her vision of a traveling showcase:

> I wonder if you could do an itinerant person that could go to the schools and just introduce all the new stuff that is out and demonstrate it. That would be nice. Kind of like the traveling vacuum cleaner salesman.

A middle school social studies teacher shared some of her questions and expressed her desire for expert guidance:

> There is so much out there. Where do you hone in? What do you focus on? So someone has to be the expert and say this is best practice for teachers. This is what you need to know and be able to do.

As this teacher explained, just a list of technologies available would not be sufficient, but rather teachers wanted information on how specific technologies could be used to effectively assist students with disabilities with specific tasks.

Strategies for integrating AT into the classroom. Participants also expressed a need to learn how AT can be integrated into the classroom. Data showed that even when AT was readily available, teachers could struggle with figuring out how it could be incorporated into the curriculum. Participants thought specific examples and models would help teachers to understand how AT could be used to provide students with access to their curriculum. A science teacher felt that teacher training in AT integration was essential to AT success and stated that AT "only fits when you have staff that are well

trained in that technology who can integrate it back into the classroom." A middle school special educator felt that AT professional development should include collaborative dialogue around needs of specific students and wanted an opportunity "for us to be able to sit and talk about ways where students can be integrated."

A high school English teacher expressed the value of professional development focused on AT integration:

> I'm glad you are doing this study because I really think that teachers need more professional development in this area and they need strategies to integrate students into the classroom to make them feel like they are a full member of the classroom and not different so to speak.

A special education teacher also spoke of the value of universal integration of AT into the classroom and felt "if we could find a way for the general ed. teachers to feel like it is a benefit for the general ed. student, not just the special ed. student, that would be great."

Teachers felt they would benefit from a path to follow when integrating AT into the classroom and a model for embedding AT into everyday learning for all students. A middle school special education teacher expressed the need for a model for integrating AT into the curriculum:

> Our social studies teacher spends an hour and a half maybe two hours each night redesigning the curriculum and it would be great if she didn't have to recreate the wheel. It seems like there has got to be a way for… sort of a path to follow to do those sorts of things.

Interviews revealed that teachers needed more concrete guidelines, strategies, and examples for how AT can be used within the general education classroom.

Solutions to problems as needed. Teachers wanted solutions to problems. Participants discussed how they would benefit from professional development as needed to determine what could help a particular student with a particular task. Often times, educators were able to identify the barriers students encountered but struggled to find solutions. Teachers felt they would benefit from having experts they could turn to for advice. The need for assistance with troubleshooting technology problems was also discussed. Although some teachers had professionals they could request assistance from, they had difficulty getting timely answers to questions. A special education teacher expressed her frustration with inefficient support:

> I find that frustrating when I am trying to change things and improve things and they are like we will email this person and get back to you and then I hear three weeks later and I'm like, well I have already moved on.

Teachers consistently expressed wanting to have someone available to give them help when they needed it. Often times, it was the needs of a particular student completing a particular task within the curriculum that drove a teacher to seek AT professional development. Learning opportunities were not always available when teachers needed them.

Hands-on practice with AT. Participants explained that they wanted hands-on opportunities to play with and practice using AT with feedback and support. Hands-on experience with the technology could help teachers to better understand the student

experience and how the AT could be integrated into different parts of the curriculum. Without experience using the technology, teachers had a hard time supporting students using the technology in their classrooms. A science teacher discussed how teachers were not given the time to learn about the possibilities of AT and claimed "we are never given the time to go explore. Go play with this." A middle school special educator explained how just hearing about or seeing AT is not sufficient:

> What I think is most beneficial is when you have time to actually play with the stuff. You know, not just hear about it, and a demonstration on how to use it but that combined with playing with it, actually doing it.

Content area and special education teachers felt it would be important to have opportunities to practice using the technology with an expert available to provide guidance, feedback, and support.

How teachers feel professional development should be delivered. In order for professional development to be most effective, it would need to meet the needs of participants in format as well as content. Interview data revealed general themes regarding how teachers felt professional development should be delivered. Participants reported wanting individualized or leveled professional development provided by experienced professionals in a convenient and ongoing format.

Individualized or leveled. Teachers reported preferring individualized or leveled professional development that is relevant to their personal needs as opposed to large group generalized workshops. Ideally, teachers would like individualized professional development, but this is not often feasible due to limited resources. A few participants

discussed how leveled professional development allowed participants to self-select professional development sessions based on their prior knowledge and skill. One teacher explained why large generalized workshops are often not effective:

> when you group a lot of these trainings together with the entire teaching population, it's not really, in my opinion, productive because only a certain part of the population will actually use what they are given, so it needs to be directed toward a subgroup rather than the entire.

A special education teacher described how workshops could be designed to meet the needs of teachers with a variety of experience and proposed having different levels of technology workshops available:

> So if someone is really uncomfortable and they need it at a basic level, there is going to be something at a basic level. For people that are already familiar with it, it can be at an intermediate level.

Data showed that teachers valued the opportunity to choose the professional development activities they participated in based on their own perceived needs.

Ongoing through the school year. Teachers felt some professional development should be frontloaded before the school year and before teachers begin working with the students. Teachers also felt that professional development should also be ongoing over several sessions evenly spaced throughout the year. It can be difficult to retain large amounts of information and ongoing professional development could give teachers the opportunity to try out new technologies and reflect on their practice over time. A high

school English teacher explained how she felt that professional development should be carefully scheduled to maximize teacher learning:

> I think it needs to be ongoing is the first thing. I feel that the professional development I have had, and I am not trying to be critical of it, it is randomly assigned throughout the course of the year. I think you need to front load it at the beginning of the year. You need a lot more to start the year off. Then it should be evenly spaced throughout the year. So you know Monday I am going to meet this person and I can ask them questions that I just had in class.

Ongoing professional development can provide opportunities for teachers to follow up and deepen their understanding.

Delivered by professionals with experience in the field. Teachers felt that professional development is most beneficial when it is provided by people in the field. Participants explained that they wanted to learn from other teachers' experiences. Even hearing about the successes and failures other teachers have had with using AT with students could help teachers to consider how they could integrate AT into their classrooms. According to one teacher, it would be beneficial, "having other people that are similar to the position you have and seeing how they have solved it or done different things."

An English teacher explained why learning from other professionals with classroom teaching experience is important:

> I think having teachers would be huge. Somebody who is in the classroom who has struggled with it. And it doesn't have to be an exact correlation. But

> somebody who can say I know what you are going through. This is what I tried. This is what didn't work. This is what worked. I think that would be more helpful sometimes than people who have not been in the classroom teaching.

Two participants explained that they had less appreciation for professional development provided by technology company representatives who had not personally experienced the trials and tribulations of using the technology with students with disabilities in the classroom. Participants wanted to hear teachers share concrete examples of how they were using AT with their students.

Convenient time and location. Interview participants explained that in order for teachers to be likely to participate, professional development opportunities needed to be accessible at a convenient time and location that was not too far away. Participants identified having to travel long distances as a barrier to accessing professional development. Because the schools in this study were all located in rural areas, participants were concerned that they had to travel long distances to attend workshops and trainings. One teacher described a model she felt would work well:

> having someone come to us…even if it was two hours after school one day. We have had some people come for that amount of time but it has to be over several sessions. Because there is no way everyone can make it whenever it is scheduled. So frequent opportunities.

Time is valuable to teachers and professional development offered at the workplace in short sessions was identified as being most convenient. Online training was discussed as

a way that professional development could be provided remotely and accessed at any time of day without the need for travel.

Conclusion

Data collected through semistructured interviews as part of an intrinsic case study were analyzed to identify common themes. Findings helped to answer the questions of how teachers use assistive technology with students with high-incidence disabilities in small rural schools in New Hampshire and what professional development teachers need in order to use AT more effectively.

When asked about their experiences with using AT with students with high incidence disabilities, participants primarily discussed how students use AT to compensate for reading or writing difficulties caused by a disability. Consistent with Sweller's (1988) cognitive load theory, teachers found that AT such as text-to-speech, speech-to-text, or recording devices enabled students to independently engage in higher level processes of comprehending or composing text. Teachers explained that AT allowed these students to access grade level text or demonstrate their understanding. Teacher experience with using AT with students with high-incidence disabilities varied; however those teachers who integrated the AT into the general education classroom found that it leveled the playing field for students with disabilities by giving them opportunities to access the same curriculum as the their peers without disabilities.

Edyburn's (2003) levels of AT literacy served as a conceptual framework for understanding teacher skill and knowledge in AT. Interview questions about the potential of AT along with how teachers learn about AT, make AT decisions, and

integrate AT helped to elicit information about the AT literacy of participants. Edyburn identified awareness of the possibilities of AT as the first level of the change process in developing AT literacy. The participants interviewed seemed to be able to recognize student performance problems and the potential for AT; however many did not know how to access the devices and services needed. In their surveys of teachers, Jost and Mosley (2011) and Ribeiro and Moreira (2010) also found that although teachers were aware of the potential for AT to improve access to the curriculum, many lacked the knowledge and skills to take advantage of the technology available. Edyburn's description of AT awareness included knowing how to access AT devices, services, resources, and expertise. Although the AT knowledge and experience of participants in the current study varied, all teachers felt they could continuously improve their understanding of the technologies available and how to access and use those technologies to support students. Flanagan et al. (2013), Ribeiro and Moreira (2010), and Alkahtani (2013) also found that the majority of teachers lacked training in types of AT and how to use AT in instruction. Teachers reported learning about AT through word of mouth, Internet searches, and trial and error. Opportunities for formal training through workshops were rare.

Edyburn (2003) identified the second level of AT literacy as working knowledge when teachers develop the ability to recommend, consider, evaluate, and locate AT. Some teachers demonstrated evidence of having reached a working knowledge level. When asked about how AT decisions were made, all participants reported making team based decisions at IEP meetings, but did not describe a routine process that was used to

make those decisions. In their analysis of AT policies, Bausch et. al. (2009) also found that states rarely provided criteria for AT decisions made during IEP meetings. The extent to which schools made AT available to students varied. A few schools tended to modify the curriculum, placing students who lacked skills due to a disability in lower level tracks where there were not high demands for reading and writing skills so students would not need AT. This was consistent with Kurth and Keegan's (2014) finding that teachers were more likely to lower reading levels or reduce the length of an assignment than consider AT. Other schools considered how they could provide students with the AT tools needed to access the grade level curriculum. Participants explained that teachers and students would experiment with different technologies to find ones that worked best for particular tasks. This practice is consistent with the statement of Douglas et al. (2012) that inexpensive and readily available devices and applications allow for more flexibility and fluidity of choice regarding AT. Data showed that AT decisions were often based on what was available for technology.

Participants reported a number of factors that impacted the integration of AT into the classroom. Availability and accessibility of AT in the general education classroom were key factors contributing to the use of AT. Students were more likely to use AT when general classroom teachers encouraged its use. Teacher comfort with AT had an impact on how effectively students used technologies within the classroom. Participants consistently reported that students wanted to be included and did not want to appear different from their peers. Teachers found inclusion to be a strong motivator and students were more likely to use AT if it involved using technology devices that all students were

using. Teachers found that students were more independent when they had access to technology tools on-demand and the ability to self-manage these tools. The classroom context, including the availability of technology, availability of personal assistance from an adult, and social acceptance of AT, played a role in if and how students used AT. This was consistent with Teo's (2013) findings that an individual's attitude and subjective norms are the key constructs determining intentions to use technology.

Edyburn's (2003) third and final level of AT literacy involved transformation of one's practice which includes advocating for accessibility for all and employing UDL. Participants from schools where all students were provided with to one-to-one devices showed evidence of this level of AT literacy. These teachers were able to provide students with universal access to AT allowing students to choose which learning tools worked best for them and reported the most extensive use of AT by students with high-incidence disabilities. The integration of AT seemed to be most effective in schools that promoted and supported the use of innovative technologies and UDL. Avidov-Ungar and Eshet-Alkakay (2011) found that the culture of a school plays a significant role in the implementation of innovative technologies.

When asked about what professional development general and special education teachers needed in order to more effectively use AT with students with high-incidence disabilities, participants reported needing to be introduced to the technologies available and given hands-on opportunities to practice using AT. Participants also reported needing to learn strategies for integrating AT into the classroom and needing timely solutions to problems. Interview data showed that teachers preferred individualized,

ongoing, convenient professional development with opportunities to learn from the experiences of teachers in the field.

A better understanding of current practices and the professional development needs of teachers regarding AT was useful in the design of professional development. Within the next year, I intend to provide a professional development program for teachers in small rural schools in New Hampshire aimed at improving teacher knowledge and skill in using AT with students with high-incidence disabilities. This professional development project is described in the next section.

Section 3: The Project

Introduction

The following describes a plan for professional development designed to improve teacher awareness and working knowledge of how AT can be integrated into the classroom to improve access to the general curriculum for students with high-incidence disabilities. The complete project including associated materials can be found in Appendix A. The design of this project is based on the research findings in Section 2 including current teacher practices and professional development needs regarding the use of AT in small rural schools. Theory and current research on adult learning and effective professional development were used to guide the development of this project. Descriptions of the project goals, rationale, and implementation are followed by a review of current scholarly literature on professional development, a plan for evaluating the project, and a discussion of possible implications for social change.

Description and Goals

The purpose of this project is to improve access to the general education curriculum for students with high-incidence disabilities by improving teacher integration of AT into the general education classroom through professional development that meets the needs of teachers in small rural schools in New Hampshire. The professional development plan consists of a full-day professional workshop, a collection of online training resources, monthly after-school training sessions, and an online professional learning network (PLN). Although this professional development program will be open

to all educators in New Hampshire, the target audience is teachers from small rural schools as it is specially designed to meet the needs identified by this group of teachers.

All participants will attend the full day workshop in August focused on increasing awareness of the possibilities of AT. The morning session is focused on strategies for integrating AT into the general education classroom using a UDL framework. The afternoon session provides a showcase of various technologies available. The workshop ends with a hands-on-session in which participants will learn how to access the online training resources and discussion forum. A collection of high-quality online training resources will provide participants with convenient options to further their learning. Participants can choose to take part in monthly after school training sessions designed to provide hands-on instruction and practice with using specific technologies. Participants will contribute to an online discussion forum where they will be encouraged to ask questions and share their experiences with other New Hampshire educators through a regional PLN. AT professionals will also be invited to join the online PLN to provide additional expertise in answering questions. The goal of this project is to provide professional development to increase the AT awareness and working knowledge of special and general education teachers in small rural schools in New Hampshire and to create a regional PLN through which teachers can continue to learn and share resources.

Rationale

In this qualitative case study, semistructured interviews were used to gain a better understanding of how teachers in small rural New Hampshire schools are using AT with students with high-incidence disabilities and the professional development teachers need

in order to use AT more effectively. Edyburn's (2003) levels of AT literacy provided a conceptual framework for understanding teachers' knowledge and skills in AT use and interview data showed how teachers' levels of AT literacy varied. Because this plan is limited in scope, in that it is only a plan for one school year, the goal is to improve the levels of AT awareness and working knowledge of participants. Future professional development with a goal of transformation (the third and final level of AT literacy) may be planned based on evaluation of this program.

Data analysis indicated that teachers currently learn about AT via internet searches, word of mouth, and trial and error and have very few opportunities to receive professional training in AT. This project addresses this lack of professional learning opportunities by outlining a plan for a year-long professional development initiative designed to meet the needs of general and special education teachers in small rural schools in New Hampshire. This project brings special and general education teachers from a variety of schools together into a professional learning community where they can engage in dialogue and critical inquiry around the use of AT with students in general education classrooms. Ongoing opportunities to discuss experiences, seek feedback, and reflect on practice with a diverse group of educators have the potential to broaden perspectives resulting in a higher level of collective expertise. At small schools such as those included in this study, there may only be one or two teachers in a particular subject area making opportunities to collaborate with fellow professionals from other schools especially important.

The professional development activities are designed to provide teachers with learning experiences to meet the professional development needs identified in the research findings described in Section 2:

- Awareness of the AT options available
- Hands-on-practice using AT
- Solutions to problems regarding AT as needed
- Strategies for integrating AT into the general education classroom

The full-day workshop and online training resources are designed to increase awareness of the potential for AT to improve access to the general curriculum as well as awareness of the specific AT devices and software available. UDL will be presented as a framework for considering how AT can be integrated into the general education classroom. The after-school trainings will provide opportunities for teachers to gain hands-on experience using specific AT devices and software. The online PLN will provide teachers with a forum to ask questions and seek solutions to problems. Colleagues can support each other by sharing their experiences and resources.

Design of the plan also takes into consideration the preferences of teachers regarding the format of professional development according to the findings in Section 2:

- Individualized or leveled training
- Ongoing training and support
- Provided by professionals with experience in the field
- Convenient time and place

The online training resources and optional after-school trainings provide participants with choices to only take part in those learning activities they feel they will best meet their individual needs. The monthly trainings and online PLN provide opportunities for teachers to continue learning throughout the school year and provide ongoing support as teachers begin implementing their new learning in the classroom. Teachers with experience using the specific technologies with their students will be asked to facilitate the after-school trainings. The online PLN will provide a forum for teachers to discuss and learn from the experiences of other teachers. The workshop before the start of the school year and the after-school trainings will be held in the northern part of the state where the majority of small rural schools are located. The online resources and PLN provide teachers with access to professional development from their own school or home at any time of day.

Data analysis revealed that all teachers discussed the need for AT to assist students with reading and writing tasks. Although AT can assist students with a wide variety of learning tasks, this professional development plan will focus specifically on the use of AT for reading and writing with students with high-incidence disabilities. Using UDL as a framework for integrating AT into the general education classroom will help to address issues related to many of the themes identified in the findings in Section 2 including independence, leveling of the playing field, inclusion, universal access and student choice, encouraging student use of AT, and curriculum demands. In addition to the findings of the data analysis in Section 2, adult learning theory and current research of effective professional development practices were used to guide the development of this

project. The following review of the literature discusses how the professional development project was designed to meet criteria identified in scholarly literature.

Review of the Literature

Conceptual Framework and Criteria

Professional development can entail a range of experiences that lead to changes in teacher knowledge, skills, attitudes, and practices ultimately leading to enhanced student learning. Based on common features identified in an analysis of empirical research, Desimone (2011) proposed a basic conceptual model of the process by which professional development leads to improved student achievement. Effective professional development follows these steps:

1. Teachers experience professional development
2. The professional development increases teachers' knowledge, skill, attitudes, and beliefs to improve the content of their instruction, their approach to pedagogy, or both.
3. Teachers use their new knowledge, skills, attitudes, and beliefs to improve the content of their instruction, their approach to pedagogy, or both.
4. The instructional changes that the teachers introduce to the classroom boost their students' learning. (Desimone, 2011, p. 30)

This serves as a core conceptual framework in the design and evaluation of this professional development project. Teachers who participate in the professional development program complete the first step. The professional development activities are designed to accomplish the second step of increasing teacher knowledge, skill,

attitudes, and beliefs regarding the integration of AT into the general education classroom. It is hoped that teachers will use their new knowledge and skills to encourage student use of AT as needed. Ultimately, student achievement may increase as student access to AT and thus access to the curriculum increases.

Based on research and evidence-based practice, the Standards for Professional Learning developed by Learning Forward (n.d.) identify key characteristics of the content, process, and context of effective professional learning that leads to improvements in teacher practice and student learning (Mizell, Hord, Killion, & Hirsh, 2011). These standards for professional learning as listed below serve as criteria in the design of this project.

- Occurs within professional learning communities
- Requires leadership to develop capacity and support
- Coordinates learning resources
- Uses data to evaluate professional learning
- Integrates adult learning theories and research
- Provides support for implementation to sustain change
- Focuses on standards-based outcomes (Learning Forward, n.d.)

The online PLN serves as a professional learning community where teachers can receive support while implementing AT. Online training resources are coordinated. Data for formative and summative evaluations are collected throughout the program. Adult learning theory and research informed the development of the professional development program.

Effective Professional Development

A review of current scholarly literature informed the genre and design of this project. Databases and search engines including Google Scholar, EBSCO Host, ProQuest, SAGE journals, ERIC, and Educational Research Complete were used to locate and access peer-reviewed articles published within the last 5 years using search terms including professional development, professional learning, teacher technology training, professional learning community, professional learning network, and assistive technology training. The literature was reviewed and critically analyzed until saturation was reached. This literature review begins by examining meta-analyses of effective professional development and then discusses more recent literature related to the project.

Evaluation of professional development has traditionally focused on the impact of professional development on teacher perceptions, and there is limited scientific research on the relationship between teacher professional development and the intended goal of improved student learning (Blank, 2013; Gaytan and McEwen, 2010). In a review of over 1,300 studies addressing the effect of professional development, researchers from the American Institutes for Research found that only nine met the What Works Clearinghouse evidence standards (Guskey & Yoon, 2009). In an analysis of those nine studies, they found that although the professional development activities and designs varied, they all involved workshops, outside experts, and 30 or more contact hours. All but one of the studies involved follow-up sessions in addition to initial workshops suggesting that "educators at all levels need just-in-time, job-embedded assistance as they

struggle to adapt new curricula and new instructional practices to their unique classroom contexts" (Guskey & Yoon, 2009, p. 497).

A meta-analysis of recent research conducted by the Council of Chief State School Officers identified 16 studies showing evidence of the effect of professional development on student achievement (Blank, 2013). The professional learning in these studies included common elements of "content focus, longer duration, multiple activities, hands-on teacher learning, specific learning goals, and collective teacher participation" (Blank, 2013, p. 53). Recognizing that it is difficult to measure the effect of professional learning on student achievement, Wei, Darling-Hammond, Andree, Richardson, and Orphanos (2009) looked at a broader range of research methodology in their review of research on professional development. They found that professional learning is most effective when it is collaborative and sustained with opportunities for active learning through modeling, practice, and reflection.

The findings of these meta-analyses are consistent with the findings of this study described in Section 2 in which teachers reported wanting ongoing professional development, hands-on-practice, opportunities to learn from professionals with experience in the field, and timely answers to questions. The plan outlined in this project study incorporates these elements of effective professional development through ongoing and sustained professional learning activities allowing teachers to learn from outside experts through an initial summer workshop, online training resources, and monthly after school trainings. Each of the after-school trainings include modeling the use of the particular technology followed by hands-on practice using the technology and reflection.

The online discussion board will provide a collaborative forum for follow-up reflection and just-in-time support.

Professional Development in AT

In a review of literature related to evaluation of professional development in instructional technology, Gaytan and McEwen (2010) found that most evaluations focused on logistics and self-reporting and failed to determine whether the goal of improving student learning had actually been met. The authors designed a five step model for evaluating professional development related to the integration of technology into teaching practices. The levels are as follows:

1. Feedback from participants
2. Participants' learning
3. Organizational support
4. Changed instructional practices
5. Student impact (Gaytan and McEwen, 2010, p.90)

The authors suggested using the reverse order when planning and setting goals for professional learning activities, beginning with the desired student outcomes and working backwards to the logistics of professional development activities. This model was used in both the design and evaluation plan of the professional development program proposed in this project study. This professional development is designed for participants from a wide variety of schools and as described in the findings in Section 2, organizational supports such as personnel, resources, and technology vary significantly between schools; therefore organizational support will not be directly planned for or evaluated as part of

this project. Nevertheless, increasing awareness of the potential for AT may be the first step in initiating organizational change. Park, Roberts, and Stodden (2012) found that educators participating in workshops geared towards meeting the needs of students with disabilities increased their commitment to providing accommodations despite insufficient institutional support and participants even formed their own learning communities advocating for changes at the system level. According to Hirsh and Killion (2009), changes in beliefs underlie sustainable changes in practice and principles are more transferable across content and contexts than practices.

According to the andragogical model, adults need to be ready to learn and will embark on learning when they understand the benefits they will gain or the negative consequences they will avoid by knowing (Knowles, Holton, & Swanson, 2005). Therefore the first step in facilitating learning is establishing a "need to know". One way to do this is to provide models of superior performance which lead to the learner discovering gaps between where they are and where they could be. Adults are also motivated to learn to the extent that it will solve problems they face (Knowles et al., 2005). Professional development sessions outlined in this project incorporate video testimonials of students, parents, and/or teachers discussing and/or demonstrating how AT has led to improved student learning. Viewing these videos and talking with experienced educators may establish a "need to know" and enhance teacher beliefs regarding the potential for AT.

Bargerhuff, Cowan, and Kirch (2010) found that science teachers were lowering their expectations for students with disabilities resulting in inequitable learning

opportunities because teachers were not prepared to make accommodations. Interview data reported in Section 2 of this study also revealed that some schools were likely to modify the curriculum before considering the use of AT to provide access to the general curriculum. New teachers tend to be better prepared to meet the needs of exceptional learners while those who have been in the field for a while may not know how to support all learners in meeting the same expectations (Bargerhuff et al., 2010). Bargerhuff and colleagues designed a workshop for both special and general education teachers focused on inclusion, disability rights, understanding barriers, and examination of one's own attitudes. Participants in the workshop witnessed how AT allowed students to be self-sufficient and participate successfully resulting in changes in participant dispositions, knowledge, and skills.

Savolainen, Engelbrecht, Nel, and Malinen (2012) found that providing teachers with concrete tools that could be used to meet the needs of diverse learners in the classroom led to changes in teacher attitudes. The professional development plan proposed in this project is designed to help teachers understand how specific AT tools can be used to reduce barriers to general education curriculum for students with high-incidence disabilities. It is possible that introducing teachers to specific AT tools will result in changes in teacher attitudes.

Based on research and the perspectives of stakeholders in the educational AT field, Gray et al. (2010) identified five themes defining state-of-the-art AT training:

- Convergence: the transformation of various technological systems to a single platform to perform multiple tasks

- Customizability and UDL: designed to be configured to meet the unique needs of individuals
- Research- or Evidence-Based: supported by evidence of effectiveness for students with disabilities
- Portability and Promotion of Independence: AT that offers flexibility to be used in various settings and moves with the user
- Interoperability: the ability of two or more systems to exchange information (p.6)

These themes are consistent with the findings of this study described in section 2. Themes related to the integration of AT into the general education classroom identified in this study were independence, universal access and student choice, the efficiency of one-to-one devices, and the ease of transitions when information exists on one device in compatible formats. In summary, convergence and customizability are directly related to the identified benefits of one-to-one devices. UDL is directly related to universal access and student choice. Portability and interoperability are related the ease of transitions and independence is one of the identified themes. The workshop, trainings, and resources included in the professional development plan focus on learning about how one-to-one devices can be used to access AT to promote student independence in a UDL framework.

Professional Learning Communities

Professional development needs to equip teachers with the skills and attitudes to address barriers in the integration of technology. Situated professional development such as mentoring is highly effective in improving teacher confidence and problem solving in

technology (Kopcha, 2010). However, mentoring is costly and not scalable. Kopcha (2010) found communities of practice to be an effective alternative allowing teachers to establish goals for integrating technology and share solutions to problems encountered. Thomas et al. (2012) found that collaborative and ongoing professional development, focused on integrating technology into language arts and social studies curriculum to improve the literacy and critical thinking skills of students with disabilities, led to teachers using a more student-centered approach and changes in student learning behaviors.

Student centered professional learning communities have the potential to sustain improvement in teaching practice and student learning. In a review of the literature, Lomos, Hofman, and Bosker (2011) found that professional learning communities had a positive effect on student achievement. Much of the knowledge teachers need is not disseminated in a workshop but rather generated through intentional investigations in classrooms and the sharing of knowledge and theory with others. Through collaborative inquiry, teachers become the experts as they explore new ideas, adjust their own practice, and examine evidence of student learning. Considering the evaluation of effective professional development in technology, Pierson and Borthwick (2010) proposed a "contextually situated and inquiry-framed TPACK model" (p.131) (technical pedagogical and content knowledge) for the design of professional development. The authors suggested that professional development ask participants to think about

> how what they learn is situated in the work they already do, by posing questions about how teaching and learning can improve, by collaborating with peers and

> more experienced colleagues to solve problems of practice, and by evaluating and sharing findings with one another as part of an ongoing effort at collective improvement. (Pierson & Borthwick, 2010, p. 130)

Following a review of recent research on continuing professional development, Kennedy (2014) identified a professional development model of collaborative professional inquiry, replacing the term of action research. Taking a democratic perspective on professionalism, collaborative professional inquiry entails collaborative problem identification and subsequent activity inquiring into the practices of the individual and others. Professional learning communities provide a forum for collaborative inquiry.

Professional learning communities can drive improvement efforts not only within schools but also between and across the context of different schools by developing leadership at all levels (Harris & Jones, 2010). When educators from diverse contexts get together to interrogate and interpret the knowledge, perspectives, and beliefs of others, it can result in a deeper and richer experience and improved learning (Hirsh & Killion, 2009). Teachers want to work with colleagues to solve problems and learn new things that can be applied in their classrooms. Based on adult learning theory, Beavers (2009) suggested that effective professional development incorporate the following principles:

- Allow teachers options regarding topics and formats
- Use teacher experiences as learning opportunities
- Focus on topics that can be practically applied
- Facilitate problem-solving dialogue among peers
- Encourage teacher facilitation

- Create an atmosphere supporting, diversity, openness, and reflection

This project brings special and general education teachers from various schools together into a professional learning community where they can engage in problem-solving dialogue, reflection, and critical inquiry around the use of AT with students in general education classrooms. Teachers have options to attend workshops where they will learn about technologies from experienced educators. The rural location of these schools, however, requires significant time and travel for teachers participating in professional development workshops or meetings. Online technology provides a viable option for professional development among these small rural schools.

Online Professional Learning Networks

Technology has the potential to enhance professional development by allowing teachers to choose what, how, where, and when they learn, facilitating collaboration among teachers with common interests and needs, and providing efficient access to resources and sustained support while implementing new practices (Killion, 2013). In a review of the literature including 74 peer reviewed journal articles published between 2000 and 2012, conducted by Blitz (2013), evidence suggested that online professional learning communities can achieve the same learning goals as face-to-face professional learning communities. Online professional learning communities were consistently found to have greater flexibility and be better at promoting teacher self-reflection than face-to-face formats; however teacher motivation to contribute was lower. Advantages of online professional learning communities over traditional learning communities included greater time and space for collaboration, lower cost, improved personalization, broader

range of goals pursued, efficient access to resources and expert knowledge not available locally, daily support during implementation, professional mentoring, and rich data collection. Evidence indicated that online professional learning communities are most effective when membership is diverse, there is an effective moderator, and participants have an opportunity to socialize in person (Blitz, 2013).

Online PLNs transform professional learning opportunities by connecting educators worldwide and providing efficient access to collections of up-to-date information. Many teachers subscribe to blogs and websites that curate information and provide connections through social media (Trust, 2012). Personal learning networks using web 2.0 technology such as blogs, Twitter, Pinterest, and Google Hangout decrease the isolation of teachers and serve as viable alternatives to traditional professional development activities (Evering & Visser, 2014). Teachers use online networks to find resources and new ideas, share information, ask questions, pool answers, and find solutions through collective knowledge (Trust, 2012).

A review of literature and international discussion on teacher professional development in technology identified the importance of informal learning involving collaboration through practice-based leaning networks in sustaining professional development (Twining, Raffaghelli, Albion, & Knezek, 2013). In a survey of members of online communities for teachers, Duncan-Howell (2010) found that 87% of members considered the online community to be meaningful professional development. Participants engaged in online communities seeking relevant, practical, just-in-time classroom strategies (Duncan-Howell, 2010).

A critical component of this professional development plan is the creation of an online PLN. An online discussion forum will provide participants with opportunities to engage in reflection and problem-solving dialogue among peers from diverse contexts. As discussed in Section 2, this study found that teachers want timely answers to questions and solutions to problems as they are working with students using AT. This forum is designed to sustain continuous improvement by providing teachers with ongoing support while implementing changes in classroom practice.

Developing and maintaining relationships and resources to generate and share knowledge is crucial for adaptation in a rapidly changing educational environment and teachers in rural areas can be especially isolated. Using a connectivist approach to professional development, Graham and Fredenberg (2015) created an open online course for teachers in small rural schools in Alaska. Their goal was to "decrease dependence on the instructor and encourage the development of like-minded networked learners" (p. 143) who could create, share, and self-regulate within an online environment. They found that their attempt to incorporate too many new networking technologies was overwhelming resulting in chaos and stress for those with less technology skills. Gray and Smyth (2012) also found that multiple online spaces can be a challenge to participants. They wrote about achieving a critical mass at which point online activity encourages members to participate. In an evaluation of their online education exchange, Gray and Smyth found that this critical mass was better achieved in small groups focused on particular tasks as opposed to larger more broadly focused groups. Smaller groups

were more likely to request email notifications of news posts resulting in more timely dialogue.

In an investigation of the goals, motivation, and outcomes of personal learning networks, Sie et al. (2013) identified seven key factors impacting learning through PLNs including "sharing, motivation, perceived value of the network, feedback, personal learning, trust and support, peer characteristics, and peer value" (p. 59). Factors impacting motivation included "different perspectives, motivation, social media and collaboration, reciprocity, intrinsic motivation, innovation, status and reputation, and networking strategies" (Sie et al., 2013, p.59). Limiting the size and focus of the PLN created in this project may increase the chances that teachers will activate discussion board notifications and respond to colleagues. Participants will have the opportunity to initially meet each other in person at the summer workshop and continue to socialize in person at the after school workshops. This may help to build rapport and trust, motivating participants to engage in the online forum. AT specialists within the state will be invited to join the forum, adding a level of expertise to share new ideas and assist with answering questions. Participants will learn how to use the discussion forum at the summer workshop in hopes of avoiding any technological barriers to participation.

Online professional learning communities can be effective in helping educators to stay abreast of current practices (Gray & Smyth, 2012). Online PLNs increase teacher awareness of existing online resources, eliminating the need to recreate redundant materials. Blended online training can be effective in extending teacher understanding of both why and how technology can be incorporated into the classroom (Alsofyani, Aris,

Eynon, & Majid, 2012). Web-based instructional materials have many advantages. They can be accessed quickly, easily, and on-demand and often include practical examples, audiovisual components, and trusted sources of information (Smith & Tyler, 2011). They can also be easily updated to stay current with new information. Participants in the PLN described in this project will have access to a collection of high-quality online AT resources.

Implementation

Potential Resources and Existing Supports

Implementation of this professional development project will require personnel, space, technology, and funding. I will serve as the lead facilitator; however other professionals will be required to assist with facilitating the professional development. Each after school AT session will be facilitated by a teacher who has experience using the particular technology with students with high-incidence disabilities in the general education classroom. Data collected through this study revealed that teachers valued learning from professionals with experience in the field. Assistive technology specialists will be invited to be part of the online discussion forum to bring a higher level of expertise in the collaborative inquiry process.

The distance required for travel to workshops was found to be a barrier for teachers seeking professional development in this study, therefore the workshops will be held in a centralized location most convenient to teachers at small rural schools in central and northern New Hampshire. The White Mountain Community College in Littleton, New Hampshire will provide classroom space for the summer and after school workshops

including use of the computer lab, iPad tablets, and projector. Recognizing the importance of convergence, interoperability, and portability (Gray et al., 2010), participants will be encouraged to bring their own devices to the workshop training sessions, however also recognizing that teachers in some districts do not have access to the necessary technology, devices will be available to participants to use during the workshops.

Recognizing that cost was identified as a limiting factor in the use of AT, efforts have been made to keep the cost of this professional development project at a minimum. However, some funds will be needed to pay the workshop facilitators, purchase refreshments, and purchase access to software and applications that do not offer free trials. Individual participants will be asked to pay a registration fee in order to take part in the professional development program. Most school districts have a professional development budget that can be used to fund teacher participation in this type of activity. The New Hampshire Department of Education may also be a source of funding for the professional development program.

Potential Barriers

One potential barrier to achieving the goals of this professional development project would be low participation. The project would not have the intended impact if only a few teachers from a few schools take part. To address this potential barrier, the professional development program will be extensively advertised with the help of the New Hampshire Department of Education, New Hampshire Association of Special Education Administrators, and North Country Education Services.

Another potential barrier to the delivery of the professional development workshops is weather, particularly snow which can make travel throughout the state difficult during the winter months. To address this barrier, the published schedule will include a snow-date for each after school workshop.

Lack of participation in the online discussion forum is another potential barrier to the success of this project. Participants will be encouraged at each workshop to participate in the forum. As an added incentive, participants who post to the discussion forum at least five times will be awarded a professional development certificate to be used towards recertification.

Proposal for Implementation and Timetable

The professional development program will begin with a full-day 8 hour workshop during which participants will learn about the potential for AT to improve access to the general curriculum, specific AT devices and software available, and UDL as a framework for considering how AT can be integrated into the general education classroom. This workshop will take place in August before the start of school and all participants will be asked to participate in this workshop in order to establish a common foundation. At the beginning of this session, participants will fill out the preworkshop survey. At the end of this session, participants will learn how to access the online discussion forum and training resources. The timetable for implementation is shown in Table 1.

Table 1

Timetable for Professional Development Project Implementation

Month	Activity
April	Secure dates for workshops including space and facilitators
May - July	Advertise program and collect registrations Set up online resources website and discussion forum
August	Full-day workshop Online training resources and discussion forum become available Participants fill out the preworkshop survey
October	Afterschool workshop: Accessing Audio Books
November	Afterschool workshop: Read Write Gold / Google
January	Afterschool workshop: Google Extensions
February	Afterschool workshop: iPad Accessibility Features and Free Apps
March	Afterschool workshop: Windows 8 and Chromebook Accessibility
April	Participants fill out the postprofessional development survey
May	Analyze evaluation data and report results

After school workshops will be offered once a month and participants will have the option to sign up for those they believe will be useful to them. These workshops will be 3 hours in length and focused on providing hands-on practice in using a specific technology. A workshop will not be offered in December as this tends to be a busy month for teachers. The online training resources and discussion forum will be ongoing beginning with the initial workshop in August. These online elements have the potential to continue as ongoing resources for professional development and support. Each

participant will be asked to complete a postprofessional development survey in April. This will allow time to evaluate the professional development program, report the results, and plan future professional development initiatives before the end of the school year.

Roles and Responsibilities of Lead Facilitator and Others

Lead Facilitator. I will serve as the lead facilitator and be responsible for arranging facilitators, rooms, refreshments, and technology devices. In partnership with the Center for Educational Excellence, I will advertise the professional development program and collect registration. I will create and maintain a website with links to AT training resources as well as the online discussion forum. By actively participating in the online discussion and posing questions, I will help to deepen participant reflection and interaction. I will also be responsible for evaluating the professional development program and reporting the findings as discussed in the next section.

Professionals. Experienced teachers will serve as facilitators of the professional development sessions. Facilitators will be responsible for demonstrating use of the technology, discussing their own experiences implementing the technology within the general education classroom, providing participants with guided practice using the technology, and answering participant questions. Facilitators will also be asked to take part in the online discussion board answering any follow-up questions about the technology presented. AT specialists and professionals within the state of New Hampshire who volunteer to be a part of the online discussion forum will be asked to subscribe to the forum, periodically answer participant questions, and share suggestions for AT use.

Participants. Participants will be responsible for taking part in the full-day workshop and at least two afterschool workshops. They will also be asked to complete the surveys and evaluations, and actively share their experiences on the online discussion forum. Participants will be responsible for securing the funds to pay the registration fee.

Project Evaluation

This project will be evaluated using both formative and summative evaluations to collect evidence of teacher progress in the integration of AT into the general education classroom. As discussed in the previous section, Desimone's (2011) stages of professional development serve as the conceptual model for the design and evaluation of this professional development plan. Using a process-based approach, each stage will be evaluated in terms of the goals and process objectives using data collected from questionnaires and the online discussion forum.

Project Goals

The long term goal of this professional development project is to improve teacher integration of AT into the general education classroom for use by students with high incidence disabilities. Edyburn's (2003) levels of AT literacy served as a conceptual framework for this project study. As discussed in Section 2, teacher levels of AT literacy varied from school to school and from teacher to teacher. The goals of this professional development project are for all participants to be aware of the possibilities of AT and interested in learning about AT and for many participants to establish a working knowledge of AT. Some participants may reach the transformation level.

The short term process objectives of the professional development project are focused on addressing the skills and knowledge teachers felt they needed most including knowledge of what is available for AT devices, hands on practice using AT, answers to questions when they need them, and an understanding of how to integrate AT into the general education classroom. Short term process objectives are as follows:

- Increase participant awareness of AT that can help to compensate for weaknesses in reading and writing,
- Increase participant skill and confidence in using specific AT through hands-on practice
- Increase participant understanding of how UDL can be used as a framework for integrating AT into the general education classroom
- Create a regional online PLN through which participants continue to solve problems and share resources.

Evaluation Goals

The purpose of the evaluation is to provide information on the impact of the professional development project and to inform future professional development initiatives. The goal is to collect evidence of teacher growth in AT literacy and integration of AT into the general education classroom as well as evidence of active and ongoing participation and support in the online PLN. Evaluations will seek to determine whether the objectives have been met.

Justification

Evaluation of professional development has traditionally focused on teacher satisfaction with the activity, failing to look at the impact on student learning (Earley & Porrrit, 2013). When using student impact models to evaluate professional development in technology integration, it can be especially difficult to sort out the effects of technology versus other initiatives (Pierson & Borthwick, 2010). More recent professional development evaluation models look for evidence of effectiveness at each stage. Ham's (2010) "conceptual model for the evaluation of professional development in technology integration" (p. 22) focuses on the process, tracing the chain of influence from the professional development event, to teacher learning, to teacher actions, to student learning. According to Ham, rich descriptions of the chain of events allow evaluations to investigate the substance, function, and worth of professional development as opposed to just the effect. He argued that both the procedural and consequential value of professional development can be investigated systematically through rich description from a variety of perspectives.

Gaytan and McEwen's (2010) model for evaluating professional development activities related to integrating instructional technology into the classroom also calls for collecting data on each of the five levels described in the previous section. Gaytan and McEwen's five levels of evaluation parallel Guskey's (2000) guidelines for the formative and summative evaluation of professional development which call for gathering and analyzing evidence of participant reactions, participant learning, organizational support, participant use of new knowledge and skills, and student learning outcomes (pp. 79-81).

King (2013) built upon the previous work of Guskey (2000) and Bubb and Earley (2010) to design a professional development impact evaluation framework. King's evaluation model acknowledged the importance of collaboration and placed more emphasis on the beliefs and attitudes of teachers, considering their significance in the change process and sustainability of practice. Acknowledging that teaching and learning are contextual, King changed "organizational support" to "systemic factors". King's model also considered diffusion, recognizing that the dissemination of new practices leads to sustainability and improved student learning.

Pierson and Borthwick (2010) framed the evaluation of professional development in technology in an ongoing cycle of "reflection, inquiry, collaboration, and sharing" (p. 129). They suggested that the effects of professional development be evaluated by teachers documenting their classroom practice and action research as they engage in collaborative problem solving and share experiences. Teachers participating in this professional development program will provide first order data about their own knowledge, beliefs and practices and second order data about students' experiences and learning. Evaluation of the first two events in the chain of influence, participant reaction to the learning experience and changes in participant knowledge and beliefs, will be evaluated via questionnaires. Teachers will fill out an evaluation questionnaire at the end of each workshop, documenting their reactions and learning. Data from these questionnaires will be used to examine teacher perceptions of the effectiveness of the workshops and to inform the presentation of future workshops.

Evidence of professional learning, network support, teacher changes in practice, and improvements in student use of AT to access the general curriculum will be collected from the online discussion forum. Participants will also be asked to complete a survey at the beginning and end of the program. Results of these surveys will be analyzed to determine if there is evidence of changes in teacher attitudes, beliefs, and/or practices.

Key Stakeholders

The final step in Guskey's (2000) guidelines for evaluating professional development is to prepare and present an evaluation report. The professional development project and the results of the evaluation will be presented to the New Hampshire Association of Special Education Administrators at a monthly meeting. A written report for further dissemination to key stakeholders will be available online. These key stakeholders are people who may be responsible for designing future professional development in AT and supporting teachers and students as they continue to integrate AT into the general education classroom. This includes school principals, special education directors, department of education personnel, teachers, specialists, parents, and students.

Implications Including Social Change

Local Community

This project was designed to meet the AT professional development needs of teachers in small rural New Hampshire schools as identified through interviews conducted as part of this study. The purpose of the professional development project is to improve teacher awareness and working knowledge of how AT can be integrated into the

classroom to improve access to the general curriculum for students with high-incidence disabilities. Hands-on practice and online support as needed may help general and special education teachers to increase their comfort with AT. Teachers may in turn encourage students to use AT and make decisions to use to AT to accommodate students with high-incidence disabilities as opposed to modifying the curriculum and lowering expectations.

Interview data revealed that students want to be included and do not want to appear different from their peers without disabilities. Through this professional development project, teachers will gain knowledge and skills for using AT for reading and writing and practical examples of ways to incorporate universal access and student choice through a UDL framework. Incorporation of UDL principles when planning instruction can level the playing field for students with disabilities increasing inclusion and independence.

This professional development project will also provide special and general education teachers with the opportunity to engage in collaborative inquiry within a local PLN. Via the online discussion board, teachers can engage in an ongoing cycle of sharing, reflection, inquiry, and collaboration. Teachers will have a forum to seek answers to questions about how to use technologies or how to meet the needs of particular students. Being part of a regional PLN may help to reduce the feelings of isolation often experienced by teachers in small rural schools.

Far-Reaching

As teachers develop the knowledge and skills to integrate AT into the general education classroom, student use of AT is likely to increase. Use of AT can compensate

for lack of particular skills, reducing barriers to the curriculum. Improved access to the general curriculum for students with high-incidence disabilities may result in higher levels of achievement, reducing the achievement gap between students with disabilities and those without. With access to the appropriate AT, students will have opportunities to develop the confidence, motivation, and independent skills necessary to succeed in college and the workplace.

As teachers share their learning with colleagues and administrators and advocate for students at their schools, awareness of the possibilities of AT will increase. Schools may take action to further professional development and access to AT. The online PLN has the potential to actively continue beyond the one-year scope of this project. Teachers can continue to share their experiences with new technology as it becomes available. Professional connections and collaborative inquiry can continue to develop. Topics of collaboration may expand beyond AT for students with high-incidence disabilities. The PLN has the potential to result in a high level of collective expertise that can benefit professionals outside the regional PLN.

Conclusion

This professional development project was designed to meet the needs of teachers identified in the findings from case study interviews discussed in Section 2. Informed by a review of the literature regarding adult learning and effective professional development, the purpose of this professional development program is to increase teacher awareness and working knowledge of how AT can be integrated into the classroom to improve access to the general curriculum for students with high-incidence disabilities. The full-

day workshop, series of afterschool workshops, collection of online training resources, and PLN will increase teacher awareness of UDL and available technologies, provide teachers with hands-on practice, and support teachers as they begin using AT through a collaborative network. The next section discusses the strengths, limitations, and implications of the project.

Section 4: Reflections and Conclusions

Introduction

This section begins with a discussion of the strengths and limitations of the professional development project and recommendations for alternative approaches. I then reflect upon what I learned about scholarship, project development and evaluation, leadership, and change throughout the process of this project study. I then analyze my own personal growth as a scholar, practitioner, and project developer. This section concludes with a discussion of the importance of the project study and the potential for positive social change. Implications, applications, and directions for future research are also discussed.

Project Strengths

This professional development project directly addresses the needs specified by teachers in the case study interviews. Allowing teachers to have input regarding professional development topics and formats is a key principle of successful professional development (Beavers, 2011). Adult learning theory was applied throughout the design of the project by using teacher experiences as learning opportunities and facilitating collaborative inquiry and problem-solving regarding practical classroom application of AT skills and knowledge (Beavers, 2011; Knowles et al., 2005). A review of the literature revealed that adult learning theory and best practices in professional development were consistent with the preferred formats for professional development identified in this study.

In addition to meeting the immediate AT professional development needs of teachers, perhaps the greatest strength of this project is the plan for developing a regional PLN. PLNs have been found to impact student achievement by promoting collaborative professional inquiry in which teachers become the experts as they explore new ideas, their own practice, and evidence of student learning (Blitz, 2013; Hirsh & Killion, 2009; Kennedy& Tate, 2012; Trust, 2012; Twining et al., 2013). Bringing together teachers from diverse schools, the PLN planned in this project has the potential to be an ongoing network of local educators. Participants can continue to share ideas and resources, adapt as new technologies become available, and achieve a higher level of collective expertise.

Recommendations for Remediation of Limitations

One limitation to this project is the fact that the infrastructure and support necessary for fully integrating AT into the general education classroom is not present at each school. The context matters as teachers need access to AT and freedom to take risks and plan flexible lessons and the context should be taken into consideration in the planning and evaluation of professional development (Desimone, 2011; Pierson & Borthwick, 2010; Gaytan & McEwen, 2010). Because this project study focused on teachers from a variety of schools, it includes plans for supporting teachers through a PLN but does not address the organizations within which teachers work. A first step in remediating this limitation would be to encourage administrators to participate in the professional development program. An alternative professional development program could be designed for school board members, technology directors, and administrative leaders focused on building institutional capacity and support for AT integration.

Ultimately, professional development should be designed for individual schools that is tailored to the individual school's needs, and builds organizational support.

An alternative way of approaching this problem might be planning to provide one-to-one devices for every student before focusing on professional development. A project taking this approach would involve budgeting, grant applications and policy writing. This type of planning is usually done at the school or district level and administrators may also benefit from the support of a regional PLN where they could share ideas, resources, and experiences.

Another limitation of the project is that the professional development plan only provides an introduction to and hands-on practice with a few technologies for use with reading and writing and it only focuses on the use of AT with students with high-incidence disabilities. Additional professional development can be planned to introduce teachers to additional technologies as well as AT that will help students with other learning tasks such as organization, problem solving, and memorization. Teachers can also be encouraged to share their experiences and suggestions for additional technologies and implementation strategies within the discussion forum and additional online training resources can be added over time. Future professional Development can be planned to address the use of AT with students with a wider variety of disabilities.

Scholarship

Throughout my doctoral coursework, research, and project development I learned that scholarship is a process that takes time, patience, and organization. Becoming a subject matter expert requires ongoing review of the literature and collaboration with

other professionals. I learned the importance of having a theoretical or conceptual framework in which to ground scholarly research. I also learned the importance of embedding one's work in the current literature. I understand the value of peer review and my responsibility for upholding the integrity of the profession. Learning is a lifelong process and people learn through a variety of experiences. Academic scholarship entails learning from the experiences of others through critical inquiry.

Project Development and Evaluation

Through the process of developing a professional development plan, I learned that it is helpful to plan for the project evaluation from the beginning. By taking a backwards design approach (Wiggins, McTighe, Kiernan, & Frost, 1998), I was able to identify clear goals and objectives for the professional development and consider what would serve as evidence that those objectives had been met. This allowed me to then plan professional development activities that were likely to result in the desired outcomes. Reviewing the literature surrounding professional development helped me to identify and apply best practices for professional development. It was interesting to learn, however, that few studies of professional development actually resulted in empirical evidence that the professional development led to student achievement gains (Blank, 2013; Guskey & Yoon, 2009).

Leadership and Change

Through my doctoral coursework, I learned about the change process and the power of distributed leadership and collaboration. I learned about the importance of considering and involving all stakeholders in the decision-making process. In reviewing

the literature, I learned how the technology acceptance model (Davis, 1989; Holden & Rada, 2011; Teo, 2013) can be used as a framework for understanding and supporting teachers as they make changes in how instruction is provided as a result of rapid advancements in technology. It is the responsibility of leaders to build the capacity for change by creating a collaborative and supportive environment.

Analysis of Self as Scholar

Throughout my doctoral experience, I learned that I needed to be disciplined and trust the process. I developed proficient skills in searching for and critically analyzing scholarly sources of information. Not only do I have the skills to engage in critical inquiry, but it has become a habit of mind. I now look to research and data to drive my decisions a practitioner, as a leader, and in my personal life. I have learned to be aware of my own biases and how they may influence my perceptions.

Not only did I learn how to conduct a case study, but I learned about a variety of research methodologies and how research questions drive decisions regarding the research methodology. I am able to carefully consider methodology, validity, and ethical implications when collaborating with colleagues to design new research projects. My scholarly writing skills continue to develop which will be important as writing is one way to share one's scholarly expertise.

Another important scholarly skill I learned was to look beyond my own school, state, country, and professional field. I have read about studies from all over the world and from different fields of practice, resulting in a more comprehensive and diverse perspective and new ideas. Completing my doctoral work online with Walden University

and having the opportunity to collaborate with peers from all over the world has resulted in an experience of far greater depth than I think I would have had if I had attended my state university.

Analysis of Self as Practitioner

I learned the importance of collaboration. It is important for me to connect with experts in my area of practice and it is also important for me to share my own learning. Most importantly, I learned the value of action research which will enable me to become a true scholar-practitioner. It is now my responsibility to apply my skills as a scholar-practitioner to create positive social change.

Analysis of Self as Project Developer

I learned that project development is part of an inquiry cycle. I learned that the teachers I interviewed in this case study were hungry to learn more about AT but many didn't know where to go get the knowledge and skills they needed. This professional development plan has the potential to meet an important need. I look forward to implementing and evaluating the professional development project and using the evaluation results to drive further projects. I will continue to learn and grow as a project developer in an ongoing cycle of inquiry including research, practice, and reflection.

Importance of the Work and What Was Learned

This case study explored how teachers in small rural New Hampshire schools are using AT with students with high-incidence disabilities and the professional development teachers need in order to use AT more effectively. Much of what I found in the interviews was expected, but what I really learned was how the resources available to

teachers and students were so drastically different between schools. Many teachers did not know where to go to find the information or technology required to meet the needs of their students. Providing professional development to increase the AT awareness and working knowledge of general and special education teachers is important. It will be important for teachers to know how to access high quality online training resources. The creation of a regional PLN will provide teachers with colleagues to turn to for ideas and help with solving problems, reducing feelings of isolation.

Through interviews, teachers were able to share their experiences working with students using AT, and their perceptions of student experiences. It was apparent in the data that students want to be included and do not want to appear different from their peers. This information is important to keep in mind as teachers learn about, recommend, consider, and implement AT. As general and special education teachers take a student centered approach to integrating AT into the general education classroom using a UDL framework, learning opportunities for students with high-incidence disabilities may improve. As the data revealed, some teachers lower their expectations for students with disabilities. Inclusion of students in the general education classroom may just mean students being present in the room and students may not be included in learning the same curriculum as their peers. Through professional development, teachers may develop awareness and working knowledge of AT, that will allow them to transform their classrooms into learning environments where students with high-incidence disabilities have opportunities to achieve the same learning outcomes as their peers without disabilities.

The Project's Potential Impact on Social Change

When teachers have the knowledge and skills to integrate AT into the classroom using a UDL framework, students with high-incidence disabilities can be included in the classroom in a way that they do not appear different from their peers. Adolescents are particularly susceptible to peer influence and sensitive to social exclusion (Sebastian, Tan, Roiser, Viding, Dumontheil, & Blakemore, 2011). Universal access to assistive technology may result in improved social inclusion of students with disabilities.

Not only will the students be included in the classroom, but AT has the potential to improve access to the general curriculum. Assistive technology may compensate for disabilities, remove barriers, and allow students with disabilities to access the same curriculum as their peers without disabilities. As teachers provide more students with high-incidence disabilities access to the curriculum and expect more students to meet grade-level expectations, there is a good chance academic achievement will improve, ultimately reducing the achievement gap.

Access to AT has been found to have a positive impact on post-secondary outcomes (Bouck, Maeda, et al., 2012). Assistive Technology can enable students to engage in learning tasks independently. Greater independence may lead to improved self-concept which is positively related to academic achievement (Huang, 2011). Self-esteem and perceived academic control can have a positive impact on student success and well-being in college (Stupnisky, Perry, Renaud, & Hladkyj, 2013). When teachers help students to effectively utilize AT and develop independent learning skills, there is a good

chance the students will continue to use these skills in college and the workplace as lifelong learners.

Implications, Applications, and Directions for Future Research

Professional learning has the potential to continue beyond the scope of this project as teachers within the PLN seek and share resources, share experiences, and solve problems collaboratively. Teachers may also use PLNs in the future to seek ideas and collaborate outside of their own school on other educational topics. Analysis of evaluation data during and at the conclusion of the professional development project may help to inform future professional development initiatives.

This project study was limited to the use of AT with students with high-incidence disabilities by teachers in small rural schools in New Hampshire. A few interview participants asked for recommendations regarding AT for nonverbal students. Future research may investigate the experiences and professional development needs of teachers regarding AT for other populations of students with disabilities. The data collected in this study were limited to teacher perceptions. Future investigations may look at student perceptions, observations, and student work samples.

Conclusion

The purpose of this study was to better understand how teachers in small rural schools in New Hampshire use AT with students with high-incidence disabilities and the professional development teachers need in order to more effectively integrate AT into the general education classroom. Analysis of data collected through semistructured interviews as part of an intrinsic case study revealed that although teachers' experiences

with AT varied depending on the school context, there were consistent themes. Students want to be independent and included and do not want to appear different from their peers. Teachers reported that when students have universal access to AT on a one-to-one device, it can level the playing field, allowing students to independently access the curriculum and show what they know. Effective integration of AT into the classroom requires teachers to be comfortable with the technology, encourage its use, and maintain high expectations for all students.

Teacher awareness and use of AT varied significantly; however teachers felt they needed to learn more about the AT options available and strategies for integrating AT into the classroom. Teachers reported wanting hands-on practice with AT devices and answers to questions as needed. A professional development project was developed to address teacher desire for convenient, individualized, ongoing professional development delivered by professionals with experience in the field. A review of the literature regarding effective professional development informed the design of the project.

Ongoing workshops, a collection of online training resources, and a regional PLN were designed to improve teacher awareness and working knowledge of how a UDL framework can be used to integrate AT into the general education classroom, reducing barriers. When easily accessible and effectively integrated, AT may compensate for disabilities allowing students to access the same curriculum as their peers without disabilities, ultimately reducing the achievement gap between students with disabilities and those without. This project has the potential to result in positive social change by

improving the independence and inclusion of students with high-incidence disabilities in the general curriculum.

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Appendix A: Professional Development Curriculum and Materials

Access for All:
Integrating Assistive Technology into the General Education Classroom
Improving Opportunities through Universal Design for Learning

A Professional Development
Program for New Hampshire Teachers

Contents

Overview

Purpose:

The purpose of this professional development program is to improve access to the general education curriculum for students with high-incidence disabilities by improving teacher integration of AT into the general education classroom through professional development that meets the needs of teachers in small rural schools in New Hampshire.

Goals:

- to improve teacher integration of AT into the general education classroom for use by students with high incidence disabilities
- to increase the AT awareness and working knowledge of special and general education teachers in small rural schools in New Hampshire
- to create a regional PLN through which teachers can continue to learn and share resources

Learning Outcomes:

- Increased awareness of AT that can help to compensate for weaknesses in reading and writing
- Increased skill and confidence in using specific AT through hands-on practice
- Increased understanding of how UDL can be used as a framework for integrating AT into the general education classroom
- Active collaboration in a regional online PLN through which participants solve problems and share resources.

Target Audience:

While this professional development program will be open to all educators in New Hampshire, the target audience is special and general education teachers from small rural schools as it is specially designed to meet the needs identified by this group of teachers.

Components:

- Full-day Workshop (8 hours in August- all participants attend)
    - Universal Design for Learning
    - Showcase of available AT for reading and writing
- Series of 5 After-School Workshops (3 hours each, participants choose to attend)
    - Hands-on practice using specific technologies
- Online Training Resources
    - High quality sources of information on AT and UDL
- Online PLN
    - Answers to questions
    - Collective expertise
    - Ongoing collaboration

Timeline:

August: Full-day workshop, online training resources and discussion forum become available, and participants fill out the pre-workshop survey

October: After-school workshop: Accessing Audio Books

November: After-school workshop: Read Write Gold / Google

January: After-school workshop: Google Extensions

February: After-school workshop: iPad Accessibility Features and Free Apps

March: After-school workshop: Windows 8 and Chromebook Accessibility

April: Participants fill out the post-professional development survey

May: Analyze evaluation data and report results

Access for All:
Integrating Assistive Technology into the General Education Classroom
Improving Opportunities through Universal Design for Learning

Full-Day Workshop

Agenda

8:30-9:30 Introduction

- Brief overview of A Study of Teacher use of Assistive Technology in Small Rural Schools in New Hampshire and the findings that led to this professional development program
- Overview of purpose, goals, and components of this professional development program
- Participants introduce themselves
- Watch the Using Technologies to Support Diverse Learning Needs video in which teachers provide models of how AT is integrated into their classrooms
- Discuss the video in small groups

9:30-10:00 Break

- Participants will complete the pre-workshop survey
- Participants are asked to introduce themselves to two new people
- Refreshments

10:00-11:30 Universal Design for Learning

- UDL At a Glance video
- Define UDL
- UDL Principles and Practice video
- Multiple means of representation, expression and engagement and associated videos providing concrete examples of the possibilities
- Small group discussions around potential barriers and incorporating flexible methods
- Implementing UDL Video
- Discussion of benefits and challenges
- Resources

11:30-12:30 Lunch Break

12:30-2:45 Showcase of Assistive Technology for Reading and Writing

- Groups rotate between 8 stations spending 15 minutes at each. At each station, groups will watch a brief video demonstrating the technology, browse associated websites to seek answers to pressing questions, and then engage in a discussion of how the technology could be used in the classroom. A self-guided packet provides directions and serves as a future reference.

2:45-3:45 Introduction to Online PLN

- What is a PLN? Opportunities and benefits are discussed.
- Instruction and hands-on practice in accessing the online resources and discussion forum is provided in groups at 3 different levels. Participants self-select group based on prior experience. All participants make an initial post to the discussion forum.

3:45-4:30 Closing

- Topics of the monthly after-school workshops are "advertised"
- Participants are asked to complete the workshop evaluation
- Participants can sign up for after-school workshops

Materials:

- Slide presentation
- Pre-workshop Survey
- Showcase of Assistive Technology for Reading and Writing Self-guided Packet
- Full-day Workshop Evaluation Questionnaire

Access for All:

Integrating Assistive Technology into the General Education Classroom

Improving Opportunities through Universal Design for Learning

After-School Workshops

Agenda

3:30-3:45 Welcome and Introductions

- Presenter(s) and participants introduce themselves
- Provide an overview of the agenda and objectives

3:45-4:00 Testimonials

- Hear from students and/or teachers about their experiences with the technology and how it has helped to reduce barriers and provide access to the general curriculum. (via video or guest speaker)

4:00-5:00 Modeling

- Experienced teacher leads instruction, modeling on an overhead projector how to use various features of the technology along with ideas of how to incorporate it into classroom learning activities.

5:00-6:00 Hands-On Practice

- Guided by the experienced educator, participants practice using the technology on individual devices.

6:00-6:30 Reflection

- Participants engage in a discussion reflecting on how the technology could be used in the classroom within a UDL framework.
- Participants complete the After-school Workshop Evaluation Questionnaire

Materials:

- After-school Workshop Evaluation

Access for All:

Integrating Assistive Technology into the General Education Classroom

Improving Opportunities through Universal Design for Learning

Agenda

- Introduction: How We Got Here
  - A Study of Teacher use of Assistive Technology in Small Rural Schools in New Hampshire
  - Purpose, Goals, and Objectives
  - Introductions
- Universal Design For Learning
  - A framework for integrating AT into the general education classroom
- Lunch
- Showcase of AT for Reading and Writing
- Engage in the Online Discussion Forum

Teacher Use of Assistive Technology for Students with High Incidence Disabilities in Small Rural Schools

A Doctoral Study by Heather Wood
Walden University

Students with disabilities:

- 13% of school aged children
- Achievement gap compared to nondisabled peers
- Greater inclusion in general education classroom
- Greater expectations to meet grade level standards
- Challenges can lead to frustration, low self-esteem, and lack of motivation

Assistive Technology

- AT can provide a vehicle for students with high-incidence disabilities to access and function independently within the general curriculum
- Defined as: Any item that is used to help an individual with a disability to function
- IEP teams must consider if child needs AT devices and services
- Effects:
  - Compensate for disabilities -Sweller's (1998) Cognitive Load Theory
  - Reduce barriers to access
  - Provide independence
  - Improve achievement
- Examples:
  - Screen readers
  - Voice recognition
  - Word prediction
  - Screen readers

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12(2), 257–285.

Problems

- The rapid development of technology
- Significant demand on both general and special education teachers to continuously learn about new devices, software, and applications
- Skills to effectively select, acquire, implement, and integrate AT.
- Little was known about how teachers use AT
- Little was known about the professional development teachers need

Qualitative Study

Interviewed 10 general and special education teachers from 6 different small rural middle and high schools in NH

Questions:

1. How do teachers use assistive technology with students with high-incidence disabilities in small rural schools in New Hampshire?
2. What professional development do New Hampshire teachers need in order to more effectively use AT with students with high-incidence disabilities?

Sub-questions:

- To what extent are teachers aware of the potential uses of AT with students with high-incidence disabilities?
- What are teachers' experiences with using AT with students with high incidence disabilities?
- How do teachers learn about AT?
- How do teachers make decisions regarding the usage of AT?
- How do teachers integrate AT into the classroom?

Findings

Awareness

- Teachers demonstrated a range of levels of awareness of AT devices.
- Most teachers reported not knowing what is out there and feeling that it is difficult to stay up to date with new technology as it comes out.
- Teachers feel a need to become more familiar and knowledgeable about not only on what technology is available but how it can be used.
- A few schools reported very minimal to no use of AT suggesting that staff may not be aware of the possibilities of AT.

Findings

Experiences

- All teachers discussed the use of AT with reading and writing.
- Teacher experiences and working knowledge of AT varied significantly by school.
- At schools where all students were provided with 1:1 devices and content area lessons were universally designed, AT was used extensively.
- At other schools where students had minimal access to technology, AT was used minimally.
- Nevertheless, the same themes emerged regarding teachers experiences with using AT with students and the integration of AT into the general education classroom.

Themes

- Independence
  - AT can help students to become independent learners.
  - Some students depend on a paraprofessional to complete tasks
  - Students tend to want to do things independently if they can.
- Leveling the Playing Field
  - AT can "level the playing field".
  - AT allows students opportunities to show what they know in different ways.
  - AT provides students opportunities to access more complex grade level content.
- Inclusion
  - Students want to access the same information and do the same things as their peers.
  - Students are more likely to use AT if it involves using technology that all students are using.

Factors Impacting Integration of AT into the General Education Classroom

- Universal Access and Student Choice
- 1:1 devices
- Encouraging student use of AT
- Teacher comfort with AT
- Ease of Transitions while Using Technology
- Access
- Time
- Appropriate Use
- Curriculum Demands

AT Professional Development

Teachers Feel They Need:

- to be introduced to what AT is out there and updated as new technologies become available.
- to learn how AT can be integrated into the classroom.
- a path to follow when embedding AT into everyday learning for all students.
- Just-in-time solutions to problems and answers to questions.
- hands-on opportunities to play with/practice using AT with feedback and support.

Goal of this Professional Development Program

- To improve teacher awareness and working knowledge of how AT can be integrated into the classroom to improve access to the general curriculum for students with high-incidence disabilities

Edyburn's Levels of AT Literacy (2003)
Framework for understanding teachers' knowledge and skills in AT use

- Awareness
- Working knowledge
- Transformation

Edyburn, D. L. (2003). What every teacher should know about assistive technology. Boston, MA: Pearson.

Components

- Today's Workshop
  - Universal Design for Learning
  - Showcase of available AT for reading and writing
- Series of After-School Workshops
  - Hands-on practice using specific technologies
- Online Training Resources
  - High quality sources of information on AT and UDL
- Online PLN
  - Answers to questions
  - Collective expertise
  - Ongoing collaboration

Introductions

- Who are you?
- Where are you from?
- Why are you here?

Using Technologies to Support Diverse Learning Needs Video

- http://www.learningtechnologiesab.com/

Small Group Discussions

- Do you agree with the statement that using technology can "level the playing field" for students? Why or why not?
- A teacher in the video declares, "It doesn't replace reading instruction, but in certain situations when I am assessing their science skill, it is not fair to penalize them for their reading ability." Do you agree or disagree with this statement? Why?
- How can we ensure that students have continued access to the learning technologies and supports in the classroom, in college, at home, and in the workplace?

Break / Social Time / Survey

- Introduce yourself to two new people
- Fill out the Survey

Objectives

Gain a general Understanding of How to Use the Universal Design for Learning Framework for Planning Instruction for Diverse Learners

- Understand how the Universal Design for Learning framework can reduce barriers to learning and support high expectations for learning
- Understand how the four curricular pillars of Universal Design for Learning implementation (i.e., goals, instruction, materials, and assessment) are applied in different instructional contexts.
- Understand the three principles of the Universal Design for Learning framework and how they apply to instructional planning, instruction, and environments that support learning.

(Israel, Ribuffo, & Smith, 2014)

Universal Design for Learning

- UDL At a Glance Video
  https://www.youtube.com/watch?t=263&v=bDvKnY0g6e4
- DEFINITION:
- a concept or philosophy for designing and delivering products and services that are usable by people with the widest possible range of functional capabilities, which include products and services that are directly accessible (without requiring assistive technologies) and products and services that are interoperable with assistive technologies.

(IDEIA, 2004), Section 602(36)-Assistive Technology Act of 1998 (29 U.S.C. 3002)

Universal Design for Learning

DEFINITION

- a scientifically valid framework for guiding educational practice that-
  - (A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and
  - (B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.

Higher Education Opportunity Act (P.L.110-315)

Universal Design for Learning

- A framework for creating instructional strategies, materials, and assessments that work for everyone through flexible approaches that can be customized and adjusted for individual needs, giving all individuals an opportunity to learn.
- Scientifically based on neuroscience, psychology, and best practices in education
- Learner variability
- Multiple means of
  - Representation
  - Expression and Action
  - Engagement

Video http://www.udlcenter.org/resource_library/videos/udlcenter/guidelines#video0

Multiple Means of Representation

What

Recognition network

Various ways of acquiring information and knowledge

- Perception
- Interpretation
- Comprehension
- Language, symbols, media

- Text-to-speech in action video http://www.learningtechnologiesab.com/text-to-speech-in-action.html

Multiple Means of Expression

How

Strategic network

Various ways of demonstrating what they know

- Action
- Expression
- Communication
- Executive function
- Strategy development

- Speech recognition in action video
http://www.learningtechnologiesab.com/speech-recognition-in-action.html

Multiple Means of Engagement

Why

Affective network

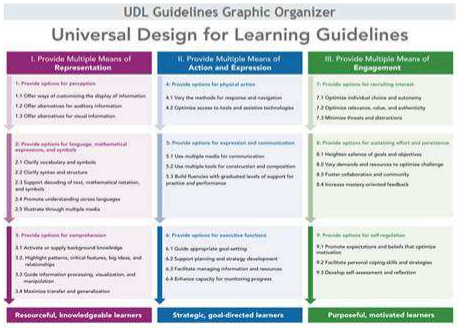
Various interests, motivations, and challenges

- Interest
- Self-regulation
- Purpose
- Motivation

- Word prediction in action video
- http://www.learningtechnologiesab.com/word-prediction-in-action.html

UDL Guidelines

- UDL graphic organizer pdf link http://www.udlcenter.org/sites/udlcenter.org/files/updateguidelines2_0.pdf



Small Group Discussion

- What do you see as potential barriers to lessons?
- How might you incorporate flexible methods of representation?
- How might you incorporate flexible methods of expression?
- How might you incorporate flexible methods of engagement?

Small Group Discussion

- What are the advantages of incorporating assistive technology in a UDL framework as opposed to as an accommodation for one particular student?
- What are the advantages of analyzing the curriculum for strengths and weaknesses rather than focusing on the student's strengths and weaknesses?

Implementing UDL

Challenges and Benefits

- Watch teachers and administrators discuss the implementation of UDL and technology at Brosseau school
- https://www.youtube.com/watch?v=pmhNGt74As0&feature=youtu.be

Discuss

- What benefits do you forsee?
- What challenges do you forsee?
- What do you need to learn more about?

Resources

- Center for Applied Special Technology - CAST- http://www.cast.org/
- National Center on Accessible Educational Materials- http://aem.cast.org/
- National Center on Universal Design for Learning - http://www.udlcenter.org/

Showcase of Assistive Technologies for Reading and Writing

Self-guided packet

This showcase is designed to Increase awareness of AT that can help to compensate for weaknesses in reading and writing by providing you with a very brief introduction to 8 technologies. You can learn more about the technologies at the websites provided.

Directions:

- With your group, rotate to each station.
- Complete the activities, each of which includes watching a short video and exploring websites.
- Discuss the questions with your group.
- You will rotate to the next station after 15 minutes.

Natural Reader

Features:

- Free
- Windows, Mac, cloud (any device)
- Text to speech
- Free voices with adjustable speed and speaker
- Convert Word, PDFs, web pages, emails, and other text
- Floating bar to read any text in other applications
- Additional features available with purchase.
- Save audio files to listen to later
- Typing echo, word prediction, and spell check

Activities:

Go to http://www.naturalreaders.com/index.php and copy and paste text or upload a document to the space provided. Try out different voices and speeds.

Watch a video providing an overview of the free features of this tool at https://www.youtube.com/watch?v=GMZDhXpLHMA

Access how-to videos at http://www.naturalreaders.com/howto.php

Discuss:

How might students use this tool to assist with reading?
How might students use this tool to assist with writing?
What students might benefit from this tool? When?

Notes

Audionote

Features:

- Compatible with PC, Mac, iOS, Android
- Free trial - $4.99 purchase
- Synchronized note taking and audio recording
- Records text or handwritten notes
- Text and drawings highlight during playback
- Tap notes to listen to that exact place in the audio
- Options to share note and audio files

Activities:

Go to http://luminantsoftware.com/iphone/audionote.html to learn more.

Watch this video on Audionote https://www.youtube.com/watch?v=1Sh6F5_NCyM

Discuss:

How might students use this tool to take and review notes?
How might students use this tool to demonstrate their understanding?
How might teachers use this tool to present information to students?
How might teachers use this tool to provide feedback to students?
What students might benefit from this tool? When?

Notes

Voice Dream Reader and Writer

Features:

- Text-to-speech
- 36 built-in voices, plus 100 additional paid voices
- Adjustable volume, rate and pitch
- Optional synchronized word and line highlighting
- Play/pause
- Text search
- Wordfinder and dictionary
- Provides feedback while typing
- Integrate with Dropbox, Bookshare, iTunes, Googledrive, Evernote
- Listen to Word, PowerPoint, Pages, RTF, PDF, and webpages
- Export highlighted text and notes

Activities:

Learn about this tool at
http://www.voicedream.com/

Watch a video showing features and uses of Voice Dream Writer at
http://www.voicedream.com/writer/

Discuss:

How might students use this tool to assist with reading?
How might students use this tool to assist with note taking?
How might students use this tool to assist with writing?
How might teachers incorporate this tool into lessons?
What students might benefit from this tool? When?

Notes

Livescribe Pens

Features:

- Specialized ballpoint pen and paper ($100+)
- Compatible with Windows, Mac, iOS, Android
- Synchronized writing and audio
- Transfer and organize notes digitally
- Tap notes in notebook or in digital version for playback from that spot
- Create audio note stickers

Activities:

Watch this video that provides a brief overview of the features of the Sky Wifi Smartpen at https://www.youtube.com/watch?v=20Hgc_B4xuM

View a chart comparing the features of the Livescribe 3, Sky Wifi, and Echo pens at http://www.livescribe.com/en-us/media/pdf/ls_smartpens_comparison_chart.pdf

Watch this video in which students discuss how they use the Livescribe pen at https://www.youtube.com/watch?v=qwWhFhq-JFE

Discuss:

How might students use this tool to assist with note taking?
How might students use this tool to assist with writing?
How might teachers use this as an instructional tool?
What students might benefit from this tool? When?

Notes

Readability

Features:

- Simplify the appearance of any web page
- Compatible with Widows, Mac, iOS, Android, Kindle
- Eliminate website clutter/distractions
- Save text to read later
- Customizable text style and size

Activities:

Learn more about Readability at https://readability.com/

Watch a brief overview of Readability at https://vimeo.com/30450876

Discuss:

How might students use this tool to assist with reading?
How might students use this tool to assist with note taking?
How might students use this tool to assist with writing?
How might teachers incorporate this tool into lessons?
What students might benefit from this tool? When?

Notes

Ginger Grammar

Features:

- Proofreading tool
- Compatible with Windows, Android, iOS, Safari, Chrome
- Grammar checker
- Sentence rephraser
- Translator
- Dictionary
- Text reader
- Personal trainer
- Keyboard can be used within a variety of apps

Activities:

Learn more at http://www.gingersoftware.com/

Try out some of the features at http://www.gingersoftware.com/features

Watch a video introducing the features of Ginger at https://www.youtube.com/watch?v=XJqc5JIiDCI

Discuss:

How might students use this tool to assist with writing?
How might teachers incorporate this tool into lessons?
What students might benefit from this tool? When?

Notes

Notability

Features:

- Create, share, and manage notes
- iOS app $2.99
- Synchronized note taking and audio recording
- Records text, handwritten notes, and photos
- Text and drawings highlight during playback
- Import and annotate PDFs
- Fill out and send forms or worksheets
- Tap notes to listen to that exact place in the audio

Activities:

Learn more about Notability at
http://www.gingerlabs.com/

Watch a video to learn how students can use Notability at
https://www.youtube.com/watch?v=vM8qrF0iQ5E

Discuss:

How might students use this tool to take and review notes?
How might students use this tool to demonstrate their understanding?
How might teachers use this tool to present information to students?
How might teachers use this tool to provide feedback to students?
What students might benefit from this tool? When?

Notes

Co:Writer

Features:

- Real-time word prediction
- Interprets spelling and grammar mistakes
- Topic dictionaries
- Use within applications such as Microsoft Word, email, or websites
- Universal access from multiple devices including Google Chrome, iPad, desktop
- iOS app ($19.99)
- Individual user or site license options

Activities:

Learn more about Co:Writer at
http://donjohnston.com/cowriter/#.VWzIOM9Viko

Watch a video demonstrating Co:Writer Universal at
https://vimeo.com/104430354

Discuss:

How might students use this tool to assist with writing?
What students might benefit from this tool? When?

Notes

Online Training Resources

CAST

http://www.cast.org/

Committed to expanding learning opportunities for all individuals through UDL, this organization is a leading force in the implementation of UDL through partnerships, research, publications, professional development, and outreach.

- Online courses http://castprofessionallearning.org/online-courses/
- Learning Modules http://udlonline.cast.org/home
- Free Online text, "Universal Design for Learning: Theory and Practice" by A. Meyer, D. H. Rose and D. Gordon http://udltheorypractice.cast.org/
- Free live and recorded webinars http://castprofessionallearning.org/free-udl-webinars/

The National Center on Universal Design for Learning

http://www.udlcenter.org/

This center is designed to support the effective implementation of UDL by connecting stakeholders and providing resources and information. Here, you will find extensive explanations, examples, and resources on UDL including guidelines, research, initiatives, presentations, and publications.

- Multimedia Learning series http://udlseries.udlcenter.org/
- Learn about UDL http://www.udlcenter.org/aboutudl/whatisudl
- Find concrete examples and resources for each checkpoint in the UDL guidelines http://www.udlcenter.org/implementation/examples

Iris Center Resources

http://iris.peabody.vanderbilt.edu/iris-resource-locator/

Designed by leading professionals in the field, high-quality research-based online learning modules provide you with case studies, activities, information briefs, videos, and up-to-date resources.

- AT overview module http://iris.peabody.vanderbilt.edu/module/at/
- Bookshare module http://iris.peabody.vanderbilt.edu/module/bs/#content

National Center on Accessible Educational Materials

http://aem.cast.org/

This site provides information and resources for accessing print- and technology-based educational materials that are useable across a wide range of user variability. Sign up for live or view recorded webinars and presentations.

- See AT in action and hear about student and teacher experiences on the AEM youtube channel https://www.youtube.com/user/AIMNationalCenter
- An Educator's Guide to the Acquisition of Alternate Format Core Learning Materials for Pre-K–12 Students with Print Disabilities http://aim.cast.org/learn/practice/use/accessible_textbooks#.VXCDes9Vikq

AIM Explorer

http://aem.cast.org/navigating/aim-explorer.html#.VXB7Qs9Viko

A free simulation that combines grade-leveled digital text with access features common to most text readers and other supported reading software. Magnification, custom text and background colors, text-to-speech (synthetic and human), text highlighting, and layout options are presented in a logical sequence to help struggling readers decide which of these supports might help them to access and understand text.

The AEM Navigator

http://aem.cast.org/navigating/aem-navigator.html#.VXB8Hc9Vikp

An interactive tool that facilitates the process of decision-making around accessible instructional materials for an individual student. Major decision points in the process include 1) determination of need, 2) selection of format(s), 3) acquisition of format(s), and 4) selection of supports for use. Guiding questions and useful references and resources support each decision point.

- Online tool http://aem.cast.org/navigator/page/

Center on Technology and Disability

http://ctdinstitute.org/

Participate in expert-led e-learning modules on assistive technology in the CTD learning center. View recorded webinars in the CTD café. Search or browse a vast collection of resources on particular AT topics in the CTD library.

Tech Matrix

http://techmatrix.org/

Use criteria to search a database of nearly 400 assistive and educational technology products. Compare up to four products across search criteria. Read related research articles on the theory and practice of using the technology to improve student learning.

UDL: Supporting Diversity in BC Schools

http://www.udlresource.ca/

At this website, teachers from British Columbia share their experiences implementing UDL. A self-directed course designed to help you understand the UDL framework includes a number of videos sharing teacher and student experiences and links to additional resources

Learning Technologies

http://www.learningtechnologiesab.com/

This website explains how teachers can use technology to provide students with choice, support, and flexibility to meet the needs of diverse learners. Learn how text-to-speech, word prediction, speech recognition, visual thinking tools, symbol-supported text can be integrated into the classroom through bulleted summaries, videos, learning guides, and research summaries.

Mobile Technologies, UDL & AT Videos

https://www.youtube.com/playlist?list=PLLVqPK58pS1iidFCUuR-lPQCnHR4CtAI7

This series of 9 videos, explains how 9 apps can support the design and delivery of each of the 9 guidelines that define UDL.

Free and Low Cost Assistive Technologies

http://ods.keene.edu/

A list of technologies used by students at Keene State College's Office of Disability Services organized by task with links to further information.

Pre-Workshop Survey

Please indicate the degree to which you agree or disagree with each statement below.

1. I believe that assistive technology has the potential to reduce barriers and improve access to the general curriculum for students with high-incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

2. I believe that students need to function without assistive technology as their use of it would negatively affect their skill development.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

3. I am responsible for helping students to use the tools they need to access the curriculum.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

4. I know where to go to find resources and learn about assistive technology to help meet the needs of students with high incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

5. I have the skills and knowledge necessary to integrate AT into the general education classroom to help students with high-incidence disabilities to access the general education curriculum.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

6. I have the resources and institutional support necessary to integrate AT into the general education classroom for students with high-incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

Estimate your level of knowledge and skill regarding assistive technology by checking <u>one</u> of the following.

- o I do not know how AT could potentially be beneficial to students in my classroom.
- o I am interested in learning more about how students could use AT to improve access.
- o I can identify barriers within my curriculum.
- o I have identified AT that may help to reduce barriers in my classroom.
- o I am prepared to begin integrating AT into my classroom.
- o I have begun to integrate AT into my classroom and design some lessons using UDL.
- o I consistently provide students with access to AT and choices and flexibility in how they demonstrate their knowledge and access information.

List the types of assistive technology available in your classroom.

Tell what you hope to get out of this professional development experience.

Post-Professional Development Survey

Please indicate the degree to which you agree or disagree with each statement below.

1. I believe that assistive technology has the potential to reduce barriers and improve access to the general curriculum for students with high-incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

2. I believe that students need to function without assistive technology as their use of it would negatively affect their skill development.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

3. I am responsible for helping students to use the tools they need to access the curriculum.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

4. I know where to go to find resources and learn about assistive technology to help meet the needs of students with high incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

5. I have the skills and knowledge necessary to integrate AT into the general education classroom to help students with high-incidence disabilities to access the general education curriculum.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

6. I have the resources and institutional support necessary to integrate AT into the general education classroom for students with high-incidence disabilities.

Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
○	○	○	○	○	○

Estimate your level of knowledge and skill regarding assistive technology by checking <u>one</u> of the following.

- o I do not know how AT could potentially be beneficial to students in my classroom.
- o I am interested in learning more about how students could use AT to improve access.
- o I can identify barriers within my curriculum.
- o I have identified AT that may help to reduce barriers in my classroom.
- o I am prepared to begin integrating AT into my classroom.
- o I have begun to integrate AT into my classroom and design some lessons using UDL.
- o I consistently provide students with access to AT and choices and flexibility in how they demonstrate their knowledge and access information.

How have new knowledge and skills impacted your teaching practices? Please explain any steps you have taken to integrate AT and UDL into your classroom this year.

Do you feel your changes in practice have impacted student learning? Please explain and describe your evidence.

Full-Day Workshop Evaluation

Please indicate which term best describes your level of learning.

1. This workshop increased my understanding of how assistive technology can help to compensate for weaknesses in reading.

Not at all	Slightly	Moderately	Significantly

2. This workshop increased my understanding of how assistive technology can help to compensate for weaknesses in writing.

Not at all	Slightly	Moderately	Significantly

3. This workshop increased my understanding of how the UDL framework can reduce barriers to learning and support high expectations for learning.

Not at all	Slightly	Moderately	Significantly

4. This workshop increased my awareness of technology tools available to assist students with reading and writing.

Not at all	Slightly	Moderately	Significantly

Full-Day Workshop Evaluation

What I learned today:	
Ways I am considering applying my new learning in my teaching:	
Most helpful or appreciated in today's workshop:	Least helpful or appreciated in today's workshop:
Suggestions:	

After-School Workshop Evaluation Workshop Topic: _____

What I learned today:	
Ways I am considering applying my new learning in my teaching:	
Questions I still have:	
Most helpful or appreciated in today's workshop:	Least helpful or appreciated in today's workshop:
Suggestions:	

Appendix B: Interview Protocol

Name_____ School _____ Date _____

Position _____

____ Informed Consent Form Reviewed and Signed (remind participant he or she can end interview)

____ Recording Started

Definitions: The purpose of this interview is to learn more about how teachers use assistive technology (AT) with students with high-incidence disabilities and the professional development teachers need in order to use AT more effectively. For the purpose of this study, high-incidence disabilities include emotional and/or behavioral disorders, learning disabilities, mild intellectual disabilities, high-functioning autism, attention deficit disorder, and speech and language impairment.

Questions:

1. Tell me about your experiences using AT with students with high-incidence disabilities. Follow-up: What (other) types of AT have you used with students with high-incidence disabilities?

2. How do other ATs have the potential to improve access to the general curriculum for students with high-incidence disabilities?

3. How do general and special education teachers at your school learn about AT?

4. How are AT decisions made at your school? Follow-up: When, why, and by whom are decisions made?

5. What factors impact the integration of AT into the general education classroom?

6. What professional development do you think general and special education teachers would need in order to more effectively use AT with students with high-incidence disabilities?

7. Is there anything else you think would be helpful for me to know about AT?

Probes:

Can you explain…	Tell me more about…
Give me an example	What else …
Why do you think …	

__Thank you. I will send an email summarizing the themes of the interview for you to review for accuracy.

Appendix C: Sample Page of Coded Transcript

Tell me about your experiences using assistive technology with students with high incidence disabilities.	
E reading, writing	The students that I use AT with have LD in reading and writing. They've got a long history of support in reading and writing.
E I Independence Curriculum	When they get to the HS, because of the academic demands, a lot of the direct service that they get tends to disappear in favor of you need 3 credits of math and 4 years of English so they are kind of left to figure things out before they go to college which is my biggest struggle now. Is getting kids away from depending on someone to write for them or depending on someone to read the questions for them or to edit their paper to "you need to do this on your own next year or the year after So use technology and increase your independence so you are more successful in college.
E speech-to-text	So the students that come immediately to mind are 3 boys that have reading and writing disabilities. 2 in particular that we have been trying to stress the technology. One has horrible handwriting and writing skills and the teachers can't read his writing and neither can he. When they say, tell me what this says? Hmm. So he has recently gotten Dragon Dictation so I guess that fits under AT. Although it is available to the general public. So he is in the process of using DD and it's helping. It is making things go quicker for him and allowing teachers to read his responses.
E I encouraging use time	He is reluctant. At first he was very uncomfortable with the program and wondering if it would work. He had tried something similar on his iPad which didn't work for him at all. But this seems to be working so I am hoping that the little bit he uses it and finds success he will use it more and realize oh I can use dragon for this or that. I think he sees it as a very narrow set of purposes. But I keep telling him, even if you have short answers, dictate your answers. Staple it to your quiz. You know it doesn't have to be a lengthy essay that you dictate. It can be a lot of things.
E I D ease of transition discovered at home access	So that's one student and then the other one that I have, writing is very difficult for him as well. He was using a word prediction program called word cue at home. Which was a CD which was very limiting because it would tie him to one computer that it was installed on . The school didn't want him bringing disks from outside to install on school computers
E A P what is out there	so I had to look for an alternative which was a little bit frustrating because I had no idea what was out there.
E L tech person trial and error	Finally, our district wide tech coordinator had mentioned google apps and there was one, read and write for google and they give you a 30 day trial so the student and I and his paraprofessional sat down and I had him give it a try and it was very similar to his word prediction program and he liked it and he could access it anywhere.
E time independence	I can't say he is using it a lot. He is also very reluctant. And I don't understand the reluctance except immaturity and being so ingrained or in a pattern of I need to have somebody write this for me. Or I think that when you start a new program it takes time, and just not patient enough to take the time to make it work.
Key:	A: Awareness of AT E: Experiences Using AT L: Learning about AT D: Making Decisions Regarding AT I: Classroom Integration of AT P: Professional Development Needs