Autism and Technology: Investigating Elementary Teachers' Perceptions Regarding Technology Used with Students with Autism

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Abstract

Despite extensive scholarship on the importance of using technology in classrooms, little has been done to explore teachers' perceptions towards using technology with individuals diagnosed with autism spectrum disorders (ASD). The purpose of this study was to examine teachers' attitudes towards the use of technology for students with autism. Data were collected through semi-structured interviews with seven elementary school teachers who taught students diagnosed with autism. Findings revealed the majority of teachers (six of the seven participants) are in favor of using technology in the classroom and believe that it can have a positive impact on students' learning experiences. A thematic analysis revealed three themes: teacher's attitudes towards using technology, benefits of incorporating technology in the classroom, and the different skills technology helps students to develop.

Keywords: *Autism, teachers, students, classroom, technology, computer, iPad, and smart board*

Introduction

The rapid increase of instructional technologies has positively changed education, demonstrating their effectiveness by improving students' focus, facilitating task completion, and increasing student learning. Specifically related to student learning, Krinic, Vidacek-Hains, and Kovacic (2010) claim that *"computer-aided education has largely proven to be more effective and efficient, primarily owing to additional motivation enhanced by the interaction with the computer*" (p. 2). Additionally, for teachers, technology has facilitated planning and assessment (Eckhouse & Carroll, 2013). Educational experts have been quick to research technology in the general education classroom, examine the benefits that result from

its incorporation into all aspects of instruction, and create space for various creative activities that teachers are able to develop for their students (Wu et al., 2013).

Research on the positive impact technology has on education has not only been prevalent with typically developing students, but has also demonstrated its effectiveness for students with special needs (Tibi, 2012). In the special education classroom, technology has improved the educational experience by providing students with special needs with the opportunity to perform tasks and improve social skills (Jacklin & Farr, 2005). The use of assistive technology has also enabled students with disabilities to overcome many of the barriers and obstacles they may face in their educational careers such as their ability to take notes and participate effectively in classroom activities. Krinic et al., (2013) assert that *"assistive technology (AT) can play a major role in overcoming the barriers that persons with developmental disorders have to face*" (p. 2).

While researchers have explored the important role technology can play in special education classrooms, very little has been done to explore teachers' perceptions regarding the use of technology with individuals diagnosed with autism. Understanding teachers' perceptions could be useful in determining the extent to which technological interventions are successful. Additionally, an examination of teachers' perceptions can aid in improving strategies or developing programs designed to increase teachers' comfort with a variety of technological tools to ensure the success of the educational experience for students with autism. The purpose of this study was to explore teachers' perceptions of the use of technology for students with autism, thus helping to bridge this gap in the literature. Broadly, the study asked the following questions: how do teachers' attitudes toward technology use affect their incorporation of technology in their teaching? What do teachers perceive as benefits from technology use for students diagnosed with autism?

Review of the Literature

This literature review is focused on research related to the utility of technology incorporation in the classroom. Prior to that, autism will be defined, with attention to its prevalence and defining characteristics. Beginning with a definition helps contextualize the study and emphasizes its significance given the increasing number of individuals being diagnosed with autism. Research exploring the benefits of technology use, its role in improving students' focus, enhancing task completion, and improving the overall learning experience for the students will be reviewed.

Autism: Definition, Prevalence and Characteristics

Autism spectrum disorder is one of the most common developmental disorders in the United States. The disorder is "is best conceptualized as a biologically determined set of behaviors that occur with varying presentation and severity which is likely the result of varying causes" (Goldstein, Nglier, Rzepa, & Williams, 2012, p. 1001). According to Zaroff and Uhm (2012), 86-91 out of every 10,000 individuals are diagnosed with autism in the United States. Laan, Ingram, and Glidden (2013) have reported statistics showing a large increase in the rates of cases of autism and report numbers from the Centers of Disease Control which show the number of individuals with autism has risen from "1 in 150 children in 2000 to 1 in 88 children in 2008" (p. 51).

Individuals with autism display different characteristics depending on the severity of their case. Webber and Scheuermann argue that those with a severe case of autism can experience *"communication and language deficits, cognitive disorders, social deficits, sensory processing deficits, and stereotyped behavior*" (p. 3). Symptoms are usually displayed after 3 years of age and can appear as early as 12 to 18 months of age (p. 3). Those challenged with language deficits tend to display a lack of motivation to communicate (p. 3). Language

difficulties impact cognitive development as well and as a result, individuals with autism are characterized as having "*here-and-now thinking*" (p. 2), meaning that unlike their peers, they find it challenging to deal with long-term planning.

Benefits of Technology

The benefits of technology use for individuals with special needs have received much attention in the literature. Gentry (1991) defines instructional technology as *"the systematic application of strategies and techniques derived from behavior and physical sciences concepts and other knowledge to the solution of instructional problems" (*p. 7). This definition is broad enough to include all the varieties of technologies that instructors can use to enhance instructional experiences and facilitate learning. Gentry cautions it is important to pay attention to the "*message design, message delivery, and evaluation*" (p. 7). Therefore, the professional *"must internalize the idea that the selection of technology depends on both purpose and values. Some strategies and techniques are superior to others and should be chosen on that basis"* (Gentry, 1991, p. 8).

While some researchers have focused on defining the field of instructional technology and theorizing about the role of the educational expert, others have focused on the benefits associated with technology. Scholars have particularly emphasized the role technology plays in enhancing interaction in the classroom, increasing educational attainment, and comprehension. When studying classroom interaction, Jacklin and Farr (2005) found that learning through a "visual impact on what they are learning" with the use of technology to be the most effective in comparison to traditional methods. In measuring educational progress, findings showed that all students, regardless of gender, benefited from the use of projected aids such as *"computer progress slides, CD's, transparencies, multimedia, projectors and other technologies*" (Atta, Jamil, Ali, Ayaz, & Bashir, 2,013). Furthermore, technology has been shown to enhance students' comprehension in vocabulary retention. Findings reported by Lin and Tseng (2012) revealed annotated videos were useful for teaching new vocabulary through embedded annotations.

Focused Learning

One of the most significant benefits of technology incorporation is that it aids in improving students' focus in the classroom. For example, Moore and Calvert (2000) explored the use of computers in teaching vocabulary to individuals with autism. Comparing a behavioral program to a software program, the researchers sought to understand the positive influence of computers on teaching vocabulary. Fourteen children diagnosed with autism were randomly assigned to the study. They concluded the use of computers is not only cost-effective but also helps with *"children's attention, motivates them, and promote[s] their learning of vocabulary" (p. 361).* Studies also provide evidence that computer use enhanced students' overall learning experiences and academic grades.

Yakubova and Doughty (2012) explored the value of a multicomponent intervention in helping students with autism and moderate intellectual disabilities to improve their skill acquisition using interactive whiteboards (IWB) or smart boards. Participants were assigned smart boards to watch video modeling clips and monitor their own performance using a self-monitoring strategy. Findings indicate that using smart boards/IWB with these participants demonstrated the utility of technological devices and their potential for increasing students' skill acquisition and increasing students' ability to interact with the materials to enhance their active participation in their own learning.

Technology and Assignment Completion

Scholars have examined the important roles that iPads play in helping students with assignment completion. In their study, Flores, Musgrove, Renner, Hinton, Strozier, Franklin, and Hil (2012) argued that using iPads in classrooms not only helps improve students' communication skills but can improve their engagement with in-class assignments (p. 74). Participants in this study were in favor of using iPad technologies as compared to traditional tools which may partly explain the significant role it played in ensuring their engagement with the assigned tasks.

Aside from its role in increasing students' focus, and assignment completion, technology use has been found to improve the skills of those who work with students with challenging behaviors. Lowdermilk, Martinez, Pecina, Beccera, and Lowdermilk (2012) examined the use of educational games for providing "parents and caregivers with an opportunity to learn skills for behavior they want to see increase, and to use techniques to reduce rates of behavior they would like to see decrease [in students]" (p. 30). Using the intervention, *Behavior Breakthroughs*, a game designed to teach appropriate behavior management techniques to individuals who work with children with autism, researchers reported the potential of online educational games providing caregivers and teachers an opportunity "to hone their skills working with a digital child exhibiting challenging behavior without harming the actual child" (p. 34).

Using Technology to Improve Learning

Hess, Morrier, Heflin, and Ivey (2008) surveyed "249 special education directors and autism consultants/specialists in 159 counties, representing all school districts in the State of Georgia" and explored different strategies in terms of technology incorporation in the classroom (p. 963). The study was useful in helping gain insight into strategies teachers implemented with their students. Findings indicated that less than 10% of the strategies used in the public schools in Georgia had scientific support for dealing with students diagnosed with autism (p. 962). In recent years, the potential of technology use in improving student learning has received much attention from scholars seeking to examine the impact of using technology to enhance the learning experience for individuals with autism.

Other scholars have examined the potential of using iPads in enhancing the learning experience by facilitating communication and motivating student engagement. The use of iPads specifically with students diagnosed with autism has also received some attention. In their study, Flores et al. (2010) compared the use of iPads in communication systems to ones that used pictures, such as PECS (p. 74). Findings indicated that while the results were mixed, students communicated more when using the iPad (p. 81). In a different study, Alves, Marques, Queiros, and Orvalho (2013) examined the use of LIFEisGAME, an iPad app, to determine its impact on the facial and emotional recognition skills of students with autism (p. 191). Their findings showed that "all participants enjoyed the prototype game and used the 15 minutes of play time" (p. 202). The iPad motivated students, and was "intuitive" for them "to start and navigate the game" (p. 203).

Method

This study examined teachers' attitudes towards using technology with students diagnosed with autism. Seven teachers in two rural elementary schools in the Appalachian region of the United States participated in semi-structured interviews to explore their perceptions toward technology use, the different types of technology used in their classrooms, and the potential for these technological tools in improving student learning. The interviews were conducted in the schools where teachers worked full-time and were conducted over a period of a semester to due to scheduling issues related to school cancellations caused by winter weather.

Participants

Seven special education teachers who teach students with disabilities at two elementary schools in the Appalachian region of the United States were recruited to participate in this study. To take part in this study, the participants were required to have had some experience teaching children identified with autism. All teachers were currently teaching students with autism except for one. The participants in this study were female teachers between the ages of 40 and 60 except for one teacher in her early 30s.

Demographic data indicates all participants had experience working with individuals with autism which ranged from three to 37 years. More than half the participants (five) had over 14 years of experience working with students with autism. Four participants had over 18 years of experience, and two had more than three years of experience. Participants also had a wide range of expertise in terms of the age ranges taught which ranged from infants to 12th grade. Six participants did not teach students above 6th grade. Six of the seven participants taught at least eight students with autism in their teaching career, and one participant taught three students. The participants were assigned numbers to ensure confidentiality and labeled P1 through P7. Demographic data can be found in Table 1.

Table 1. Participants' Demographic Data

Participant	P1	P2	P3	P4	P5	P6	P7
Teaching grades	K to 6	3rd to 6th	Infant to PK	K to12th	K to 6	PK to 6th	K to 2nd
Years of Experience	18	14	34	37	19	3	3
Students with Autism	8	9	20	15	8	3	20
Use of technology	Against	In favor	In favor	In favor	In favor	In favor	In favor

Instruments

Semi-structured interviews were used as the method of data collection for this study. This method was chosen because it allows the researcher flexibility to begin with a standard set of questions, then probe for additional information during the interview if the researcher determines it is relevant. The participants were asked about their views regarding their experience teaching students with autism, their views regarding technology use, the specific types of technologies they employ in their classrooms, and their views regarding its benefits and utility for learning.

Procedures

Permission was first obtained from the university's Internal Review Board (IRB) for the use of human subjects and permission to contact teachers was gained from school district administrators. After administration permission was granted, the researcher personally went to each of the schools to explain the study and invite potential participants to take part in this research project. The individual interviews took place at the schools where the participants worked and lasted between 15 to 20 minutes. An audio recorder was used to ensure participants' responses were accurately captured. At the end of each interview, the researcher carefully transcribed the interview while the information was still fresh.

Data Analysis

After the interviews were recorded and transcribed, they were read repeatedly. The researcher began the coding process to determine common themes among the responses. The researcher relied on close-in and far-out comparison looking at *"opposite or extremes to bring out significant properties"* (Strauss & Corbin, 1998, p. 94). The researcher utilized thematic analysis to highlight important concepts that emerged, which helped in the search for broader categories that encompassed the different concepts. After similarities were established between the concepts, the researcher divided participant responses into broader categories under which the themes fell. These categories included: teacher's attitudes towards technology use, benefits of using technology, and technology's roles in students' independence. Using thematic analysis, the researcher was able to identify common threads and determine the similarities and differences in participants' perceptions towards the use of technology with students diagnosed with autism.

Results

This study's findings revealed an overall positive attitude towards technology use, with six of the seven participants indicating they utilize high tech technologies in their classrooms. The findings are divided into three different themes: teachers' attitudes towards using technology, perceived benefits of incorporating technology in classrooms, and the different skills technology helps students to develop.

Types of Technology

Six of seven participants used technology in the classroom: one declared that she never uses the computer in her classroom. Instructors also reported using a variety of technological tools which included computers, iPads, visual timers, smart boards, flashcards, and apps. Six of the instructors used computers, and four used iPads. Five used smart boards, while four used flashcards/pictures. Three participants reported using educational games, and two reported the use of visual timers. Two stated they use apps. P1 was consistent with her views reporting that she only used books in her classroom.

Two participants recommended the use of apps, and two others encouraged the use of smart boards. Three recommended the use of computers, and three recommended the use of iPads. Four instructors recommended the use of flashcards, and four recommended the use of pictures, while one recommended the use of a communication device.

Benefits of Technology

Focus on task. Focus on task is one of the most important benefits teachers reported of technology use in the classroom. Focusing on a task is often a challenge for individuals with autism because it requires spending time on a given task without being easily distracted. Participants highlighted the importance of using technology to help with student focus to enhance task completion and indicated that technology benefits in its ability to accommodate different learning preferences. Participants also pointed out that technology helps motivate students by encouraging engagement and focus on tasks. Related to this category is the fact that technology is interesting to children and attracts their attention, which aids in task completion. Technology also provides alternatives for engaging with the task, which facilitates task completion. In terms of helping students focus on tasks, one participant indicated that technology can function as "a reward system" that can be useful in helping students focus on the task in anticipation of a reward.

Assignment completion. The respondents expressed positive views regarding the use of technology to impact student learning. Two instructors spoke of the role technology can play

in providing students with alternative tools to express themselves and answer the question, supporting active participation in the classroom. As one the respondent put it, students do not need to "verbalize" their answers. They can simply use pictures or click and point techniques to answer questions. In terms of helping with task completion, one participant highlighted the important role that technology can play by encouraging "students to start/stop assignments, to obtain better behavior, study, habits, and skills" through its function as a "reward system."

Convenience was also a category that emerged. Three respondents praised technology for its accessibility, how it facilitates assessment, and encourages independence. Technology's accessibility and utility was made clear by one participant who labeled it the "new backpack" implying its convenience and mobility. Another pointed out the importance and utility of using technology to engage parents' in the child's learning experience. For example, technology in the form of email, is used to send extra materials to parents to help with the child's homework. Another category that emerged is the ability of technological tools to ensure better quality work.

Impact on student learning. The respondents also held positive views regarding the use of technology to impact student learning. Different categories emerged from instructors' responses. Two instructors spoke of the role technology can play in providing students with alternative tools to express themselves and answer questions by simply using pictures or clicking and pointing techniques to answer questions.

It became clear from the instructors' responses that technology positively influenced student self-expression which manifests itself in improved writing and communication skills. Two respondents highlighted the importance of technology in improving students' writing abilities, and one respondent pointed out its importance in improving communication in general.

Another category that emerged was students' motivation. Technology, as pointed out by three of the participants, increases students' engagement and focus. Two respondents reported using technology leads to boosting students' motivation while one respondent highlighted the importance of using technology to help them focus.

The use of technology was also reported to facilitate student learning. For example, using technology was described as having an impact on students' comprehension, understanding, and participation in classroom activities. Technology was found to help improve students' learning skills such as note taking and keyboarding. Respondents also pointed out the importance of using technology to help accommodate students' learning preferences. One instructor described the benefits of technology to help address those with visual learning preferences.

Discussion

This study examined teachers' attitudes toward using technology with students diagnosed with autism. The findings suggest that technology has a positive impact on students' focus on task, assignment completion, and increased learning. Findings further suggest that using technology positively influences students' ability to focus on their writing and reading skills. In this study, focused-learning in the classroom environment meant focusing students' attention on the subject matter. Findings also suggest that technology makes it easier for students to finish their tasks in a timely manner and independently. Moreover, it makes it easier for the teacher to provide useful and timely feedback.

In this study, assignment completion referred to finishing assignments and classroom activities. This study found teachers perceived technology incorporation to be beneficial for those with autism. Technology provides students with alternative ways of completing tasks; for example, using smart boards as an alternative for worksheets actively engage students to enhance assignment completion. Technological tools not only are flexible and accessible to

use, but also offer different learning methods that motivate students to enhance efficiency. This study found that technology is useful in terms of facilitating task completion and increased engagement.

Increased learning, in this study, was coupled with the two previous findings: focus on task and assignment completion. This study found that once students focused on their task and finished their assignments in a timely manner using technology, their learning improved. For example, one participant explained that after utilizing different technology in the classroom, she witnessed many changes in students' learning skills. She indicated that using technology not only improved students' writing and reading skills, but also improved their comprehension levels and participation in the classroom.

These findings are consistent and support earlier findings regarding the role technology plays in impacting task completion. The role technology plays in improving students' motivation was established by Xin and Sutman (2011) who used smart boards to implement social stories to motivate students. Moore and Calvert (2000) also found that using computer technologies with students with autism is not only cost-effective, but also motives them to learn.

Conclusion

The purpose of this study was to examine teachers' attitudes towards technology use. Through the use of semi-structured interviews, the researcher collected data from seven participants. The respondents reported positive views regarding the use of technology to impact student learning. Three themes emerged from instructors' responses which included: assignment completion, focus on task, and positively impacting the overall learning experience of the students.

One of the implications of these findings is that school administration needs to ensure teachers are provided with the tools and training they need to achieve the desired outcomes with the incorporation of technology in the classroom. As new technologies appear, administrators may want to ensure teachers are provided with the opportunity to receive training on how to use these new tools to facilitate their integration into the school curricula.

Because of the ability of technological tools to engage students and provide alternative methods for learning and self-expression, students with special needs can benefit greatly from them. Technology allows students to respond to questions without the need to verbalize their answers, which is useful for those who experience difficulty with communication. The benefits of technology ought to be further explored to ensure that students are able to participate and actively take part in the lesson.

Although the current study provides useful insights into teachers' perceptions towards the use of technology, there are some limitations. A bigger sample size would have provided better insights into the different tools used by special education teachers. Because teachers in the study came from only two schools in one district, it would have been useful to interview instructors from more schools across districts to determine the range of technology tools used. Differences across grade levels would also be useful to determine if the type of technology use differs by age of the students.

Future research should examine the different factors that influence teachers' choice of technology with a larger sample. Interviewing parents may also be useful to determine parents' perceptions of the impact of technology on their children's learning experiences. Although instructors use a variety of technological tools, it would be useful to determine what factors influence their choices by exploring the pedagogical basis for teachers' technology choices . Although the data revealed teachers had positive perceptions regarding technology use in the classroom for students with autism, future research should focus on analyzing factors that influence teachers to use specific technological tools over others.

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