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Special Education Teachers' Knowledge of Using Assistive Technology with Students with Autism Spectrum Disorder

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Abstract:
The aim of this study was to explore teachers' knowledge of using assistive technology (AT) with students with Autism Spectrum disorder (ASD) based on their gender, years of teaching experience, level of education, grade level of instruction, and training. A sample of 312 teachers were collected in this study. Multiple Linear Regression was conducted for data analysis. Results indicated that trained teachers showed more knowledge of the using of AT in classrooms for students with ASD. Teachers who have more years of teaching experience reported more knowledge of using AT in classrooms for students with ASD. The results support a greater need for further studies using AT for students with ASD from stakeholders and decision makers perspectives in Saudi Arabia.

***Keywords*:** Special Education, Knowledge, High Assistive Technology, Autism Spectrum Disorder.

Introduction

Autism Spectrum Disorder (ASD) is a range of developmental disorders that are typified by behavioral challenges, social interaction impairments, and communication shortfalls (American Psychiatric Association, 2013). However, the Center for Disease Control and Prevention (CDC) in The United States has estimated that 1 in 59 children in America has ASD with a rate of 1 in 37 boys and 1 in 151 girls (CDC, 2018). The number of students with autism has increased in the Middle East. One report showed 42,500 cases of autism in 2002 while many more cases remain undiagnosed (Yazbak, 2004; Kazdoba, Leach & Crawley, 2016). According to Al-Ansari and Ahmed (2013), in 2005, 4.3 out of 10,000 persons in Bahrain has ASD. Moreover, 1 per 167 children in Saudi Arabia has ASD (Aljarallah, Alwaznah, Alnasari, & Alhazmi, 2007). According to Mostafa (2011), 1.4 out 10,000 children in Oman were diagnosed with ASD, while in the United Arab Emirates 29 per 10,000 of children have ASD.

AT now play a crucial role in the lives of students living with autism with positive effects being witnessed in the areas of emotional and social development, communication, and academic development (Battal, 2016; Kauffman, Hallahan & Pullen, 2017) When students are unable to verbally share the text-to-speech function, they turn their screen to the classroom and the computer will read their story (Asaro-Saddler, Knox, Meredith, & Akhmedjanova, 2015; Miller, & Bugnariu, 2016). Furthermore, ATs allow teachers and students with autism to relate through using high-tech devices such as tablets, iPads, or computers and this has enhanced the learning experience for students with autism. In the Asaro-Saddler et al. (2015) study, results indicated that children with ASD are more motivated to participate when using innovative technology (IT) and visual media.

Unfortunately, the lack of connections between disease centers or autism institutions and schools reflects the limited information about ASD prevalence in Saudi Arabia. Consequently, there is no accurate estimate about the number of people with ASD in Saudi Arabia. In fact, clear information can help families, researchers, schools, academic and special education institutions, and all people who are interested in ASD.

Prevalence of ASD in Saudi Arabia

Saudi Arabia is one of the countries in which the prevalence of children with autism is on the rise (Almana, Alghamdi, & Laila, 2017). One report showed 42,500 cases of autism in 2002, while many further cases remain undiagnosed (Yazbak, 2004). Additionally, 1 per 167 of children in Saudi Arabia has ASD (Aljarallah et al., 2007). Eighteen out of 10,000 people in Saudi Arabia have ASD (Athbah, 2015). Similarly, 6 children ages 16 and below out of every 1,000 individuals have been diagnosed with ASD in Saudi Arabia (Alnemary, 2017).

Currently, there is no accurate number for the prevalence of people with ASD in Saudi Arabia (Almana et al., 2017). The numbers of people with ASD in Saudi Arabia are conflicting because of the lack of connections between disease centers or autism institutions and schools in Saudi Arabia. Furthermore, level of awareness and limited information on autism for the community in Saudi Arabia as well as some invisible characteristics of autism such as weak communication and social skills lead to inaccurate information on the number of people with autism. For these reasons, the information about ASD prevalence in Saudi Arabia is limited. Clear information could help families, researchers, schools, academic and special education institutions, and all people who are interested in ASD, and more investigation of diagnostic practices is needed (Alotaibi, 2015).

The previous mentioned estimated numbers categorically show the increase of the ASD diagnosis in Saudi Arabia. Additionally, students with autism find it hard to understand concepts in the classroom or concentrate in the classroom setting. Thus, there is a need for early intervention on how we can make students with autism feel, communicate, and behave with their peers like regular children in classrooms (Ministry of Education of Saudi Arabia, 2017). Recent advancements in technology have allowed the integration of technology in learning to enhance the quality of education for students with autism. In the field of special education, technology has experienced similar advances in the use of assistive technology (AT) devices to help students with autism to succeed in their studies. According to Adak and Halder (2017), many researchers and scholars have proposed different explanations for this high prevalence, including cultural differences, definition of ASD, and different methods of research. In their study on the prevalence of autism in a metropolitan area in the United States, Yeargin-Allsopp et al. (2003) found that the prevalence of autism is 3.4 per 1,000 with a female-male ratio of 1:4. Their study further revealed that the prevalence of ASD is comparable for both Black and White children. Johnson and Myers (2007) reported that the prevalence of ASD is not related to a specific race, education level, or the socio-economic status of parents. Additionally, the rate of autism in the United States reported in the study by Yeargin-Allsopp et al. (2003) was higher than rates from research studies that were conducted in the 1980s.

Problem Statement and Significance of the Study

With the increasing number of students diagnosed with ASD, studies on the knowledge of special education teachers regarding the use of AT in classrooms to support these students is important to investigate (Meyer, 2016). The research on the knowledge of AT in classrooms for students with ASD is limited in Saudi Arabia. Since the government in Saudi Arabia has a vision of a 2030 plan, a full inclusion program for students with disabilities is one of the vision's goals. In fact, all teachers, based on the vision of the 2030 plan, will teach students with disabilities in general classes. As a result, their knowledge of using AT were important for this study. Nonetheless, studies on the knowledge of special education teachers toward the use of AT with students with autism are needed. It is important to explore these knowledge, since they are strong predictors of future behavior. Studies have indicated that teachers in Saudi Arabia might have negative attitudes and knowledge toward individuals with disabilities (Alotaibi & Almalki, 2016b).

Purpose of the Study

The knowledge of special education teachers of using AT are similar to making decisions about other services for students with ASD. There is a need to incorporate a team approach that consists of members who know more about children, their weaknesses, strengths, activities, and tasks. The main goal of this study was to investigate the knowledge of special education teachers of using AT in the classroom setting for students with ASD in Hail, Saudi Arabia. There are various factors that could influence the success of AT including, student age, teacher's age, and teacher's level of interest in HAT (Abuzaid, 2015). The successful implementation of AT in the classroom setting when teaching students with ASD relies on the technique and teaching practices of the educator who uses them (Alharbi, 2018). A teacher's perception of a high assistive device affects the manner in which the AT was utilized and implemented in the classroom environment. Alotaibi and Almalki (2016a) noted

that such variation is as a result of the resistance or fear of teachers toward modern-day approaches. The utilization of smartphones, laptops, and iPads when teaching students with ASD depends on the level of comfort a special education teacher feels in regard to technology (Johnson, 2013, p. 8). The efficiency of a new teaching approach relies on the epistemological practices and beliefs of the special education teacher (Alshumaimeri & Almasri, 2012).

Research Questions

The following questions guided this study:

R1: What are teachers' knowledge of using AT in the classroom for students with ASD?

R2: To what extent do teachers' gender, years of teaching experience, level of education, grade level of instruction, and training explain teachers' knowledge of using AT for students with ASD in Hail, Saudi Arabia?

Research Methodology

The research objective and questions required utilizing quantitative research methodology. Quantitative research describes the research issue and finds an explanation of the relationship between variables (Creswell, 2015). Quantitative research methodology focuses on dividing the research questions by using a questionnaire survey in small parts to measure the main issue, which will help researchers to measure, analyze, and discuss the results from a given set of numerical or categorical data.

Research Design

The research design was a quantitative approach. The quantitative approach examined data from the field using a survey. "Survey research designs are procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviors, or characteristics of the population" (Creswell, 2012, p. 376).

Study Population and Sample Selection

The survey study sample consisted of 312 special education teachers identified by the General Directorate of Education in Hail, Saudi Arabia. Purposive sampling, also called selective sampling, is a research technique that allows researchers to depend on their own judgement while identifying and selecting participants who can represent the rest of the general population to participate in the study (Onwuegbuzie, 2003).

Instrumentation

The survey instrument in this study was developed to assess teachers' knowledge of using AT in classrooms for students with ASD through posed questions within 2 sections. According to Creswell (2012), an instrument is a tool that researcher uses to measure, observe, or document quantitative data. I used Qualtrics Survey Software to create an online self-administered survey. Creswell noted that online data collection is quick and easy (Creswell, 2015).

Validity and Reliability

In research methodology, validity is the degree to which certain data collection instruments for quantitative research can accurately measure and establish what they were formerly designed to measure. The instrument for this study was mentioned during the literature review to determine the objectives of the measurement and support the survey validity. Also, an expert in quantitative research was invited to develop the validity of the survey. In addition, a pilot test was used to look for initial evidence of the usefulness of the survey and to define the validity and reliability of the instrument. Comments and feedback from the 12 teachers were taken into consideration. As a result, items that showed low reliability in the pilot test were avoided.

Data Collection Procedures

Researcher used the Qualtrics survey website to create and format the survey. The Qualtrics software allows the survey to be linked on the website and allows the researcher to organize information and collect data

automatically. The Qualtrics survey link was created and sent to the special education teachers in Hail via their personal e-mail addresses.

Data Analysis Procedures

Researcher used Statistical Package for the Social Sciences (SPSS) software to analyze the data. Descriptive statistics, such as frequencies and percentages, were used in this study as appropriate. Descriptive statistics were displayed in tables. Also, a multiple regression analysis was conducted to examine the extent to which variables predict special education teachers' knowledge of using AT with students with ASD.

Data Analysis and Results

Response Rate

The Qualtrics platform was used in this study to collect data and answer this research questions, which is a commonly used data collection platform for researchers. The Ministry of Education sent the survey link to all schools' teachers in the city of Hail. The responses sample size was 312 teachers.

Descriptive Results

Gender

The study sample consisted of 312 school teachers in Hail, Saudi Arabia, 173 (55.4%) were male teachers and 139 (44.6%) of them were female teachers.

Level of Education

The education of the participants in this study included 1 (0.3%) participants with a 2-year diploma, 145 (46.5%) with a bachelor's degree, 115 (36.9%) with a master's degree, and 51 (16.3%) with doctorate degree.

Years of Teaching Experience

Each participant was asked to answer a question indicating their years of teaching and was able to write his or her response in an open-ended text box. Participants' years of teaching experience in their careers ranged from 0 to 35 years, with an average of 10 years' teaching experience. The data showed a wide variation in the years of teaching experience for survey respondents.

Grade Level of Instruction

In the survey, participants had four options to indicate their grade levels of instruction. Participants were asked to choose from the following choices: pre-school, elementary school, middle school, and high school. Results indicated that 47 (15.1%) were pre-school teachers, 199 (63.8%) were elementary school teachers, 57 (18.3%) were middle school teachers, and 9 (2.9%) were high school teachers (see Table 1). The highest number of participants in this study (60%) were elementary school teachers.

AT Training

Respondents were asked if they had been trained on how to use AT in classrooms for students with ASD. Responses showed that 106 (34%) had this training and 206 (66%) had not had this training. Table 1 shows the breakdown of these descriptive results.

Table 1

Demographics of the Study Participants

Item	***N* = 312**	
	Frequency	**Percentage**
Gender		
Male	173	55.4
Female	139	44.6
Level of Education		
2-year diploma	1	0.3
Bachelor's degree	145	46.5
Master's degree	115	36.9
Doctorate degree	51	16.3

Grade Level of Instruction		
Pre-School	47	15.1
Elementary School	199	63.8
Middle School	57	18.3
High School	9	2.9
Assistive Technology Training		
Yes	106	34
No	206	66

Reliability Estimates

To answer the research questions, The Qualtrics survey link was sent to special education teachers in Hail for both males and females, trained and untrained teachers for all grade levels of instructions. A total of 312 teachers participated in this study. Survey items included both positive items and one negative item. However, before analyzing the data, I reversed the codes for the negative item's responses. The item anchor that had a response value of 7 = "Strongly Disagree" was reversed to a value of 1 before the analyses and the item anchor "Strongly Agree" was assigned a value of 7. The regular positive items were left as they were in the survey.

The negative item in the survey was item number 5. After running the reliability estimate for all surveys' items, I found that the coefficient alpha for the knowledge scale was.90 which indicated a good reliability estimate based on the previously mentioned literature (see Table 2).

Table 2

Reliability Statistics of Teachers' Knowledge.

Survey Items	Cronbach's Alpha
Teachers' Knowledge Alpha (7 Items)	.90

Research Question 1 Results:

To answer the first research question, "What are teachers' knowledge of using AT in the classroom for students with ASD in Hail?" a descriptive statistic measured teachers' knowledge of using AT for students with ASD in classroom. Item 5 read, "I know that assistive technology options range from low-tech to high-tech" had the highest mean from all items (M = 2.62, SD = 1.12). more than half of the participants 184 (59 %) reported that they have a weak knowledge of assistive technology options range from low-tech to high-tech. Specifically, 96 (30.8 %) showed that they have no knowledge of assistive technology options range from low-tech to high-tech, 88 (28.2%) showed that they have inadequate knowledge of assistive technology options range from low-tech to high-tech, while 58 (18.6%) showed that they have adequate knowledge for the same item. On the other hand, 54 (17.3%) participants showed that they have an excellent knowledge of assistive technology options range from low-tech to high-tech, while 16 (5.1%) of them have a superior knowledge for the same item.

Item 1, ": I know the concepts and terms regarding AT.," had the lowest mean comparing to other items (M = 2.45, SD= 0.97). Almost, half of the participants, 213 (68.2 %), showed that they do not know the concepts and terms regarding AT and 62 (19.9%) of them have adequate knowledge, while only 37 (11.9%) of them showed an excellent and superior knowledge as shown in Table 3.

Table 3

Teachers' Knowledge Toward the Use of AT for Students with ASD

Item 5: I know that assistive technology options range from low-tech to high-tech.				
	Frequency	Percent	*Mean*	*SD*
No Knowledge	96	30.8	2.62	1.12
Inadequate Knowledge	88	28.2		
Adequate Knowledge	58	18.6		
Excellent Knowledge	54	17.3		
Superior Knowledge	16	5.1		
Total	312	100		
Item 1: I know the concepts and terms regarding AT.				
	Frequency	Percent	*Mean*	*SD*
No Knowledge	123	39.4	2.45	.967
Inadequate Knowledge	90	28.8		
Adequate Knowledge	62	19.9		
Excellent Knowledge	33	10.6		
Superior Knowledge	4	1.3		
Total	312	100		

Note. The responses for the above items are as follows: 1 = "No Knowledge," 2 = "Inadequate Knowledge," 3 = "Adequate Knowledge," 4 = "Excellent Knowledge," 5 = "Superior Knowledge." (N = 312).

Regression Analysis Results:

Research Question 2 asked, "R2: To what extent do teachers' gender, years of teaching experience, level of education, grade level of instruction, and training explain teachers' knowledge of using AT for students with ASD in Hail, Saudi Arabia?". Multiple regression analysis was conducted to determine whether gender, years of teaching experience, level of education, grade level of instruction, and training are significant predictors of the teacher' knowledge of using AT in classroom for students with ASD.

Table 4 presents the results of the multiple regression analysis for special education teachers' knowledge of using AT in classroom for students with ASD. Two variables were statistically significant: years of teaching experience (p = .014) and AT training (p < .001). Specifically, trained special education teachers reported more use of AT in classroom for students with ASD by .27 units. Also, each additional year of teaching experience was associated with .13 unit increase in the reported use of AT, indicating that those with more experience report a *greater* use of AT, controlling for other factors.

Table 4

Regression Analysis of Special Education Teachers' Knowledge Toward Using AT for Students with ASD

	Unstandardized Coefficients		Standardized Coefficients		
Category	***B***	***Std. Error***	***Beta***	***t***	***Sig.***
Gender:	-.013	.058	-.013	-.229	.819
Years of experience	.134	.054	.135	2.481	.014
Bachelor Degree	.620	.466	.623	1.331	.184
Master Degree	.737	.466	.716	1.581	.115
Doctoral Degree	.970	.470	.723	2.067	.110
Elementary-School	-.002	.081	-.002	-.021	.983
Middle School	.042	.096	.033	.435	.664
High School	.114	.176	.038	.646	.519
Training	.274	.057	.261	4.814	<.001

Note. Gender: 1 = "Male" and 2 = "Female." Teacher's Level of Education: 1 = "Two-year Diploma," 2 = "Bachelor's," 3 = "Master's," and 4 = "Doctorate." Years of Teaching Experience is scale from 0-35. Grade Level of Instruction: 1 = "Pre-School," 2 = "Elementary School," 3 = "Middle School," and 4 = "High School." AT Training: 0 = "No training" and 1 = "Training.". Knowledge: 1 = "No Knowledge," 2= "Inadequate Knowledge," 3= "Adequate Knowledge," 4= "Excellent Knowledge," 5= "Superior Knowledge." (N = 312).

Discussion and Conclusions

Research Question 1: What Are Teachers' Knowledge of Using AT in Classrooms for Students with ASD in Saudi Arabia?

Most of the teachers in this study reported that they have weak knowledge of how to use AT in classroom for students with ASD, which significantly affects and can minimize the use and implementation of AT. This influences the quality of teaching by these teachers, because it has been shown that AT is beneficial to students at various levels. Thus, 59 %of the teachers responded that they know that assistive technology options range from low-tech to high-tech. Almethen, 2017 reported that teachers who work with children with ASD show a lack of knowledge of using AT which confined the use of AT with students with ASD. Therefore, a lack of knowledge by the teacher may hinder the implementation of technology in schools (Ahmed, 2015).

In contrast to a study by Almethen (2017), this study did not find that a teacher's knowledge is a signifying predictor toward the use of AT for students with ASD. It could be that teachers do not do effective implementation of technology-based interventions. A study by Coleman et al. (2015) to evaluate art educators' use of AT found that there is a need for more in-service and pre-service training for teachers for the effective implementation of technology-based interventions.

Research Question 2: To what extent do teachers' gender, years of teaching experience, level of education, grade level of instruction, and training explain teachers' knowledge of using AT for students with ASD in Hail, Saudi Arabia?

Results showed that, AT training and years of teaching experience were statistically significant predictors of their use of AT in classrooms for students with ASD. This result is consistent with the Ajuwon et al. (2016) findings, which support the idea that teachers would use AT to enhance student outcomes only if they received training to do so. Also, Coleman et al. (2015) showed that expert teachers usually use AT more than un expert teachers. This finding is also supported in the Alkahtani (2013) study, which pointed that teachers should have training to increase their ability of implementing AT for teaching students with disabilities. Nonetheless, in contrast with a study by Flanagan et al. (2013), this study did not find teachers' gender to be a significant predictor of using AT in classrooms for students with ASD.

Implications for Practice

The results obtained from this study have different implications on the quality of education provided by special education teachers across Saudi Arabia. First, the results will help different stakeholders and decision

makers to understand where there are weaknesses and different ways in which they can manage to reduce the weaknesses and use the strong points and advantages of AT. For instance, the different levels of implementation and views provided by teachers can be used to create certain objectives for the stakeholders and decision makers in the education sector to create standards that must be followed and achieved for the schools to have funds from the Ministry of Education.

The findings in this study support teacher orientation and training on the implementation of AT whenever they are assigned to teach students who need it. Even if some could be experienced teachers and have received AT training in the past, changes in technology and the use of different systems demand new and different knowledge all the time, and orienting teachers on each new system will help create positive learning environments toward the use of AT in classrooms for students with ASD. This will also help the teachers understand that AT complements their work and in no way competes with what they provide as teachers. At the same time, it will help the teachers understand when they will apply the different levels of AT (from low-tech to high-tech) to address different levels of student needs.

Studies in the future ought to consider investigating AT training courses provided by educational colleges. Strong preparations of AT in the pre-service level can assist with teacher confidence in their abilities to implement AT in classrooms.

Recommendations for Future Research

The results of this study support the use of AT in classrooms for students with ASD based on the knowledge of special education teachers in Hail, Saudi Arabia. Moreover, these results are aligned with Alharbi's (2018) results, which reported that parents of children with ASD have positive attitudes toward the use of AT and portable devises. Future research should explore the attitudes of stakeholders and decision makers in Ministry of Education toward the use of AT in classrooms for students with ASD. The information from this study could help to create a training project for teachers that would increase their use of AT in classrooms for students with ASD. Also, future study can investigate if the use of AT among students with ASD and their peers are effective as measured by student outcomes.

Studies in the future ought to consider investigating AT training courses provided by educational colleges for special education teachers. Strong preparations of AT in the pre-service level can aid teachers to be more confident in their abilities to implement AT in classrooms. This would also build on the research by Almethen (2017) who reported that special education teachers have a lack of knowledge of AT and report a weak ability to use AT in their classrooms.

Conclusion

This study has revealed both general and special education teachers' attitudes toward the use of AT in their classroom with ASD students. From the results, it is clear that teachers' knowledge toward the use of AT in classrooms for students with ASD depend on different factors including training. Results of this study also show that AT training significantly affects teachers' knowledge toward the use of AT. Coleman et al. (2015), who evaluated art educators' use of AT, found that there is a need for more in-service and pre-service training for teachers for the implementation of technology-based interventions. Being a trained teacher creates a positive behavior toward the use of AT in classrooms for students with ASD. Thus, training of the use of AT translates to positive behavior and implementation of AT in classrooms for students with ASD.

Some recommendations have been provided to help improve the standards and level of use and implementation of AT in classrooms for students with ASD in Saudi Arabia. The recommendations are also meant to help improve the attitudes and knowledge levels of teachers toward the use of AT in classrooms for students with ASD. The most important recommendation is that teachers need to be trained and professionally refreshed more often to allow *greater* use of AT.

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