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The Effect of Assistive Technologies on Academic Achievement and the Development of Behavior and Language among Students with Autism Spectrum Disorder/Teacher Opinion

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Abstract

The current study aims to identify the impact of assistive technologies of the third advanced level (iPad with educational, behavioral, and linguistic applications) on students with autism spectrum disorder who were included in public schools in the Emirate of Abu Dhabi in the United Arab Emirates, where the research tool (questionnaire) was distributed to A random sample of 275 public education teachers in government schools who had to answer the 13 items of the questionnaire divided into 3 sides. The results indicated that 45.8% of the study sample representing general education teachers in public schools believe that there is a positive effect of assistive technologies in developing the academic, behavioral, and linguistic achievement of students with autism spectrum disorder. As for the rest of the study sample, 33% of them were neutral, and the rest of the sample, 22%, did not notice a positive effect of assistive technologies.

Keywords: Assistive Technologies, Autism Spectrum Disorder (ASD), Academic Achievement, Behavioral Development, Language Development.

Introduction

Autism spectrum disorders are defined by persistent deficiencies in social communication and interaction, as well as confined and repetitive behaviors, interests, and activities, according to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). DSM-5 introduced major revisions compared to the previous edition (DSM-IV-Text Revision). Language abilities not used in social communication have been de-emphasized in the diagnostic criteria. Furthermore, diagnostic subgroups such as autistic disorder, Asperger disorder, Rett disorder, childhood disintegrative disorder, and pervasive developmental disorders (PDD) not otherwise defined have been eliminated. DSM-5 categorizes ASD into three severity levels: (1) "requires support," (2) "requires significant help," and ultimately (3) "requires very substantial support".

Autism spectrum disorder has been divided into three levels since the publication of the DSM-V in 2013. The degree of autism and the level of care that may be required to help that

individual live a full and independent life might be better understood by categorizing a person's autism spectrum disorder diagnosis as Level 1, Level 2, or Level 3. Level 1 autism spectrum disorders refer to the mildest form of autism that requires the least amount of assistance. Level 2 autism spectrum disorders are the middle level of autism spectrum disorders, and they usually necessitate a lot of help in some areas. Level 3 autism spectrum condition is the most severe form of autism, and it necessitates a lot of aid to enable the individual to accomplish daily activities that are crucial for social or behavioral skills (Brown-Beasley, 2020). Obvious symptom is social disorder. In 2013, the DSM-5 replaced Autistic Disorder, Asperger's Disorder, and other pervasive developmental disorders with the umbrella diagnosis of autism spectrum disorder.

An assistive technology device, according to the 1997 modifications to the Individuals with Disabilities Education Act (IDEA), is "any piece of equipment or product system that is utilized to augment, maintain, or improve the functional capacities of individuals with disabilities." Serving, according to Lewis (1998), Assistive technology has two purposes: increasing one's capabilities and counteracting the impacts of impairment and creating a different mood for doing a task. As a result, students can employ technology to compensate for or fully eliminate their impairment. All children, including kids with impairments, can benefit from technological advancements (Flanagan & Richardson, 2013).

There were three degrees of assistive technology tools: low technologies, medium technologies, and high technologies. We will focus our research on the high-level technology used in Abu Dhabi city, such as computers, iPods, talking devices, and many more gadgets that require advanced programming (Cohen & Simon, 2008). In terms of academic capabilities, the performance of children with autism spectrum disorder and intellectual disabilities in school settings using computer-based programs has also been studied (Pennington, 2010; Knight et al., 2013; Fletcher-Watson, 2014; Ganz et al., 2014). For example, using a tablet computer-based intervention to improve the vocabulary abilities of three children with autism spectrum disorder aged 8 to 14. When compared to the baseline, all participants improved their performance during the intervention phases.

Statement of The Problem

The researcher noted, through his previous experience as a teacher for students with special needs in general and with autism spectrum disorder in particular, and through his current work as a specialist in the assessment and diagnosis of autism spectrum disorder, that the Ministry of Education in the United Arab Emirates is keen to distribute assistive devices and technologies to students with autism spectrum disorder who are in regular school, whether they use these techniques or not, but just because you have autism spectrum disorder, you deserve these financially expensive techniques, and in many cases, they may not be used because the teacher is not convinced of their benefit to students in terms of academic achievement, language communication, and behavior because of his negative attitudes about including this category in schools public or for fear that some challenges or difficulties impede the use of these technologies in the public classroom. The main research problem is trying to find out if there is an effect of assistive technology on students with autism who are included in public schools in Abu Dhabi city according to the teacher's Opinion.

Research Question

1.What is the impact of Assistive technology on the academic achievement of students with

autism spectrum disorder?
2.What is the impact of Assistive technology on the language of students with autism spectrum disorder?
3.What is the impact of Assistive technology on the behavior of students with autism spectrum disorder?

Literature Review

Technology has contributed to the support in the field of education and the promotion of daily life skills, social skills, and other academic and communication skills. The auditory, visual, and kinesthetic aids have also contributed to individuals with disabilities in greater independence and freedom of movement and mobility (Al-Katib, 2005). Assistive technology is one of the modern programs that have been used with autistic children to develop communication skills and an understanding of spoken language. Despite the limitation in the number of studies, however, (Merinda, 2001), it the undermines the es effectiveness of the technology. Supportive technology has an effective role in reducing the difficulties facing children who suffer from autism (Joanne, 2008), whether in the aspect of communication or in terms of Most of the studies that were conducted on the recovery of supportive technology with children suffering from autism showed that the supportive technology protects them in their folds.

Assistive technology has been able to open the door for individuals with autism spectrum disorder, thus helping to reduce the effects of disability, if these tools are used correctly and services are available, individuals will achieve greater progress, independence, and increased self-confidence (Skylar, 2006). Assistive technology has effectively contributed to teaching daily living skills, social skills, communication skills, social skills, and academic skills (Al-Khatib, 2005). Assistive technology is one of the modern programs that have been used with children with autism to develop communication skills and the understanding of spoken language, despite the limited number of studies (Merinda, 2001).
Supportive technology has an effective role in reducing the difficulties facing students who suffer from autism (Joanne, 2008), whether on the side of communication or the side of social interaction. Support and protection within its folds are the most important of the mothers of these children, the most recent of which is Merinda, 2001, and those who care for them (Smith & Tyler, 2010). It was also concluded by (Pleinis & Romanczyk, 1985) that Autism exhibits a lower level of distractibility and dysphoria because of excitatory stimuli when it is restored. Computerized programs are more than activities that require the presence of a directed teacher, and they have been described as having several behaviors. Unwanted subjective arousal becomes negligible when computerized programs are retrieved.

Fan et al(2012) conducted a study that aimed to understand the effective learning of the iPad and the use of the system to assist elementary-age students with learning. The research literature promotes different types of assistive technology used for learning and suggests a few applications to use for the iPad. Four students with autism learned to use an iPad tablet to learn phonics. An empirical approach was used via teacher action research by collecting observation data on students. The purpose of this research was to evaluate the effectiveness of using the iPad in teaching language arts. The data indicated that all participants began learning more independently after the iPad was introduced. Their performance in communicating and in recognition and identification of letters became apparent. These results

are presented in the context of how effective the iPad can aid students who are on the autism spectrum.

McNichol et al (2020) conducted a study that d to know the influence of assistive technology use on educational engagement, academic self-efficacy, and well-being for students with disabilities in higher education in Ireland, as well as the impact of assistive technology use on competence, adaptability, and self-esteem. The College Learning Effectiveness Inventory, the Student Course Engagement Questionnaire, the Self-Efficacy for Learning Form Abridged, the Psychosocial Impact of Assistive Devices Scale, and the Warwick-Edinburgh Mental Well-Being Scale were used in a cross-sectional online survey of 111 students with disabilities. In the domains of competence, adaptability, and self-esteem, assistive technology use was found to have a positive psychological impact. When compared to individuals with unmet assistive technology needs, those with fully met assistive technology needs scored significantly higher on academic self-efficacy, well-being, and four of the ten educational engagement subscales. The educational engagement was not affected by whether assistive technology demands were addressed. Conclusion: These findings show the importance of assistive technology for students with a wide range of disability diagnoses in terms of both educational engagement and psychosocial well-being. When allocating financing to disability services within institutions, federal authorities must consider the far-reaching benefits of assistive technology.

Fathia (2017) conducted a study to see how assistive technology might help youngsters with autism improve their communication abilities. Methods: Twelve children with autism (mean age: 8) were randomly allocated to one of two experimental groups or a control group (n=4). The language abilities measure for children with autism was found to be valid and stable in this study. They were given the scale as a pre-, post-, and follow-up exam. The findings showed that the average grade level of children with autism in the two experimental groups differed statistically significantly (0.05). The children in the two experimental groups improved their language scores more than the children in the control group from pre- to post-test. Conclusions: Based on the findings, it can be concluded that assistive technology can help children with autism improve their language abilities.

Methodology

Descriptive research describes phenomena as they exist. It is used to identify and obtain information on a characteristic of a particular issue like community, group, or people. In other words, we can say that this type of research describes social events, social structure, social situations, etc. What did the observer find and how did he describe it? What, who, where, how, and when are all questions that descriptive research addresses. It's utilized to figure out what's going on right now. In physical and natural science, it is commonly utilized. But it is used more commonly in the social sciences, as in socioeconomic surveys and job and activity analysis(Khanzode, 1995). The descriptive design is used to measure the effects of the independent variables on the dependent variables, the researcher will present questionnaires to the teachers participating in the research sample and conduct semi-formal interviews to collect qualitative data, and then interpret and compare the data. In our study, we need to collect quantitative data from public teachers who work in public schools, and the best way to collect this data was a questionnaire.

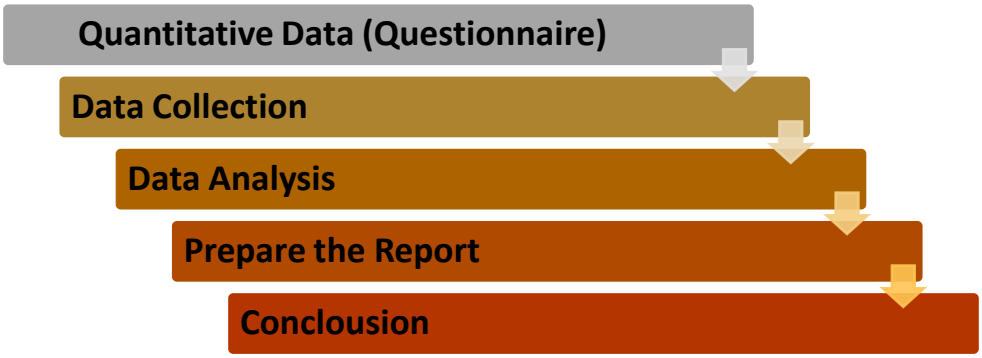

Figure 1.1 The Descriptive Research Design

The attached figure above shows the steps of the scientific sequence of descriptive research, which begins with defining the study tool, and then collecting and analyzing data, writing final reports, and reaching conclusions and research contributions.

Adaptation of the Study Instrument (questionnaire)

To adapt a research tool to collect data that answer the study questions about the effect of assistive technologies on the academic, linguistic, and linguistic achievement of students with autism spectrum disorder, the researcher conducted a comprehensive literature review and interviewed 8 educational coordinators in public schools to verify the validity of the study tool and to ensure that the questionnaire items measure what was designed to measure it. After preparing the draft questionnaire, the researcher presented it to arbitrators working in the field of education, and university professor, and their number was 7, and the percentage of arbitrators' agreement was extracted, and 13 paragraphs were agreed upon by the arbitrators at high rates.

To extract the stability percentage, the test and retest method was adopted.Where the study tool was distributed to a random sample of 40 teachers, and after two weeks, the researcher redistributed the questionnaire to the same sample and the validity and reliability coefficients of the research tool were extracted.

Content Validity: by presenting the study tools in their original form to 7 highly qualified and experienced arbitrators from 3 universities in (UAE) and specialists in mental health, special education, counseling, measurement, and evaluation to ensure the validity of the content and correct the formulation of the paragraphs of the tool when needed. The arbitrators were asked to express their opinion on the affiliation of the paragraphs and their relationship to the objective to be measured, the accuracy of the wording, and any other observations. 80% of the arbitrators' agreement was adopted as a criterion for accepting the paragraph.

Study Tool Reliability

Test-Retest Reliability: Test-Retest reliability refers to the consistency of test scores over time (Johnson & Christensen, 2000). In the method during the pilot study after two weeks on the same sample that applied the test the first time, consisting of 40 teachers, then calculating the Pearson correlation coefficient between their estimates both times. The reliability will be calculated using the internal consistency method according to Cronbach's alpha equation.

Table 1.1
The reliability coefficients for the study instrument

Study Tool	Person Correlation	Reliability Statistics Cronbach's Alpha
Impact of Assistive Technologies on students with autism spectrum disorder	0.83	0.74

Table 1.2
Distribution of the questionnaire into its three sections

Academic Achievement	Behavior	Language
Items N	Items N	Items N
1	2	3
4	7	5
10	11	6
	13	8
		9
		12

The attached table above shows the distribution of the 13 questionnaire items on the three sections that aim to know the effect of assistive technologies on (academic achievement - behavior - language) for students with autism spectrum disorder.

Study Tool Distribution

After the researcher completed extracting the indications of validity and reliability for the administration of the study (the questionnaire), the researcher distributed it through Google Drive to 19 public schools in the Emirate of Abu Dhabi, randomly, and 275 public teachers responded to the paragraphs of the questionnaire. The questionnaire that was adopted consisted of 13 items, through which the participant can answer with “Agree” or “Neutral” or “Disagree”, where an Agree answer gets 3 points, Neutral on 2 points, and disagrees with 1 point (in the case of positive paragraphs) and in the case of (negative paragraphs), and Agree answer gets 1 point, 2 points for a neutral answer, and 3 points for a Disagree answer. Where 13 paragraphs of the questionnaire covered the three dependent variables (academic achievement, language development, and behavioral development).

Results and Discussion

Discussing the results of our current study is very important, as it will support or oppose previous studies on the impact of assistive technologies for students with autism spectrum disorder in terms of academic achievement, language, and behavior.

Table 1.3
The average response of the participants to the questionnaire items

N.	Items	Agree	Natural	Disagree
1.	Assistive technologies increase the academic performance of students with autism spectrum disorder.	%57.4	%28	%14.6
2.	Assistive technologies increase the attention of students with autism spectrum disorder in the classroom.	%61.9	%22.1	%16
3.	Assistive technologies increase the language proficiency of students with autism spectrum disorder.	%48.5	%29.7	%21.8
4.	Assistive technologies make exams easier for students with autism spectrum disorder.	%82	%11	%7
5.	Assistive technologies improve the linguistic interaction of autism spectrum disorder students with those around them.	%31.9	%28.7	%39.7
6.	Assistive technologies help the autism spectrum disorder student with self-expression.	%41.2	%12.8	%45
7.	Assistive technologies improve team play of a student with autism spectrum disorder with other students.	%47	%38.9	%14.1
8.	*Assistive technologies reduce the ability of a student with autism spectrum disorder to understand receptive language.	%12.9	%35.7	%51.4
9.	Assistive technologies reduce the repetition of speech by a student with autism spectrum disorder during class.	%52.4	%22.6	%25
10.	Assistive technologies increase the participation of students with an autism spectrum disorder in academic tasks in the regular classroom	%59.8	%19.9	%20.3
11.	*Assistive technologies increase the shyness ness of students with autism spectrum disorder.	%22	%35.8	%42.2
12.	Assistive technologies help students with autism spectrum disorder use sentences.	%49.6	%39.9	%10.5
13.	Assistive technologies support students with autism spectrum disorder in their daily tasks.	%53.7	31.3	%15

Table1.4
Percentages of the distribution of participants' answers to the questionnaire sections

Academic Achievement		**Behavior**		**Language**	
Items N	Ratio	Items N	Ratio	Items N	Ratio
1	57.4%	2	61.9%	3	48.5%
4	82%	7	47%	5	39.7%
10	59.8	11	42.2	6	41.2%
Total	**66.4%**	1**3**	53.7%	8	51.4%
		Total	**51.2**	9	52.4%
				12	49.6%
				Total	**47.1%**

The first attached table above shows the average answers of the participants on all the items of the questionnaire and their choice is Agree, Neutral. Disagree. The second table attached above, shows the average of the highest answers of the participants in the questionnaire, which indicates their agreement that there is an effect of assistive technologies on students with autism spectrum disorder. We summarize both tables as follows:

- 54.9% of the sample members participating in the study agreed on the

existence of a positive effect of assistive technologies on students with autism spectrum disorder.

- 27.4% of the sample members participating in the study were neutral regarding the existence of a positive effect of assistive technologies on students with autism spectrum disorder.
- 17.6% of the sample members participating in the study did not agree with the existence of a positive effect of assistive technologies on students with autism spectrum disorder.
- 66.4% of the sample members participating in the study confirmed the existence of a positive effect of assistive technologies on the academic achievement of students with autism spectrum disorder.
- 51.2% of the sample members participating in the study confirmed the existence of a positive effect of assistive technologies on the behavior of students with autism spectrum disorder.
- 47.1% of the sample members participating in the study confirmed the existence of a positive effect of assistive technologies on the language of students with autism spectrum disorder.

The study results confirmed the results of many previous studies, (Aspiranti et al., 2020; Arshad et al., 2020; Yavich et al., 2019; Stasolla et al., 2016; O'Malley et al., 2014) which confirmed the existence of an improvement in the academic performance of ASD students when they use assistive technologies. Although some studies have examined the impact of the iPad, computer, or robot, they are all considered highly assistive technologies. Most of the previous studies confirmed the existence of a positive and significant effect of assistive technologies on the academic achievement of students with autism spectrum disorder and encouraged the use of assistive technologies for ASD students because it is useful in education, except the (Larwin& Aspiranti, 2019) study, where the findings of the study indicated that there were no positive results for using the iPad with ASD students.

The results of this study confirmed the results of many previous studies (Muharib et al., 2019; Valencia et al., 2019; Fage et al., 2018; Vandermeer et al., 2015; Sigafoos et al., 2013) that confirmed an improvement in the behavior of students when they use assistive technologies, as well as an improvement in social interaction. And while some of the studies have been experimental, descriptive studies, or case studies and have examined the effect of an iPad, computer, or robot, they are all highly assistive technologies.

These outcomes matched those of the recently completed study, as the results of the analysis of the questionnaire of general teacher knowledge of autism showed the weakness of correct information possessed by general teachers in classrooms, and the results were like studies conducted in the same geographical area in nearby countries (Saudi Arabia - Yemen – Oman-Jordan).

Literary review of previous research conducted by Gomez-Marie (2021) related to teachers' knowledge about autism spectrum disorder using various international search sites during the period from 2015-2021. The results indicated that 20 studies out of 25 indicate a low or medium level of knowledge about autism spectrum disorder, and 5 studies had a percentage of knowledge of more than 70%.

These results are consistent with the results of our current study, which indicated that there is an average knowledge of the general teacher at 53%, but it is considered weak

knowledge compared to the great efforts made by the United Arab Emirates to develop teacher knowledge.

The results were not expected due to the great efforts made by the United Arab Emirates in the field of educating workers in the educational field, due to the common mistakes about autism and the teachers' lack of knowledge of the continuous updates in the developmental scientific field. The researcher suggested using simple regression analysis to explore whether there is a correlation between the general teacher's knowledge of autism and his decision about the effect of assistive technologies used for autistic children in regular classrooms. The results of the current study indicated that teachers who had better knowledge about autism were more supportive of the positive impact of assistive technologies.

Future Recommendations

Despite the results of our current study, which confirmed the results of previous studies on the impact of assistive technologies on students with autism spectrum disorder and the presence of positive effects on academic achievement, behavior, and language, the researcher recommends more research, which can include other variable factors such as gender, educational qualification, or experience.

It has also become necessary to have laws and regulations that support the right of students with an autism spectrum disorder to obtain assistive technologies in the classroom and to train those around the student on them.

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