

توظيف التكنولوجيا المساعدة في تدريس
الطلبة ذوي اضطراب طيف التوحد: دراسة
نوعية

**Employing Assistive Technology in
Teaching Students with Autism
Spectrum Disorder: A Qualitative
Study**

ثامر حسن الأحمد

جامعة أم القرى

Thamer Hassan Alahmed⁽¹⁾

Umm Al-Qura University

Abstract

Assistive technology plays a vital role in designing education and addressing its problems for people with disabilities. Studies have demonstrated the positive role of employing assistive technology in teaching people with disabilities, especially students with autism spectrum disorder (ASD). However, obstacles such as teachers' perceptions, beliefs and attitudes often hinder its effective employment in the educational context. This study aimed to identify teachers' perceptions of employing assistive technology in the educational process for students with ASD in Makkah city. Nine teachers of students with ASD were interviewed. The findings revealed that all participants viewed the use of assistive technologies in the classroom positively. Both low- and high-tech assistive devices are commonly used. Nonetheless, several challenges were identified, regarding teachers, students, classroom environments and assistive technology. The study recommends providing modern assistive technology tailored to the needs and abilities of students with ASD, and emphasizes the importance of training teachers in the effective use of such technology.

Keywords: assistive technology; students with autism spectrum disorder; teachers; Makkah

المستخلص:

تلعب التكنولوجيا المساعدة دورًا حيويًا في تصميم التعليم ومعالجة مشكلاته للأشخاص ذوي الإعاقة. وقد أثبتت الدراسات العلمية الدور الإيجابي لاستخدام التكنولوجيا المساعدة في تعليم الأشخاص ذوي الإعاقة، وخاصة الطلبة ذوي اضطراب طيف التوحد. ومع ذلك، العقبات مثل تصورات المعلمين ومعتقداتهم ومواقفهم غالبًا تعيق استخدامها الفعال في السياق التعليمي. لذلك، هدفت هذه الدراسة إلى التعرف على تصورات المعلمين حول توظيف التكنولوجيا المساعدة في العملية التعليمية للطلبة ذوي اضطراب طيف التوحد في مدينة مكة المكرمة. تمت مقابلة تسعة من معلمي الطلبة ذوي اضطراب طيف التوحد. كشفت النتائج أن جميع المشاركين لديهم آراء إيجابية حول استخدام التقنيات المساعدة في الفصل الدراسي. أيضاً أشارت النتائج إلى أن الأجهزة المساعدة منخفضة التقنية وعالية التقنية هي الأكثر شيوعاً في الاستخدام من قبل المعلمين. ومع ذلك، ظهرت العديد من التحديات، بما في ذلك تلك المتعلقة بالمعلمين والطلبة وبيئات الفصل الدراسي والتكنولوجيا المساعدة نفسها. وبناءً على ذلك، توصي الدراسة بتوفير تكنولوجيا مساعدة حديثة مصممة خصيصاً لاحتياجات وقدرات الطلبة ذوي اضطراب طيف التوحد، وتؤكد على أهمية تدريب المعلمين على الاستخدام الفعال لهذه التكنولوجيا.

الكلمات المفتاحية: التكنولوجيا المساعدة؛ الطلبة ذوي اضطراب طيف التوحد؛ المعلمين؛ مكة المكرمة

(1) Assistant Professor at Department of Special education, Umm Al-Qura University thahmed@uqu.edu.sa

Introduction

Assistive technology (AT) is a crucial tool that can enhance the quality of life and independence of persons with disabilities, enabling their integration into society. According to the World Health Organization (2024), more than 2.5 billion people require AT; this number is expected to increase to 3.5 billion by 2050. International systems and legislations have been concerned with AT in relation to the education of persons with disabilities. In 1988, the concept of AT for such individuals was defined and approved by the United States Congress; however, the Individuals with Disabilities Education Act (2004) amended this definition to exclude medical devices. The Act defines assistive technology as any item, piece of equipment, or product system—whether commercially acquired off the shelf, modified, or customized—used to increase, maintain, or improve the functional capabilities of a child with a disability. This indicates that AT can range from very simple to very complex, depending on the needs and capabilities of each student with a disability (Thoreson, 2021).

AT is divided into three main categories: low-, medium-, and high-tech (Sado & Robinson, 2010). Low-tech devices are readily available and inexpensive, and usually do not require batteries or electricity. Medium-tech devices are usually digital and may require batteries or other power sources. By contrast, high-tech devices are often computer-based, have advanced features, and can be tailored to the specific needs of each student (Daud et al., 2018; Koch, 2017; Qahmash, 2018). Such high-tech devices have been used more commonly by teachers of students with autism spectrum disorder (ASD), compared to low- and medium-tech ones (Alasmari, 2021). These three categories, illustrated in Figure 1, provide a practical framework for understanding the diversity of AT tools.

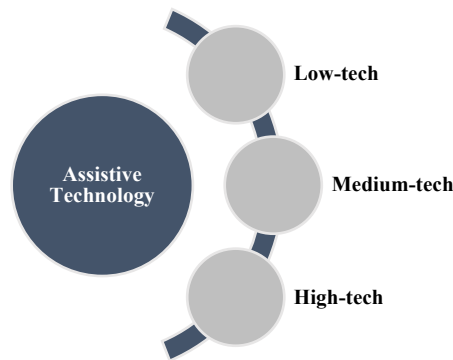


Figure 1.
Categories of Assistive Technology

The American Psychiatric Association (2013) defines ASD as a neurodevelopmental disorder characterised by difficulties in verbal and non-verbal communication, social interaction, and restricted and repetitive patterns of behaviours and interests. Since these characteristics can undermine effective education, AT can contribute to providing such students with successful and effective education (Daud et al., 2018; Khalifa et al., 2020; Zahra & Ali, 2019). Indeed, the educational abilities of students with ASD improve after using AT (Pham et al., 2019). Bollin et al.'s (2018) review showed that AT

contributes effectively to the development of communication skills and social and linguistic interaction.

Nevertheless, despite AT being considered an effective intervention strategy to help students with ASD access educational curricula and achieve high-quality educational goals, it has encountered challenges owing to teachers' attitudes and perceptions of its use in the educational process (Almulhim, 2021). While some view it as a crucial factor in the educational process, others consider it ineffective, arguing it may cause individuals with ASD to become dependent, and that it would hinder their ability to perform educational skills and tasks independently (Ahmed, 2018). Although AT cannot replace education directly, it can play an important role in improving the capabilities of individuals with ASD (Allen & Shane, 2014). It can be an effective tool for increasing students' independence, improving their communication, and enabling them to fully participate in learning and play activities (WHO & UNICEF, 2015).

In the Kingdom of Saudi Arabia, the legislation and regulations stipulate the provision and adaptation of educational and training services, including AT, according to the capabilities and needs of persons with disabilities (Authority of People with Disability, 2023). The Special Education Strategy also includes a clause on the use of AT for persons with disabilities (Ministry of Education, 2019). However, Alhossein and Aldawood (2017) and Al-Asmari (2021) stated that persons with disabilities face various obstacles in the use of AT in the Kingdom, including the lack of specialists, lack of related training courses, poor knowledge, and weak administrative and financial support. In a study based in Saudi Arabia, Khasawneh (2024) found a strong relationship between the use of AT and academic success of students with disabilities. AT not only plays an important role in educating people with and without disabilities, but also helps address individual differences among students, enables the development of necessary skills, encourages effective participation in the classroom, and supports the principle of independence without undue reliance on others (Ramadani & Mustafa, 2024). Similarly, Baniawwad et al. (2024) showed that training special education teachers on AT positively affects their performance and self-confidence.

Despite scientific developments in technology, the use of AT in teaching students with ASD remains limited (Suhaila & Nordin, 2022). Understanding the factors that influence teachers' use of AT can help policymakers and education officials address the needs of special education teachers and staff (Al-Attayah et al., 2022). As noted by Alasmari (2021) and Aldehami (2022), limited knowledge and skills about AT use is among the most prominent obstacles facing teachers in Saudi Arabia. Increasing awareness and providing training opportunities for teachers may contribute to its successful use and benefit students with ASD.

Although teachers have positive perceptions about employing AT for students with ASD in Saudi Arabia, they frequently face challenges in integrating such technology with teaching, particularly when they lack adequate training, tools, resources, and technical support (Alasmari, 2021; Al-Moghyrah, 2017). Even if AT is available, its effectiveness in the classroom may be limited if teachers' perceptions and attitudes towards it are not positive (Siyam, 2018). Therefore, the need for legislative support, in addition to teacher training, is imperative (Baglama et al., 2017).

A Study Problem

The success of AT adoption in classroom teaching rests heavily on the attitudes and perceptions of teachers. Therefore, understanding the trends in their perceptions and their knowledge about using AT is necessary. Despite the significant progress made regarding educational issues related to children with ASD in the Kingdom, a fundamental issue remains: teachers' perceptions of the use of AT for students with ASD in the educational process. Despite the Kingdom's focus on this issue (Aldehami, 2022), few studies have examined it. Therefore, using a qualitative approach, this study addresses the knowledge gap and its potential implications regarding teachers' perceptions on the use of AT for students with ASD in the educational process in the Makkah region.

By identifying these perceptions, this research will enrich existing educational resources in the field of special education and provide a modern theoretical framework that uncovers teachers' perceptions on the use of AT for students with ASD in the educational process. Additionally, the results will stimulate further research on the use of AT in alternative contexts (such as other countries or disability categories), and identify solutions to address these perceptions. Finally, by shedding light on teachers' perceptions on the use of AT for students with ASD, this research can inform decision-making in Saudi government institutions and agencies, and facilitate the development of solutions based on educational policies and practices. Therefore, the importance of this study lies in its focus on the global trend of the use of AT and its role in the education of students with ASD. It aims to answer the following questions:

RQ1: How do the teachers of students with ASD perceive employing AT in the educational process?

RQ2: What types of AT are commonly used by the teachers of students with ASD in educational settings?

RQ3: What are the main challenges faced by the teachers of students with ASD in employing AT in the educational process?

RQ4: What are the suggestions for improving the knowledge and employment of AT by the teachers of students with ASD?

Objectives of the Study

This study aims to identify perceptions the teachers of students with ASD regarding the use of AT in the educational process in the city of Makkah and the types of AT used most frequently. It attempts to identify the main challenges these teachers encounter when employing AT in the educational process, and the most effective and useful solutions, from their perspective, to overcome these challenges.

Significance of the Study

Theoretically, this study can contribute to enriching the current educational literature in the ASD field, providing a modern theoretical framework that identifies teachers' perceptions of students with ASD regarding their use of AT in the educational process; identifies the obstacles to its implementation; and highlights the most practical and effective solutions to overcome these challenges. The results may help increase researchers' motivation to conduct further studies regarding the use of AT for students with various disabilities, which may help fill this gap in the special education field.

Practically, this study's significance lies in its treatment of students with ASD, which represents a positive step towards identifying and addressing their educational issues. Therefore, the findings may help identify solutions to address this issue and provide the Kingdom's policymakers and

decision makers in education with insights into teachers' perceptions of using AT for students with ASD.

Terminology of the Study

1. Autism Spectrum Disorder

Conceptual Definition

The Ministry of Education in Saudi Arabia (2020) defines *autism spectrum disorder* as a neurodevelopmental disorder appears in early childhood and affects an individual's social and communication skills in different ways and to varying degrees.

Operational Definition

Autism spectrum disorder is defined as a developmental disorder that affects the development of the brain and is characterised by difficulties in communication and social interaction, in addition to the emergence of repetitive and restricted behavioural patterns.

2. Assistive Technology

Conceptual Definition

Assistive technology refers to assistive products and services used to maintain and improve the functional abilities of people with disabilities by enabling them to engage in education, work, and social life (Authority of People with Disability, 2021).

Operational Definition

An effective intervention strategy, *assistive technology* utilises a variety of tools and devices to assist learners with ASD in accessing educational curricula and attaining high-quality educational objectives.

3. Methods

After reviewing theoretical literature and studies on AT in the Saudi context, the researcher found that most studies had adopted a quantitative approach. To understand teachers' perceptions of using AT for students with ASD in educational settings, this study used a qualitative approach, as it was more appropriate for the objectives, questions, and nature of the study. This approach aims to deeply explore and uncover facts by understanding the perceptions, experiences, and behaviours of the participants. It answers the how and the why instead of the what, which focuses on number and quantity (Tenny et al., 2017). The use of qualitative research on issues related to the education of individuals with disabilities is crucial for gaining an in-depth understanding and for finding appropriate solutions (Al-Hanou, 2016).

1 Participants

Poles (2020) emphasised that participants in qualitative studies are typically few in number, ranging from six to ten, and that each participant can be interviewed multiple times. Therefore, the qualitative approach focuses on providing a deep understanding of the issue, rather than on the quantity of data (Maxwell, 2008). Participants were selected based on the study objective; a selection process based on specific criteria can contribute to providing meaningful information about the study's issues and questions (Creswell & Poth, 2016). Nine participants were selected from among the teachers of students with ASD because of data saturation. Table 1 presents the participant data; the names have been replaced with codes to protect confidentiality.

Table 1.*List of interview participants*

Participants	Code	Gender	Qualification	Experience	Workplace
ASD Teacher	T1	Female	Bachelor's	5 years	Inclusion School (Governmental)
ASD Teacher	T2	Female	Master's	7 years	Special Education Centre (Non-governmental)
ASD Teacher	T3	Female	Bachelor's	4 years	Special Education Centre (Non-governmental)
ASD Teacher	T4	Male	Bachelor's	3 years	Special Education Centre (Non-governmental)
ASD Teacher	T5	Female	Bachelor's	9 years	Autism Centre (Governmental)
ASD Teacher	T6	Male	Master's	12 years	Autism Centre (Governmental)
ASD Teacher	T7	Male	Bachelor's	9 years	Inclusion School (Governmental)
ASD Teacher	T8	Male	Bachelor's	4 years	Special Education Centre (Non-governmental)
ASD Teacher	T9	Male	Master's	6 years	Special Education Centre (Non-governmental)

2. Instrument

Based on the aims and methodology of the study, semi-structured interviews were adopted as the main tools for data collection. Such interviews are flexible tools for data collection (Creswell & Poth, 2016), allowing the researcher to ask additional questions to clarify a specific point (Hassan et al., 2019). An interview guide was prepared, which included a consent form for participation, general information about the researcher, the title and purpose of the study, and the teachers' role in it. It informed the teachers that participation was voluntary and that they were free to withdraw from participation at any time without consequence. Participants were also informed that the interview would be recorded and that it would conclude within the expected timeframe. They were assured of confidentiality, especially that the data were to be used solely for the study, and that the data would be analysed and published in scientific journals, with them having the right to review their interviews. Subsequently, a pilot interview was conducted with a sample matching the main study criteria to refine the study tool. The pilot sample in qualitative studies was intended to test and evaluate the tool, ensuring its readiness for the main study sample (Creswell & Poth, 2016).

3. Data Analysis

Data analysis is the organisation and understanding of data in various ways by identifying themes and revealing relationships and factors, through which researchers demonstrate their potential, skill, and mental ability to understand the subject of the study (Al-Abdulkarim, 2020). Thematic analysis, one of the most well-known and widely used qualitative approaches in educational studies (Al-Qahtani, 2020), was chosen according to the aims and methodology of the study.

4. Ethical Considerations

As the present study topic is sensitive, several measures were taken to ensure compliance with ethical standards. All teachers provided informed consent before participating. They were informed about the nature and purpose of the research, as well as how the data would be handled. They were

asked if they wished to participate, and were assured there would be no penalties for non-participation. Their anonymity was maintained out of respect for the ethical implications of their responses, with full assurance that their identities would remain confidential.

5. Study Trustworthiness

To achieve a high degree of reliability and quality, the researcher established the most prominent standards. According to Lincoln and Guba (1985), four standards exist for achieving quality and reliability in qualitative research: credibility, transferability, dependability, and confirmability.

The sources and strategies of data collection in this study were diverse. The participants were selected from governmental and non-governmental (private) institutions. Their selection was not limited to one institution; rather, different contexts from within Makkah city were chosen. Therefore, diversification was ensured at the time of data collection owing to the difficulty of the selection of participants across institutions.

Strategies that could contribute to the quality of transferability were used. The participants were carefully and intentionally selected, and had a close connection to the study's context. All were teachers of students with ASD. According to Given (2008), one of the main factors in increasing the level of transferability is to ensure that the participants in the research are connected to the context of the study, and fit its aims and nature. Another strategy used to achieve transferability was to provide a comprehensive and in-depth description by supporting the study results with direct quotes from participants.

Reliability in qualitative research can be achieved by providing readers with a comprehensive description of the methodology, tools, and procedures of the study (Ahmed, 2024). The researcher explained to the participants the research methodology and tools used, sample identification and selection methods, and procedures for applying the tools. To achieve confirmability, the researcher presented the interview questions to colleagues specialising in the field to obtain their opinions and suggestions about their suitability for the purpose and nature of the study. The questions were modified accordingly.

Findings

RQ1: How do the teachers of students with ASD perceive employing AT in the educational process?

An analysis of the data revealed the emergence of two main themes: professional development for the use of AT in educational processes, and the use of AT in the educational process.

Professional development in the use of AT in the educational process

Two of the nine respondents had developed themselves professionally by employing AT in the educational process for students with ASD by attending training courses, workshops, or studying a university course at the master's level.

At first, my perception of the meaning of AT for people with disabilities was that it was only a computer, until I further studied this term. The training at this stage was not professional or in specialised courses, but was through a master's course at Umm Al-Qura University. Before this, I did not have a firm background in AT for people with disabilities in general. This course included field experiments and ideas for some AT used with people with ASD... But I do not think this course makes me sufficiently proficient in using AT... T2

I was trained when I attended a training course on how to use the Smartboard in teaching and when I trained people with ASD and enhanced their learning. This was done by using it [AT] during the class to increase students' attention, motivate them, and enhance their learning outcomes... T5

The remaining respondents mentioned various reasons for not training themselves, including the scarcity of training courses and a lack of conviction regarding the effectiveness of AT for students with ASD. T3 said, 'For your information, I do not use it frequently because it harms students more than it benefits them due to the difficulty of the cases I have'.

Others believed they had sufficient knowledge of employing some forms of traditional AT, such as YouTube or projectors. Employing AT in the educational process for students with ASD requires specialised and modern forms consistent with the abilities and needs of the students.

Employing AT in the education process

All respondents believed that AT in the education process is useful and effective for both students and teachers.

It develops several skills, such as self-reliance, concentration, visual-motor coordination, and other sensory and motor skills. T1

Educationally and academically, AT helps convey and facilitate information, and helps develop verbal and nonverbal communication, especially since communicating with people with ASD is one of the most difficult things I face as a teacher. It fosters the social experiences of people with ASD in direct and indirect ways through their personal experience in using technology or through the various social information provided by technology, such as learning about football teams, famous personalities, national anthems, or even different social cultures. It contributes to religious education by helping students memorise the Holy Quran and the hadiths of the Prophet (e.g. Adnan, the Quran teacher, and other devices). It helps bring students with ASD closer to the teacher and build a good relationship between them, besides increasing students' love for the school or centre. This reduces the isolation of students with ASD and helps them work and play cooperatively with their peers. T2

It may be used to reinforce desirable behaviour and to discourage undesirable behaviour. T3

It contributes to conveying information to the student in a way that is easier for the teacher and more acceptable for the student than traditional methods. T4

It is very useful and helps in the student's achievement and enhances his learning as it increases the student's focus, reduces distraction, and raises his level of motivation for continuous learning. T5

It helps them integrate into the lesson and sometimes, it is fun for them. T6

It is easy to convey information to students with ASD and to consolidate information and skills because it gains his attention and interest. T7

It can help develop social skills, communication skills, and the ability to speak and develop fine motor skills as well. T8

It is beneficial because it makes education enjoyable, increases the ability to access information, makes the educational process easier and smoother, helps visualise abstract concepts, and helps overcome time and place barriers. T9

Thus, all respondents held positive perceptions about employing AT for students with ASD. Technology has played a major role in improving and facilitating educational processes for all students with disabilities, particularly those with ASD. The majority of such students have technological capabilities that distinguish them from those with other disabilities; therefore, these capabilities must be employed and exploited in the education process and development of the skills they need.

RQ2: What types of AT are commonly used by the teachers of students with ASD in educational settings?

Based on the participants' answers, it is clear that low- and high-tech AT devices are commonly used, whereas medium-tech AT devices are not employed. Two main themes emerged from the respondents' answers.

Low-tech AT devices

Low-tech AT devices are not as commonly used as high-tech AT devices. The reason for this may be its availability in educational institutions, and its ease of use by most teachers due to technological development. T1 stated, 'Wooden boards were used for letters, numbers, geometric shapes, as well as for colours, as well as building blocks, animal models...'

However, only one respondent used the Picture Exchange Communication System (PECS) to teach students with ASD, which confirms the weak knowledge of teachers of students with ASD about one of the most important ATs. T2 stated:

Because of the weakness of verbal communication among those with ASD, the AT I use most with my students is (PECS), which is based on pictures. I do not limit my use of this technology to an educational tool only, because I need (PECS) even in daily instructions or independent skills. In general, most of my communication with my students depends on (PECS). T2

High-Tech AT Devices

High-tech AT devices are a prominent and common theme among teachers for students with ASD.

I also rely on YouTube applications, either through computers, PlayStation, or other devices. In my opinion, YouTube is distinguished by the combination of sound and image in the same clip, often because the receptive language of those with ASD is good to some extent. In addition, YouTube helps develop language skills, sometimes by linking the image to sound. It is one of the most popular entertainment programs for those with ASD and has many educational benefits if used skilfully and correctly.

T2

The following devices were used by the other participants:

I used technology, but with simple devices such as electronic boards, because I work with severe and nonverbal cases, and they have some aggressive behaviours and hyperactivity. T3

Projector device T4

The smart board was used inside the classroom... T5

The projector and the computer. T6

...including the smart board... as well as assembling shapes or numbers... T7

...iPads and computers... T8

...computer, projector, iPad... T9

Thus, most of the technical AT employed by teachers of students with ASD were traditional, could be used with both students with and without disabilities, and might not be contribute effectively and specifically to students with ASD.

RQ3: What are the main challenges faced by the teachers of students with ASD in employing AT in the educational process?

Several challenges related to students, teachers, school environments, and even technology itself emerged.

Challenges related to students

Teachers face many challenges with respect to students with ASD, one being the interest and attachment of students with ASD to specific technologies rather than others.

The student's attachment to a specific device or technology limits his acceptance of other means (as if the student comes to school only for the technology that he is attached to). It is known that those with ASD love routine; therefore, the teacher's attempt to change this technology or try another method faces extreme stubbornness and a lack of acceptance from some students... T2

A teacher said that AT does not suit the characteristics of all students with severe ASD.

In addition to the fact that some ATs do not match the capabilities of all students with ASD, I believe there are students for whom there is no AT that reaches their levels and weak abilities; I can say that most ATs for those with ASD target the elite or those with high to average abilities from this disorder and ignore those with weak abilities... T2

Some other teachers stated:

The difference in cases and their severity of difficulty is a challenge in their use. T3

The student with severe ASD or sensory integration disorder... It may be an obstacle to using AT, either because he/she does not know how to deal with it or the lighting or sounds may be an annoying factor for him/her. T5

Sometimes, owing to the small number of students, there are behaviours that may affect AT, leading to its damage. T6

The student does not accept it or sometimes it is difficult for the student to understand it, and it needs many technological means to deliver the skill or information.... T7

However, two respondents were not convinced about employing AT for those with ASD.

...technology can be a distraction... T8

...sometimes a distraction... T9

Challenges related to teachers

Among the challenges faced by the teachers of students with ASD, the following were identified: lack of sufficient knowledge about employing AT for students with ASD, how to employ it, and preparing and controlling the class before using it.

My general lack of technological knowledge as a teacher, my lack of awareness as a teacher of all modern AT and the benefits of each of them, in addition to my inability to adapt some technologies to help with a specific goal... T2

There are no challenges that limit its use other than preparing and controlling the class before starting the explanation process. T4

Challenges from the school environment

Two respondents mentioned the challenges they faced in employing technology.

Lack of availability of technologies in abundance and according to the teacher's needs... T2

The lack of provision of modern technology by the institute and it is considered expensive for the teacher... T6

Challenges related to AT

Some respondents perceived AT as an obstacle to employment stated as follows:

Some of the many details within AT may cause distraction for the student. T1

Continuous care of the devices and ongoing maintenance and its cost... T5

Technology is complex and difficult to use and often does not achieve the desired goal... T9

RQ4: What are the suggestions for improving the knowledge and employment of AT by teachers of students with ASD?

Several suggestions were made by teachers of students with ASD to improve their knowledge and employ AT, including the need for teachers to attend specialised training courses and workshops related to employing AT to teach students with ASD.

I believe that AT for those with ASD needs more practical training than theoretical, but basically, I may need as a teacher multiple theoretical courses in technology and computers in general, and then come(s) field training on its use in helping students with ASD. If I, as a teacher, do not find sufficient training in my personal use of this technology, how can I use it to the greatest extent possible and sufficiently help my students... T2

Engaging in educational courses helps teachers understand how to use these technologies correctly and achieve maximum benefit from them in the classroom... T4

Taking courses on AT to know what it is because AT is very wide and we only know a little of it...T6

Technology has facilitated much effort and time in education and has become one of the basics for students with ASD. We hope to learn about new technology and its use in education and its benefits to students... T7

Attending workshops and learning about the latest devices used by ASD students... T8

...attending training courses...T9

I believe that knowledge of basic computer skills in particular and technology, in general, may be sufficient to use it with students, and repeated use and research are sufficient to improve my knowledge. T5

Another suggestion involved educating teachers about the importance of AT for teaching students with ASD and how to employ it.

There may be some minor shortcomings of some teachers due to their lack of acceptance of technology and its rapid development. During the past two years, we have seen a strong difference in its proper use. T3

...the class must be adjusted before the teacher uses technology. T9

Another suggestion included the proper selection of AT to match the needs and abilities of students and achieve the intended educational goals. T3 stated, 'I recommend choosing AT carefully according to the case'.

From my point of view as a teacher of students with ASD, some students with this disorder have very high capabilities in technology that surpass others who are not disabled, and they may even be better than some of their teachers. I cannot overlook the fact that I have learned some things about computers and technology from some of my students with ASD through my observation of them; for this reason, we must

provide them with more space to use these technologies and devices, in addition to not being lenient in seeking help if we encounter problems in operating or using some technologies. We must not suppress their attempts to use these technologies for fear of damaging them or otherwise, but give them a chance first and then the opportunity to consider whether there is a danger in dealing with technology so that we can give them confidence in trying and using it afterwards...T2

Another suggestion was not to rely entirely on AT. T5 stated, ‘...it is an aid to convey information or reduce problems and alleviate difficulties’. T6 believed that educational institutions should play an effective role by holding training courses and providing AT: ‘...that institutes, centres, and schools have full knowledge of technology and provide a number of courses and also provide AT devices’.

Discussion

The results related to the RQ1 showed that most teachers (seven) did not upskill themselves professionally by employing AT in the educational process for students with ASD. The main reason for this, they believe, is the scarcity of related training courses. This result is consistent with the findings of Stoner et al. (2008), Alkahtani (2013), Al-Badu (2020), Khalifa et al. (2020), Abo El Maged (2018), and Al-Enezi and Al-Qahtani (2023), who agree that teachers do not have sufficient knowledge and skills regarding the use of AT. Thus, there is a need to impose effective legislation and appropriate training for teachers to employ AT in classrooms (Baglama et al., 2017). Additionally, teacher preparation programmes should be implemented for developing teachers’ skills to practice and use AT in their classrooms (Ajuwon & Chitiyo, 2016).

The answers related to RQ2 revealed that high-tech AT (computers, iPads, projectors, and smart boards) was more commonly used by teachers than low-tech ones (wooden boards, cubes, models, and PECS). This result is consistent with the findings of Al-Enezi and Al-Qahtani (2023) and Al-Zahrani and Maajini (2019). Teachers may prefer high-tech AT over low-tech when teaching students with ASD due to the former’s ability to address the unique challenges and needs associated with these students. Shoaib et al. (2017) stated that high-tech AT improves academic, social, and behavioural outcomes and helps students with ASD adapt to changes in the learning environment. Despite its high costs, difficult maintenance, and limited availability, high-tech AT has significant benefits in promoting independence and personal growth in students with ASD (Carvalho et al., 2024; Santos et al., 2024).

The results related to RQ3 identified several challenges that the teachers encounter in employing AT in the educational process. Some participants reported that AT might not be compatible with the abilities and characteristics of some students with ASD. However, Zahra and Ali (2019) argue that choosing the appropriate AT and employing it effectively in a manner compatible with the abilities of students with ASD will overcome all the limitations that may appear. Regarding challenges associated with teachers’ insufficient familiarity with employing AT, it is essential to reconsider policies and practices by providing training courses and workshops (Khalifa et al., 2020). As for the availability of AT devices in classrooms, participants indicated that while devices are present, teachers may face difficulties in their use due to their beliefs and attitudes (Siyam, 2018). Finally, challenges exist about the AT used, including difficulties in usage and a lack of ongoing maintenance. Baturay et al. (2017) stated that teachers often do not use AT in classrooms because of a lack of adequate training, resources, tools, and technical support. Therefore, solutions to overcome these obstacles must be found.

Based on this study’s results, several recommendations emerge, the most prominent of which is to provide appropriate training for teachers of students with ASD regarding AT use in the classroom. Teachers require intensive training to employ AT in the classroom (Atanga et al., 2020). In addition, modern AT devices are appropriate for the characteristics and nature of students with ASD, despite

requiring continuous maintenance and follow-up. There are several challenges in providing AT within educational institutions, such as financing, professional qualifications of staff, family involvement, and device availability (Lee & Templeton, 2008). To overcome these challenges, regulations and legislation related to AT use can be enacted. MacLachlan et al. (2018) state that systems, legislation, and policies related to AT are urgently required to overcome the gap between its need, use, and availability within educational institutions. Finally, educational institutions and research centres should conduct more experimental research to address the obstacles regarding the use of AT for students with ASD, and find relevant solutions.

Limitations and Future Research

The study has several limitations that could be addressed in future research. First, the refusal of some teachers to allow their interviews to be recorded, despite assurances of data confidentiality. To overcome such issues in the future, increased awareness and cooperation from the Ministry of Education are necessary. Second, identifying female teachers of students with ASD willing to participate in direct interviews. This was challenging due to cultural limitations related to the privacy of face-to-face interviews. Employing modern technology for remote interviews could help mitigate this issue. Finally, studies on this topic within the Arab context are scarce, limiting the potential benefits of existing research. More scientific studies are recommended, as the study sample may vary by disability category. Despite these limitations, this is the first study to employ a qualitative approach on this topic, considering that existing Arab research has used a quantitative approach. This study may support and guide other researchers using qualitative designs in future studies.

Conclusion

This study identified teachers' perceptions of AT use in the educational process for students with ASD. The results showed all teachers have positive perceptions of AT use in classrooms for students with ASD and believed that AT in the education process is effective for both students and teachers. However, several challenges emerged related to students with ASD, teachers, the school environment, and the use of AT. Many respondents believed that some students with ASD favour specific technologies rather than others, and that AT does not suit the characteristics of all students with ASD. Challenges related to teachers included the lack of sufficient knowledge about employing AT for students with ASD. Regarding challenges related to the school environment, two respondents believed that AT is sometimes not available in required quantities and according to the teacher's needs. Finally, some respondents perceived AT itself as an obstacle to employment due to its maintenance and cost.

Recommendations

- Encouraging teachers to use AT in a way that aligns with the abilities and needs of students with ASD.
- Providing modern AT devices suited to the characteristics of students with ASD.
- Offering training courses and workshops to help teachers use these devices effectively in the classroom.

Acknowledgements

The author is thankful to all associated personnel in any capacity who contributed in/for the purpose of this research.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- Abo El Maged, A. (2018). Obstacles to the use of special education technology for teachers and students in this category in light of their requirements (in Arabic). *Journal of Specific Education and Technology*, 10(3), 314–332. <https://doi.org/10.21608/MAAT.2018.98541>
- Ahmed, A. (2018). Perceptions of using assistive technology for students with disabilities in the classroom. *International Journal of Special Education*, 33, 129–139.
- Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 2, 100051. <https://doi.org/10.1016/j.glmedi.2024.100051>.
- Ajuwon, P. M., & Chitiyo, G. (2016). Survey of the use of assistive technology in schools in Nigeria. *Journal of the International Association of Special Education*, 16(1), 4–13.
- Al-Abdulkarim, R. (2020). *Qualitative research in education (in Arabic)*. Al-Rushd Library Publishers.
- Alasmari, O. A. (2021). *Barriers to reducing the assistive technology use for students with autism as perceived by special education teachers in Saudi Arabia* (Doctoral dissertation, University of South Florida).
- Al-Attayah, A., Dababneh, K., Hamaidi, D., & Arouri, Y. (2022). Employing assistive technologies in teaching children with disabilities in early childhood settings: Teachers' perceptions. *International Journal of Early Years Education*, 30(2), 419–433. <https://doi.org/10.1080/09669760.2020.1863192>.
- Al-Badu, A. (2020). The effectiveness of the use of supportive education technology in the blended education for people with special needs in schools from the teachers' point of view (in Arabic). *International Journal of Research in Educational Sciences*, 3(1), 273–304. <https://doi.org/10.29009/ijres.3.1.6>.
- Aldehami, S. (2022). Saudi Arabia special education teachers' attitudes toward assistive technology use for students with intellectual disability. *Contemporary Educational Technology*, 14(2), 1–17. <https://doi.org/10.30935/cedtech/11541>
- Al-Enezi, A., & Al-Qahtani, A. (2023). The reality of using assistive technology in teaching students with autism spectrum disorder in Tabuk City (in Arabic). *Arab Journal of Disability and Giftedness Sciences*, 7(27), 99–140. <https://doi.org/10.21608/JASHT.2023.306811>.
- Al-Hanou, I. (2016). The extent of using qualitative research methodology in special education: An analytical study of ten peer-reviewed Arab journals in the period from 2005 to 2014. *Journal of Special Education and Rehabilitation*, 3(10), 179–213.
- Alhossein, A., & Aldawood, H. A. (2017). Challenges faced by teachers of students with ADHD in integrating assistive technology, and teachers' attitudes about it (in Arabic). *Journal of Educational Sciences*, 29(3), 355–377.
- Alkahtani, K. D. F. (2013). Teachers' knowledge and use of assistive technology for students with special educational needs. *Journal of Studies in Education*, 3(2), 65–86. <https://doi.org/10.5296/jse.v3i2.3424>.
- Allen, A. A., & Shane, H. C. (2014). Autism spectrum disorders in the era of mobile technologies: Impact on caregivers. *Developmental Neurorehabilitation*, 17(2), 110–114. <https://doi.org/10.3109/17518423.2014.882425>.
- Al-Moghyrah, H. (2017). Assistive technology use for students with Down syndrome at mainstream schools in Riyadh, Saudi Arabia: Teachers' perspectives. *Journal of Education and Practice*, 8(33), 119–130.
- Almulhim, L. (2021). Assistive Technology Act in special education: A comparative Study between United States of America and Kingdom of Saudi Arabia (in Arabic). *Journal of Educational and Psychological Sciences*, 5(21), 58–75. <https://doi.org/https://doi.org/10.26389/AJSRP.E170121>.
- Al-Qahtani, N. (2020). Obstacles to applying qualitative research in the educational field at King Saud University (in Arabic). *Educational Journal of the Faculty of Education in Sohag*, 79(79), 2637–2676.
- Al-Zahrani, M., & Maajini, F. (2019). The reality of using assistive technology in teaching students with autism spectrum disorder in Jeddah (in Arabic). *International Journal of Special Needs Sciences and Rehabilitation*, 16, 138–194.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.
- Atanga, C., Jones, B. A., Krueger, L. E., & Lu, S. (2020). Teachers of students with learning disabilities: Assistive technology knowledge, perceptions, interests, and barriers. *Journal of Special Education Technology*, 35(4), 236–248. <https://doi.org/10.1177/0162643419864858>.

- Authority of People with Disability. (2021). *Assistive technologies and their use in empowering people with disabilities in the Kingdom of Saudi Arabia (in Arabic)*. <https://apd.gov.sa/web/content/4533?unique=424a43678db752c472f15a8dc6c11a7e180a0608>
- Authority of People with Disability (2023). *Domestic Legislation: The Law Regarding the Rights of Persons with Disabilities (in Arabic)*. <https://www.apd.gov.sa/web/content/28796?unique=1056897c4fd027a71866b77f2ad9646636e28679>
- Baglama, B., Yikmis, A., & Demirok, M. S. (2017). Special education teachers' views on using technology in teaching mathematics. *European Journal of Special Education Research*, 2(5), 120–134. <https://doi.org/10.5281/zenodo.839032>
- Baniawwad, A. H., Tarif, L. I. B., Rady, Y., Yousef, N. I., Soliman, M., Farag, H. A., Elkilany, A. M., & Khasawneh M. A. S (2024). Influence of Assistive technology training on educators performance in Saudi special education: With the Mediating Role of Educators Knowledge and Educators Self-Efficacy. *Eurasian Journal of Educational Research*, 110, 1–17.
- Baturay, M. H., Gökçearslan, Ş., & Ke, F. (2017). The relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and intention of technology acceptance. *International Journal of Technology Enhanced Learning*, 9(1), 1–13. <https://doi.org/10.1504/IJTEL.2017.084084>.
- Bollin, A., Vandermolen, J., & Bierwagen, T. (2018). The impact of assistive technology on autism spectrum disorder: A systematic review. *Journal of the American Academy of Special Education Professionals*, 107, 125. <https://files.eric.ed.gov/fulltext/EJ1254606.pdf>.
- Carvalho, A. L. B. de, Moura, L. de, Marcucci, L., Knak, L. D., Claro, S. V., Reis, M., Gonçalves, A. C. de S., Lavander, T. L., & Gonçalves, A. (2024). Educação inclusiva e o uso de tecnologias assistivas para alunos autistas. *Lumen et Virtus*, 15(43), 8205–8213. <https://doi.org/10.56238/levv15n43-043>
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.
- Daud, S., Maria, M., Shahbodin, F., & Ahmad, I. (2018). Assistive technology for autism spectrum disorder: A review of literature. *International MEDLIT Conference, Seri Kembangan, Selangor*.
- Given, L. M. (Ed.). (2008). *The Sage encyclopedia of qualitative research methods*. Sage publications.
- Hassan, H., Al-Daykh, F., & Hussein, K. (2019). Specialists' opinions on evidence-based practices provided to children with autism spectrum disorder (in Arabic). *Journal of Al-Zaytoonah University*, 32, 182–201.
- Individuals with Disabilities Education Act, 20 U.S.C. § 1401. (2004). [Section 1401—Individuals with Disabilities Education Act](#).
- Khalifa, A., Al Mufreh, A., & Hamed, A. (2020). The barriers of using assistive educational technology (AET) from perspectives of special education teachers (in Arabic). *Reading and Knowledge Journal*, 20, 139–161. <https://doi.org/10.21608/mrk.2020.137534>
- Khasawneh, M. A. S. (2024). Measuring the impact of assistive technology integration on academic achievement of students with special needs in Saudi schools. *Educational Administration: Theory and Practice*, 30(3), 386–395. <https://doi.org/10.53555/kuey.v30i3.1276>
- Koch, K. (2017). Stay in the box! Embedded assistive technology improves access for students with disabilities. *Education Sciences*, 7(4). <https://doi.org/10.3390/educsci7040082>
- Lee, H., & Templeton, R. (2008). Ensuring equal access to technology: Providing assistive technology for students with disabilities. *Theory into Practice*, 47(3), 212–219. <https://doi.org/10.1080/00405840802153874>
- Lincoln, Y., & Guba, E.G.(1985). *Naturalistic inquiry*. Beverly Hills: Sage Publications.
- MacLachlan, M., Banes, D., Bell, D., Borg, J., Donnelly, B., Fembek, M., ... Hooks, H. (2018). Assistive technology policy: a position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. *Disability and Rehabilitation: Assistive Technology*, 13(5), 454–466. <https://doi.org/10.1080/17483107.2018.1468496>
- Maxwell, J. A. (2008). Designing a qualitative study. In P. Alasutari, L. Bickman, & J. Brannen (Eds.), *The SAGE handbook of applied social research methods* (Vol. 2, pp. 214–253). SAGE Publications.
- Ministry of Education in Saudi Arabia. (2019). *Scientific Guide to Assistive Technologies*. <https://departments.moe.gov.sa/SPED/Documents/sgatgid/pdf>

- Ministry of Education in Saudi Arabia. (2020). *A comprehensive teacher's guide to autism programs (in Arabic)*. <https://www.moe.gov.sa/ar/aboutus/aboutministry/RPRLibrary/%D8%AF%D9%84%D9%8A%D9%84%20%D8%A7%D9%84%D9%85%D8%B9%D9%84%D9%85%20%D8%A7%D9%84%D8%B4%D8%A7%D9%85%D9%84%20%D9%84%D8%A8%D8%B1%D8%A7%D9%85%D8%AC%20%D8%A7%D9%84%D8%AA%D9%88%D8%AD%D8%AF.pdf>
- Pham, A. V., Bennett, K. D., & Zetina, H. (2019). Technology-aided interventions for individuals with autism: Implications for policy and practice. *Policy Insights from the Behavioral and Brain Sciences*, 6(2), 202–209. <https://doi.org/10.1177/2372732219857750>
- Poles, K. I. (2020). *A qualitative phenomenological study into online accessibility for disabled students in higher education* (Doctoral dissertation, Northcentral University).
- Qahmash, A. I. M. (2018). The potentials of using mobile technology in teaching individuals with learning disabilities: A review of special education technology literature. *TechTrends*, 62(6), 647–653. <https://doi.org/10.1007/s11528-018-0298-1>
- Ramadani, P. C. R., & Mustafa, R. (2024). Benefit of incorporating technology in special education. *Asian Journal of Research in Computer Science*, 17(1), 1–10. <https://doi.org/10.9734/AJRCOS/2024/v17i1408>
- Sado, K., & Robinson, N. (2010). *Assistive technology for young children. Creating inclusive learning environments*. Paul H. Brookes Publishing, Co., Inc.
- Santos, S. M. A. V., Teixeira, C. F., Almeida, C. S. D., Brito, L. M. S. de M., Tavares, P. R., Resstel, R., Mafra, S. S., & Schmitz, V. K. (2024). Integrating technology and special education: innovative approaches to teaching Autism. *Contribuciones a Las Ciencias Sociales*. <https://doi.org/10.55905/revconv.17n.2-154>
- Shoaib, M., Hussain, I., Mirza, H. T., & Tayyab, M. (2017). The role of information and innovative technology for rehabilitation of children with Autism: A Systematic Literature Review. *International Conference on Computational Science and Its Applications*, 1–10. <https://doi.org/10.1109/ICCSA.2017.7999647>
- Siyam, N. (2018). Special education teachers' perceptions on using technology for communication practices. *Journal for Researching Education Practice and Theory (JREPT)*, 1(2), 1–16. <https://doi.org/10.5281/zenodo.2537590>
- Stoner, J. B., Parette, H. P., Watts, E. H., Wojcik, B. W., & Fogal, T. (2008). Preschool teacher perceptions of assistive technology and professional development responses. *Education and Training in Developmental Disabilities*, 77–91. <http://www.jstor.org/stable/23879745>
- Suhaila, N. A., & Nordin, N. M. (2022). Assistive technology for autism spectrum disorder: Systematic literature review. *International Journal of Advanced Research in Education and Society*, 4(2), 25–39.
- Tenny, S., Brannan, G. D., Brannan, J. M., & Sharts-Hopko, N. C. (2017). *Qualitative study*. StatPearls Publishing. <https://europepmc.org/article/NBK/nbk470395>
- Thoreson, C. (2021). Assistive technology in early childhood. *Minnesota State University Moorhead RED: A Repository of Digital Collections*.
- United States Congress. (1988). *Public Law 100-407. S.2561 - Technology-Related Assistance for Individuals With Disabilities Act of 1988. Section 1401 - Individuals with Disabilities Education Act*. Congress.gov.
- WHO & UNICEF. (2015). Assistive technology for children with disabilities: Creating opportunities for education, inclusion and participation: A discussion paper. *World Health Organization (WHO)*. [Assistive-Tech-Web.pdf \(unicef.org\)](https://www.who.int/publications/i/item/9789241500000)
- World Health Organization. (2024). Assistive technology. <https://www.who.int/news-room/fact-sheets/detail/assistive-technology>
- Zahra, N., & Ali, A. (2019). The reality of the use of educational techniques in the development of different skills in children with autism disorder in Saudi Arabia (in Arabic). *Arab Journal of Sciences & Research Publishing*, 8(3), 65–85. <https://www.ajsrp.com/journal/index.php/jeps/article/download/878/830/1655>