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Approach to Using Assistive Technology in Sporting Autism Education: A Review Study

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Abstract

Assistive technology is a teaching aid material used specifically in autism education to enhance teaching and learning. The study analyzes various strategies for implementing assistive technology in autism education. The study focuses on researching the understanding of teachers, the utilization of assistive technology, and the impact of assistive technology on autism education. The analysis uses citations from reputable sources like Scopus, Google Scholar, ERA, and WoS. Hence, the findings of the conducted analysis and research might serve as a valuable point of reference for researchers, the Ministry of Education, or future researchers. However, in order to establish the validity of the themes gained from survey surveys conducted in Malaysia, it is necessary to undertake an empirical study with high impact.

Keywords: Teacher Knowledge, Assistive Technology, Autism Students, Intervention

Introduction

In the education era of the 21st century, the growth of technology in learning has become an essential agenda item in education. The Malaysia Education Development Plan 2015-2025, specifically the 2025 educational Transformation Plan (TS25), outlines the necessary learning and educational environments that support and improve 21st-century education (Education, 2013). Furthermore, Sustainable Development Goal 4 (SDG 4) aims to attain high-quality education and provide inclusive and equitable education for all students in Malaysia, irrespective of their typical or exceptional requirements.

As part of the development and technological growth plans, many strategies and procedures have been implemented in education that cater to the specific needs of students with disabilities (Wahida et al., 2021). Equal educational opportunities should be provided to all individuals, including students with autism who have unique requirements. Students diagnosed with autism experience challenges in the classroom and necessitate the use of educational aids to facilitate successful instruction and learning (Muhamad et al., 2021). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5,2023), children

with autism exhibit impairments in social interaction and communication abilities. Autism is classified as a learning disability under the 2008 Disabled Persons Act, specifically falling within the category of disabled individuals (OKU). Within the realm of special education and learning difficulties, students with autism are frequently seen as distinct and necessitate unique and adaptable teaching methods and tactics.

Providing support for teaching aids is crucial in order to ensure effective teaching and learning for students with autism. The reference citation is from (Hajis et al., 2022). Assistive technology has emerged as a valuable tool for facilitating the learning process of kids with autism, in keeping with the objectives set forth in the Malaysia Education Development Plan 2015–2025. Assistive technology refers to a device or system that facilitates the performance of tasks by an individual, making them easier to accomplish. (Purnama et al., 2021). The Act respecting Assisted Technology for impaired Persons 1988 (Civil Law 100-407) defines assisted technology as any item, equipment, or product system that can enhance the functional ability of impaired individuals, regardless of whether it was commercially obtained, modified, or adapted. In addition, children who are exposed to technology such as computer software can experience heightened stimulation and motivation, leading to improved learning outcomes with more speed and effectiveness (Mohid et al., 2018). The utilization of this assistive technology represents a rehabilitation or novel approach employed to provide support or facilitate the recovery of students with autism (Martolia & Gupta, 2020).

Recent research suggest that teachers still have difficulties in effectively implementing assistive technology for educational reasons (Omar et al., 2021). The teacher's proficiency in utilizing innovative audio, video, and animation components remains restricted and does not encompass the complete range of features required to captivate the attention of children with autism during the process of instruction and acquisition of knowledge. (Muhamad et al., 2021). The degree of technological expertise among instructors is high, however, the level of mastery and knowledge of assistive technology remains moderate (Omar et al., 2021). The majority of conducted studies did not prioritize the acquisition of technological skills for kids with autism. Previous research mostly focused on the use of technology in elementary classrooms and for neurotypical students. Furthermore, the teachers' proficiency in utilizing this assistive technology is seen as a crucial component in enhancing the abilities of students with autism (Khan et al., 2023). Baglama et a. (2017) conducted a study indicating that the utilization of advanced technology could result in a diminished ability to regulate behavior in students with autism. There is a study indicating that the utilization of state-of-the-art technology could potentially result in challenges when it comes to effectively managing students diagnosed with autism. (Moganasundari & Toran, 2021). The implementation of technology-based interventions in the classroom can result in behavioral modifications among kids with autism. According to Martolia and Gupta (2020), behavioral changes in communication skills and cognitive skills can be either beneficial or bad.

The objective of this study is to ascertain the level of proficiency among teachers in utilizing assistive technology, explore the utilization of assistive technology as an instructional tool, and examine the impact of employing assistive technologies on students with autism.

Methodology

The study examined articles published from 2016 to 2023 by utilizing the Scopus, Google Scholar, ERA and WoS databases. Joklitschke et al (2018) emphasize that a crucial element in conducting article searches is the search term or keyword. The utilized keywords include "assistive technology," "teacher knowledge," "intervention using assistive technology," and

"students with autism." To effectively analyze this article, it is necessary to employ rigorous methodologies for both searching and validating evidence, thereby facilitating the examination of information. The study will categorize the information based on the themes identified in the chosen articles.

The document analysis process comprises two stages, with the first stage entailing the selection of articles based on predetermined criteria. We acquired a grand total of 60 articles using the designated keywords. During the second stage, we adjusted the filter to focus more specifically on the designated target. We acquired a cumulative sum of 21 articles that align with the designated keywords and objectives of this study. The collected articles revealed three main themes: teachers' knowledge of using assistive technology in autism education, the utilization of assistive technology tools for autism intervention, and the influence of assistive technologies on the instruction and acquisition of knowledge in autism.

Table 1
List of reviewed articles based on theme

Author	Theme		
	Teacher's Knowledge	Utilization of AT as a tool of intervention	influence of assistive technology
Juliana Mohamed (2023)	/		
Alzahrani (2022)	/	/	
Muhamadet al. (2021)		/	
Khan et al.	/	/	
Aldehami (2022)	/	/	
Moganasundari & Hasnah Toran (2021)		/	/
Zuraida Ibrahim et al (2023)		/	
Purnama et al. (2021)		/	
Suparjoh et al. (2020)		/	/
Piraneh et al. (2022)		/	
Rosenfield et al. (2019)		/	/
Zhagan et al. (2017)			

Author	Theme		
	Teacher's Knowledge	Utilization of AT as a Tool of intervention	Influence of assistive technology

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Arshad et al. (2020)	/	/
Mughi Puspa Annisi (2022)		/
Suhaila & Nordin (2022)	/	
Sharmin et al. (2018)	/	
Ke et al. (2022)	/	
Schafer et al. (2016)	/	
Cakir & Korkmaz (2019)	/	
Martolia & Gupta (2020)	/	
Radwan & Cataltepe (2016)	/	

Findings

Findings from the highlights of the study reveal that the approach to the use of assistive technology in autism education identified in the reviewed research articles is categorized into three groups: teachers' knowledge in the use of assistive technology, assistive technology as a teaching aid, intervention, and the influence of assistive technology in the education of autistic students.

Theme 1: Teacher knowledge in the use of assistive technology in autism education.

Knowledge in technology is deemed crucial for teachers in 21st-century education. Assistive technology can enhance the educational progress and skill acquisition of autistic students in the classroom (Mohamed, 2023). According to Alzahrani's (2022) research, a significant number of teachers lack sufficient understanding regarding the implementation of assistive technology in the classroom to support students with autism. Nevertheless, there exists a cohort of educators who possess knowledge and proficiency in utilizing assistive technology, although at an intermediate to advanced level. However, their competence in applying these tools in multimedia contexts is generally lacking (Muhamad et al., 2021). Conversely, Khan et al (2023) discovered that the teacher possessed a reasonably elevated level of expertise and demonstrated a willingness to utilize assistive technology as a supplementary instructional tool in order to enhance the comprehension of autistic students regarding the subject matter being taught. Teachers understand the application of assistive technology for instructional purposes and acquiring knowledge within the classroom setting. Aldehami (2022) found that while most teachers possess fundamental understanding of assistive technology, their level of knowledge varies depending on the educational setting. The emphasis placed by the school plays a crucial role in ensuring that teachers possess comprehensive knowledge regarding the utilization of this assistive technology.

Proficiency in the utilization of assistive technology is imperative for teachers in order to facilitate the teaching and learning process in the classroom, particularly in light of the advancements towards the IR 4.0 revolution (Kapitang et al., 2023). In order to enhance the capacity and understanding of teachers in the field of autism exposure education and related programmes, it is necessary to further develop the potential and knowledge of assistive technology. In order to enhance the potential and understanding of assistive technology among teachers in autism exposure education and related programmes, it is necessary to enhance assistive technology itself to ensure that teachers' augmented knowledge directly benefits autistic students during classroom instruction and learning.

Topic 2: The utilization of assistive technology as an intervention tool for autism

Autism Spectrum Disorder (ASD) is an intricate neuro-developmental condition that impacts an individual's communication, socialization, and interaction with their environment. The condition encompasses a range of diverse symptoms, with varying degrees of severity. Individuals with autism spectrum disorder encounter difficulties in areas such as social communication, repetitive behavior, and restricted interests (American Psychiatric Association, 2013). This has significantly influenced their academic performance and daily activities. As per Suhaila & Norazah (2022), Assistive Technology (AT) refers to any object, device, software programmer, or system employed to enhance the growth and functional capacity of individuals with special needs, as defined by the Association of Assisted Technology Industries (ATIA). Subsequent studies have been undertaken to examine the efficacy of assistive technology tools as an intervention strategy for aiding ASD students in navigating their current difficulties.

Subtheme 1: Robots

They design, create, and analyze robotic instruments that combine aspects from a variety of scientific domains, such as electronics and engineering, in robotics. Robotics has grown considerably and has benefited a wide range of industries, including global trade, health science, and personal services. While robots are intelligent tools that are programmed to engage with humans, encourage interaction, and act continuously (Suhaila & Norazah, 2022). A study by Arshad et al (2020) argued that robotic intervention is an effective assistive technology for ASD students. The results demonstrate that positive improvements in the teaching and learning process in the classroom promote student interest and involvement in every activity carried out. In addition, there is an impact on the increased attention and focus of students in the classroom. The interaction and communication between students and teachers have also succeeded in creating an interesting and fun environment (Aldehami, 2022). The study successfully demonstrated that the Robot-Assisted Autism Therapy (RAAT) system developed provides accuracy in measuring the involvement of autism students during therapy in education.

Programmers incorporated into assisted technology can enhance the cognitive social skills of autism students and further enhance their social communication skills through the image exchange communication system mode used to help autism learners have a stable learning environment to understand and associate images with their functions (Martolia & Gupta, 2020)

Subtheme 2: Mobile Application

Developers build mobile apps using devices like tablets, iPads, and smartphones. Teachers often use this mobile application to teach autism students in classroom teaching and learning sessions (Sharmin et al., 2018). The use of gadget, which is an unlimited media tool of technology, affects the physical and cognitive development of autism students positively and negatively, especially those aged 7 to 9. (Moganasundari & Toran, 2021). Radwan and Cataltepe (2016) confirmed this fact by demonstrating the development of web and touch-based applications for teaching object recognition using PC or tablet images. Radwan & Cataltepe (2016) have proven that tablets are an effective educational tool for improving students' understanding of autism in teaching and learning.

Ibrahim et al (2023) developed the multimedia application interactive social skills module (MISSM) to teach and learn social skills and assess the impact of mobile-based aid technology

on the development of social skills in children with autism. Autism students use technology as a learning intervention tool. Among the additional support is additional and alternative communication (ACC) and computer software that helps with reading, writing, and other academic skills (Khan et al., 2023). While Purnama et al (2021) argued that the use of AT can attract the interest of autism students to learn easily through the visual, it has been proven that this mobile application is a very beneficial intervention for autism students.

Subtheme 3: Virtual Reality (VR)

VR is gaining a growing attention as a platform for instructing social and interactive abilities. Virtual Reality (VR) enables users to immerse themselves in authentic environments and actively engage with them through a virtual environment or a computer-generated three-dimensional simulation (Ke et al., 2022).

The study illustrates the efficacy of the Virtual Reality System (VRS) as an assistive technology in facilitating the acquisition of socially acceptable and feasible skills by students with autism. This is achieved by enhancing their confidence in engaging with the external environment (Rosenfield et al., 2019). Virtual Reality as an assistive technology, offers innovative and effective alternatives to help students with autism achieve their full learning potential.

Subtheme 4: Wearable Device Technology (WAT)

A wearable device, abbreviated as WAT, is a compact electronic device available in various forms that can be conveniently and comfortably worn on the user's body or affixed to their garments (Shen et al., 2017). According to Alzahrani (2022), this assistive technology also intervenes to meet the needs of students and improve their knowledge and skills. Utilizing assistive technology can enhance the learning experience for deaf students with autism, facilitating improved connectivity and communication with their peers.

Research has demonstrated that the utilization of remote microphone (RM) technology can enhance auditory filtering, auditory focus, auditory memory, and auditory abilities in diverse hearing scenarios encountered in domestic, educational, and social settings. In general, the utilization of RM technology has enhanced auditory performance in children with Autism Spectrum Disorder (ASD) to effectively address the auditory impairment challenges they encounter (Schafer et al., 2016).

In addition, the Remote Microphone (RM) technology, which is employed as WAT, can also observe behavior in device-free scenarios. RM technology aids children with autism by facilitating auditory comprehension of instructions and promoting behavioral modification, while also enhancing their engagement with the device (Schafer et al., 2016).

Ultimately, the utilization of WAT as an assistive technology necessitates the collaboration of medical professionals and therapists to ascertain the most suitable device based on the specific requirements of students with autism. This is because the utilization of an appropriate device can enhance their comprehension of lessons while also effectively regulating their behavior.

Subtheme 5: Augmented Reality (AR)

Computers or smartphones convert information, materials, and images to the user's screen, enabling the user to see any visual item or image as AR. (Cakir & Korkmaz, 2019). The study Suparjoh et al (2020) found that most of the AR developed focused on social and communication disorders for autistic groups. AR contains video modeling, visual signaling, specialized training, and performance feedback components that are an important part of

assisted technology interventions. An Augmented Reality (AR) application developed using assisted technology as an intervention provides step-by-step instructions for involving autism students in learning and therapy.

AR technology has the ability to combine virtual and real objects in real settings, which can attract the attention of children with autism learning through visuals. Piraneh et al (2022) found that video modeling used in self-care education is one of the teaching materials that uses augmented reality (AR) effectively in improving psychomotor skills among students with autism compared to conventional teaching approaches.

This proves that the use of AR technology has facilitated the teaching and learning process for students with autism. People with autism understand the content of the lesson through video modeling rather than oral description.

Theme 3: The influence of assistive technology in autism teaching and learning

The application of assisted technology not only expands accessibility but also stimulates the development and skills of children with autism, both inside and outside the classroom (Moganasundari and Toran, 2021). the use of gadgets can have a positive influence on the ability to count and recognize numbers. While the negative influence on the ability to add and push occurs only at a very minimal rate, In addition, Arshad et al (2020) stated the use of robotics improves the cognitive capabilities of children with autism. He believes that the use of robotics also has a very effective ability to improve the skills and learning of children with autism when compared to traditional learning. In this regard, assistive technology can not only help children with autism apply learning beyond therapeutic sessions but also help professionals by providing behavioral and communication skills. (Rosenfield et al., 2019).

In the context of technology exposure, the use of laptop computers as a tool can enhance the creative arts in children with autism (Zhagan et al., 2017). The results showed autism children have a high interest in using laptops, and some of them show a strong talent or interest in the creative arts. The application of this technology not only improves art development but also provides opportunities for communication and emotional development in children with autism. In addition, the use of the ASD (Autism Schedule Day) application is able to influence the leisure time use of children with autism so that they can be more productive on their own. (Mughi Puspa Annisi, 2022).

Assistive technology plays a crucial role in enriching the learning and development of children with autism. The use of gadgets, robotics, laptops, and ASD applications is capable of expanding their potential in communication, behavior, cognition, and skills. Therefore, incorporating technology into learning and teaching approaches for individuals with autism can be viewed as a crucial strategy or influence in facilitating their development, rather than merely an innovative force within the realm of education.

Discussion

Education tailored to the needs of individuals with autism characteristics is necessary. Independent studies have been conducted to prove the effectiveness of built-in aids in helping with autism education. Using assistive technology is considered an effective approach. However, to maximize the benefits of MBPK both inside and outside the classroom, we need to reconsider certain aspects that can enhance the use of assistive technology. Special education classes need to improve or upgrade Internet access and ICT facilities to enable all students with special education needs to make optimal use of assistive technology. In addition, the effectiveness of the use of assisted technology in training programmers should

be given to teachers. Teachers need exposure and training on how to apply assisted technologies in their teaching and learning. This is because it involves using specialized software technology skills, mobile applications, and appropriate and relevant learning strategies according to the needs of students with special education preferences. By enhancing teachers' knowledge, we can maximize the utilization of assistive technology in
Next, the role and cooperation of parents with the school are very important in providing incentives and support to autism students in using assisted technology. This ensures the use of technology is running smoothly and gives maximum benefit to the learning development of autism students.

Conclusion

The study focuses on topics related to teachers' knowledge, the use of assisted technology, and the influence of assisted technology in the education of students with autism. Autism students have cognitive differences between each other that require a special approach in education. Thus, various assistant technologies have been developed as supporting tools that impact the teaching and learning process in the classroom. The results from the study highlighted the need to pay attention to teachers' knowledge regarding the use of assistive technology, most of which is still at the basic level of use. However, there are teachers who have been skilled in using assisted technology and have made it a tool for teaching in the classroom. Less-skilled teachers need improved training. The impact of the use of assistive technology in the classroom has a positive impact on changes in academic terms, social skills, communication behavior, and emotions.

As a whole, assistive technology not only provides a platform that can help autism students and create innovative learning with the existence of applications such as video modeling brushing teeth, multimedia interactive social skills modules using virtual reality (VR), augmented reality (AR), and wearable device technology, (WAT). Research has proven that this approach improves the functional and social skills of children with autism, facilitates more inclusive learning, and enhances the lives of these students.

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