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Research Article

Teachers' Perceptions and Challenges in Implementing Digital Learning for Autism Spectrum Disorder (ASD) Students in Inclusive Classrooms

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Abstract

The aim of the study is to explore the perceptions and challenges encountered by teachers in implementing digital learning for ASD students within inclusive classroom settings. The research niche emphasises how crucial it is to take into account the viewpoint of teachers in order to implement digital learning for ASD students in inclusive classroom environments. The research addresses gaps in understanding teachers' perspectives and challenges in using digital learning for ASD students in inclusive classrooms and to provide insights into teacher needs and solutions for digital learning in ASD-inclusive settings. Therefore, this qualitative study was conducted by interviewing 12 teachers (N=12) from schools in Kuala Lumpur, Malaysia. The results show that digital learning could help teachers in the teaching and learning process of ASD students in the inclusive classroom. The findings emphasise that teachers view the use of digital tools in inclusive classrooms as facilitating their preparation and lesson planning for ASD students. They also consider digital technology as providing personalised instructions to ASD students and enabling data tracking and progress monitoring. Furthermore, teachers believe that digital tools can help engage ASD students in lessons. However, teachers stated challenges that related to attention difficulties and technological issues. Teachers also faced challenges in transitioning between activities or devices for ASD students and the issue regarding sensory sensitivities, which hinders the learning process. As a conclusion, teachers have provided positive perceptions towards the use of digital learning for ASD students in inclusive classrooms, yet still face some challenges that definitely have solutions.

Keywords: digital learning, autism spectrum disorder, inclusive classrooms, teachers' perception, challenges

INTRODUCTION

Today's education incorporates digital learning, which provides new solutions for a variety of learning demands. Inclusive education, which integrates students with disabilities like autism spectrum disorder (ASD) into general education classes, has risen in acceptance. Digital learning technologies allow inclusive schools to customise learning experiences for ASD students, making them indispensable. However, the successful implementation of these tools often depends on the perceptions, preparedness, and support provided to teachers who are at the forefront of delivering these educational interventions. This study examines teachers' opinions and obstacles in incorporating digital learning for ASD students in inclusive classrooms, a developing area in educational research and practice. The Centers for Disease Control and Prevention (CDC) estimates that 1 in 36 (28%) of students in the USA have ASD, making it

one of the most common developmental disorders (CDC, 2023). ASD students have many communication, social, and behavioural issues, which may make studying in a regular classroom challenging. Thus, including these students in general education classes requires unique interventions to meet their requirements.

Digital learning tools show potential for many ASD students. For example, problems faced by ASD students, such as confusion in using writing or pictorial symbols in learning (Samsudin & Adnan, 2021), can be overcome by using technology in digital learning. Personalising these digital learning tools to learning styles improves communication and engagement (Kanchon et al., 2024). Furthermore, digital platforms may engage ASD students by increasing visual and auditory learning and gamifying material (Ramos Aguiar et al., 2023). Studies also show that digital learning can help ASD students reduce social anxiety, especially in inclusive classrooms (Allen et al., 2020). Thus, inclusive classrooms with good digital learning may boost student performance. Although beneficial, incorporating digital learning for ASD students in inclusive classrooms is tough. Without knowledge of handling ASD and digital tool training, many teachers feel unprepared to use digital technology (Chu et al., 2020; ElSayary, 2023). Technology's rapid expansion may sometimes overwhelm teachers with new tools and methods. Teachers in inclusive classrooms must balance the demands of ASD students and their typically developing peers without adequate resources (Cook & Ogden, 2022). Thus, successful digital learning strategies for inclusive settings need to understand teachers' viewpoints and concerns.

The rising use of digital learning aids in modern classrooms, although beneficial, adds complexity to instruction (Hassan et al., 2014). Teachers are at the centre of this problem because they deploy digital learning practices in inclusive classrooms. Therefore, their perceptions of digital learning tools and their ability to apply them to ASD students might greatly impact the outcome of these treatments (ElSayary, 2024; Ke & AL Saqqaf, 2022). Without understanding teachers' attitudes and obstacles, initiatives to promote digital technologies in inclusive settings may fail, missing chances to enhance ASD students' educational performance. This study has the potential to alter inclusive digital learning by asking new questions and understanding teachers' lived experiences. That prompted the following research questions:

(a) What are teachers' perceptions of using digital learning to teach ASD students in inclusive classrooms?
(b) What are the challenges experienced by the teachers while implementing digital learning in inclusive classrooms with ASD students in the class?

LITERATURE REVIEW

Digital Learning in Inclusive Classrooms

Digital learning in inclusive classrooms has transformed education by engaging students of all abilities and needs. In inclusive education, digital learning improves accessibility and personalisation (Kaimara, 2023). Diversity in learning styles is a major advantage of digital learning. According to Çakiroğlu et al. (2020), multimedia tools such as adaptable interactive simulations, video lectures, and instructional games may benefit auditory, visual, and kinaesthetic learners. This is helpful in inclusive classrooms with diverse learning requirements. Digital learning may also help disabled students by offering modifications such as text-to-speech, speech-to-text, or larger font sizes to accommodate students with visual, auditory, or cognitive disabilities (Oliva-Zamora & Larreina-Morales, 2024; Zolkipli et al., 2023). Moreover, special education software and applications may improve verbal, social, and academic abilities (Derbissalova et al., 2024). These technologies increase access, independence, and self-directed learning (Rashid & Asghar, 2016). For example, screen readers provide speech rate modifications for visually impaired ASD students. To improve understanding, students may personalise this feature, voice, and loudness. Nevertheless, digital learning platforms may promote collaboration and individual requirements. Online

forums, shared papers, and virtual group activities allow students to collaborate remotely, providing a more inclusive environment. According to Sweet et al. (2020), such platforms may remove obstacles to participation and promote peer contact, which is essential for social skills and community building. Digital learning technologies with data analytics may also track student development in real time. This helps teachers quickly detect and solve learning gaps. Data-driven insights may improve individualised learning plans by guiding instructional tactics and targeting interventions, according to Reeves & Chiang (2018).

Teachers' Perceptions of Digital Learning

Several studies show that teacher views on digital learning differ depending on their expertise, technological confidence, and student advantages. Kalyani (2024) notes that teachers who are more acquainted with digital technologies believe they can improve engagement and learning. In contrast, teachers who lack expertise or confidence in employing these technologies are typically hesitant or sceptical. Teachers who prefer digital learning say it may accommodate different learning styles while providing tailored training (Putra, 2018). Haleem et al. (2022) claim that many teachers favour digital learning's flexibility, which enables students to study at their own speed and provides access to various resources outside the textbook (Ghafar et al., 2023). Digital platforms also encourage student cooperation, which some teachers find desirable for peer learning. Many digital systems automatically grade assignments and quizzes, saving teachers time and offering students immediate feedback (Mohamad et al., 2022). Teachers may monitor student performance in real time to determine who needs additional support and change instruction (Hase & Kuhl, 2024; Budiastuti et al., 2023). Digital learning has several hurdles, notwithstanding teachers' optimistic views. Screen time and student well-being are often issues for teachers. According to Nakshine et al. (2022), digital learning is convenient, but teachers worry that students may become too dependent on screens, reducing physical exercise and social connection. Digital learning teachers typically struggle with device reliability, technical assistance, and student engagement. These obstacles affect classroom technology integration and teaching quality (Celeste & Osias, 2024). Teachers also struggle to balance instructional objectives and technology demands, disrupting learning flow (Fernández-Batanero et al., 2021). Overstimulation from screen brightness, auditory effects, and lack of tactile connection might potentially impede learning, particularly for ASD students (Black et al., 2022).

Inclusive Education for ASD Students

Inclusive education integrates ASD students into regular classes to provide fair learning opportunities for everyone. Inclusive settings foster social interaction, helping ASD students develop essential communication and social skills that are often challenging for them. Furthermore, inclusive education can reduce the stigma associated with disabilities by promoting understanding and empathy among all students (Strnadova et al., 2023). However, the inclusion of ASD students in mainstream classrooms requires careful planning and support. Many ASD students exhibit unique needs, such as difficulties in communication, sensory sensitivities, and repetitive behaviours, which can be barriers to participation in traditional classroom settings. To address these challenges, individualised education plans (IEPs) and classroom accommodations, such as sensory-friendly environments and tailored learning strategies, are implemented. Teacher training in ASD-specific strategies, including the use of visual aids, social stories, and positive reinforcement, is also critical for fostering a supportive learning environment (Dynia et al., 2020). Research has shown that with appropriate supports, ASD students can thrive in inclusive settings, experiencing academic gains and improved social outcomes. Additionally, their neurotypical peers benefit by learning to appreciate diversity and engage in cooperative learning experiences (Khatab et al., 2024). Thus, inclusive education for ASD students offers a pathway to more compassionate, equitable, and effective learning environments for all.

METHODOLOGY

Data Collection Process

The study developed the qualitative research approach, which allowed researchers to examine social and cultural phenomena by keeping an eye on people's attitudes, beliefs, behaviours, and feelings (Mohajan, 2020). The teachers involved in this study were interviewed using the Zoom or Google Meet application. Each teacher's interview lasted approximately thirty minutes.

Data Analysis

The collected data were subjected to thematic analysis. The data analysis process employed descriptive analysis, which examines the structure, meaning, and circumstances of social events. It attempts to gather systematic data through the use of the inductive method and looks for information in social reality (Azungah, 2018).

Participants

Twelve teachers (five male and seven female) were the respondents, aged between 31 and 47 years. This diversity in age allows for a multifaceted understanding of teaching practices, as younger teachers may bring innovative approaches while older teachers offer wisdom and experience. The educational backgrounds of the teachers in our sample encompass a wide range of qualifications, including bachelor's degrees, master's degrees, and specialised certifications. This diversity in educational attainment influences teaching methodologies, subject expertise, and professional development interests. The years of teaching experience among the sample group vary, with some teachers being relatively new to the profession and others boasting decades of experience. This difference in experience levels illuminates the development of teaching approaches and the issues teachers encounter at various career phases. The teachers hold bachelor's degrees in education and have also attended Postgraduate Teaching Courses (Kursus Perguruan Lepasan Ijazah (KPLI) for 18 months (a year and 6 months) at several teaching institutes throughout Malaysia. Teaching tenure of teachers who have more than 10 years is one of the focuses of research. According to Phytanza & Burhaein (2020), teaching tenure will also affect the way of teaching in the classroom and the willingness to accept a teaching method that has been or will be introduced by the school or the ministry.

Data Trustworthiness

To enhance credibility, the current study interviewed twelve teachers to have a consistent pattern in the theme of digital learning for the ASD students. Saturation was known when recurrent insights emerged across participants. This shows consistent patterns in perceptions and difficulties. An audit trail was established in this research by documenting the interview procedure, coding, and theme analysis. This transparency allows for replication and proves discoveries that are based on reliable, grounded in systematic methods. Therefore, it made sure that perceptions and challenges did not result from a biased assumption of the researcher but were raised by the participants. Contextual information, including teacher demographics and their digital learning experience, was also described in detail to enable others to judge the applicability of the findings to similar educational contexts. Table 1 shows the demographics of the 12 teachers involved in this study.

Table 1: Teachers' Demographics

Participants	Gender	Age	Educational Background	Teaching Experience	Participants	Gender
Teacher 1	Male	36	Bachelor Degree	11	6	Mathematic
Teacher 2	Female	42	Bachelor Degree	17	8	Science
Teacher 3	Male	35	Bachelor Degree	10	7	Mathematic
Teacher 4	Female	39	Master's Degree	14	8	Mathematic
Teacher 5	Female	31	Bachelor Degree	6	6	Science
Teacher 6	Female	45	Bachelor Degree	20	10	English
Teacher 7	Female	40	Master's Degree	15	8	English
Teacher 8	Female	36	Master's Degree	11	6	Science
Teacher 9	Male	47	Bachelor Degree	22	9	Mathematic
Teacher 10	Female	39	Master's Degree	14	8	English
Teacher 11	Male	37	Bachelor Degree	11	7	English
Teacher 12	Male	33	Bachelor Degree	10	6	Science

FINDINGS

As a result of the interviews that have been conducted with teachers, we have focused the research findings on two aspects based on two research objectives: perception and challenges. For the research findings on teachers' perceptions, we have obtained four thematic findings on teachers', which are (1) facilitating teaching preparation and lesson plans, (2) providing personalised instruction, (3) data tracking and progress monitoring, and (4) increased student engagement. We have focused our research findings on the challenges faced by these teachers. Among the thematic challenges that have been stated by the teachers are (1) attention difficulties, (2) technological barriers, (3) transitioning between activities or devices, and (4) sensory sensitivities.

Perceptions

Teachers' perceptions of using digital learning tools in educating ASD students are crucial, as they significantly influence the implementation and success of these technologies. These perceptions are shaped by various factors, including the effectiveness of the tools, the ease of use, and the observable benefits for students. Interviews that have been conducted with twelve teachers who recognise the potential of digital learning to enhance engagement, communication, and personalised learning experiences for ASD students are more likely to adopt and integrate these tools into their teaching practices.

Facilitating Teaching Preparation and Lesson Plans

As a result of the interviews, ten teachers highlighted that digital learning provides unparalleled access to a wide array of educational resources. Teachers stated that they can explore online educational websites, free software and applications, and digital libraries to gather information and inspiration for their lessons. Teacher 2 had stated that:

"Many resources from such as Kahoot! or Khan Academy, are updated. It helped me in preparation and also in lesson plans." (Teacher 2, Science).

Teachers also asserted that digital platforms like Khan Academy, Kahoot!, and YouTube offer high-quality content that can be integrated into lesson plans. This vast repository of resources ensures that

teachers can present up-to-date and comprehensive information to their students, enriching the learning experience. Teacher 11 affirmed:

“There are many references or resources on YouTube. I enjoy my work preparing lesson plans." (Teacher 11, English)

Digital learning tools allow for significant customisation and differentiation in lesson planning. Teachers can tailor their instructional materials to meet the varying needs of their students. Three teachers think that the digital learning platform is easy to modify, which could save teachers' time. One of the teachers is Teacher 6, who stated that:

“I can create adaptable, shareable lesson plans using digital platforms. Digital learning platforms save me time.” (Teacher 6, English)

The findings on facilitating teaching preparation and lesson plans are in line with the study conducted by Kapici & Akcay (2023) on a teacher education program to identify how Technological Pedagogical Content Knowledge (TPACK) influences enhancing lesson plans on the virtual platform. Their study has outlined that incorporating virtual lesson planning practice can be an effective strategy in teacher education programs to enhance TPACK self-efficacy among student teachers.

Provide personalised instruction

Digital learning platforms allow students to learn at their own pace. This is particularly beneficial for ASD students, who may need more time to process information or prefer to revisit concepts multiple times to fully understand them. Kyriakaki & Nikolaidis (2024) stated that personalised instruction helps reduce anxiety and pressure among special needs students, including ASD students. This will enable ASD students to engage more deeply with the material. Seven teachers agreed that digital learning provides personalised instruction, and their statements are as follows:

"Digital platform is helping me to personalise the instructions. I can prepare suitable questions for ASD students using Kahoot." (Teacher 1, Mathematics)

“Many software and applications are designed based on the student's learning pace, strengths, and areas that require more attention. This customisation extends to subject matter, difficulty level, and even the mode of content delivery. Less stress for ASD students.” (Teacher 7, English)”

"Sometimes ASD students don't like the sound produced from software or applications, so they make calculations using Jamboard. I teach ASD students based on what platform they prefer.” (Teacher 9, Mathematic)”

Personalised instruction is very important to provide a learning experience to ASD students based on their capabilities and abilities (Barua et al., 2022). This can help ASD students gradually develop greater independence in their learning. Moreover, teachers can scaffold skills progressively, helping students become more self-sufficient over time.

Data Tracking and Progress Monitoring

The ability of data tracking and progress monitoring in digital learning to provide educators with practical insights is one of its primary benefits. Teachers obtain a thorough grasp of every student's learning experience

through the gathering and analysis of data. The results of the interview show that 9 teachers have stated that digital learning helps them in recording student progress data and monitoring student progress. Teacher 3 stated:

"Now the digital learning platform lets me track student growth and performance." (Teacher 3, Mathematics)

Five teachers also provided insights on how the use of digital platforms such as Kahoot and Quizziz helps them save time because all information about student achievement is automatically recorded, and the level of error is very small.

"Kahoot! or Quizziz gives me real-time performance data when I deliver exercises. This automated collection saves time and provides correct, up-to-date data. (Teacher 12, Science).

Moreover, four teachers also stated that the digital learning platform helps to see real-time progress for each student.

"I can quickly identify students who are excelling and those who may need additional support." (Teacher 10, English)

In addition, there are two teachers who asserted that digital learning provides student progress for the long term. Every record automatically saved by this digital platform can be consulted at any time as long as it is not deleted.

"Digital learning tracking allows me to see long-term student performance trends. I may compare mid-year and end-of-year student achievement to assess student performance." (Teacher 4, Mathematics)"

Increased Student Engagement

Student engagement in digital learning can be understood through three primary dimensions, which are behavioural, emotional, and cognitive engagement (Bond et. al., 2020). Students' behavioural engagement includes participating in online courses and submitting exercises on time. Students' curiosity, excitement, and sense of belonging affect their emotional involvement with learning. Cognitive engagement refers to students' willingness to work hard to understand complex concepts and develop critical thinking skills by using interactive simulations, adaptive learning technologies, and a wide range of resources for different learning styles and paces. There are 8 teachers who agreed that digital learning helps increase the engagement of ASD students in learning. Teachers asserted that the use of textbooks or writing on paper is no longer relevant nowadays and made the following statement:

"Using textbooks, writing on paper, or using exercise books is not suitable today because it causes students to have no mood to learn." (Teacher 11, English)

Three teachers also stated that the use of digital platforms such as Kahoot!, Quizlet, Quizziz and Khan Academy can help the involvement of ASD students. This also coincides with a study by Wang & Tahir, (2020) which shows that the use of Kahoot! has a very big impact in terms of student engagement. Kahoot!, which has the concept of learning through gamification, can attract the interest of students, especially ASD students.

"Kahoot! makes students feel like they are playing games, and student engagement is very satisfying." (Teacher 4, Mathematics)

Teachers also stated that using digital learning such as Kahoot! would encourage students in the learning process, as the students can see the score or grade they got after finishing answering the questions.

"I use Kahoot in class. Students get excited when they see the score and want to try to do other exercises as well." (Teacher 8, Science)

Besides, two teachers also stated that the factors of colour, movement, and interactivity of digital learning can help the involvement of ASD students. One of the statements from the teacher:

"My ASD students like to see things that move, bright colours, so when I use this gamification platform, they become more active." (Teacher 9, Mathematics)

According to a study conducted by Kurnaz et al. (2022), bright colours and warm colours have a negative effect on special needs students, including ASD students. However, colours are known to enhance memory retention. Colours aid ASD students in memory and organisation (Smees et al., 2019). Light colours like yellow, green, red, and blue may affect ASD students' physiological and behavioural responses (Nuria, 2020).

Challenges

The rise of digital learning has revolutionised education, offering numerous benefits such as flexibility, accessibility, and a wealth of online resources. However, for ASD students, this shift presents unique challenges, particularly concerning attention difficulties. Teachers, in turn, face significant hurdles in addressing these challenges effectively. Although the teachers gave many positive perceptions towards the use of digital learning, aspects of the challenges faced by the teachers were also identified as below.

Attention Difficulties

As a result of the interview, eight teachers stated that digital learning challenges them in terms of students' attention and focus. They highlighted that students often get easily distracted by external factors such as notifications, social media, and other online content, which can disrupt their ability to stay engaged during lessons. Teacher 5 stated,

"Sometimes, digital platforms could overwhelm ASD students with colours, noises, and movements that will distract them." (Teacher 5, Science).

The challenge was also experienced by Teacher 6, as stated in the following statement:

"My ASD students always get distracted seeing pop-ups or notifications. They cannot give full attention. They wait for the next pop-ups." (Teacher 6, English)

This is relevant to the study conducted by Lane & Radesky (2019), when it was found that the learning process of ASD students is easily interrupted when using digital learning. ASD students may find it difficult to concentrate and focus due to the multimedia aspect of digital learning resources, which can cause overstimulation and distraction. Teacher 8 has also provided the same statement, which is:

"My ASD student just focuses on what he loves. His interests may not match digital learning material, making it challenging to hold their attention. (Teacher 8, Science).

Saggers & Ashburner (2019) suggested that one of the most effective strategies for addressing attention difficulties is creating a structured and predictable classroom environment. Moreover, teachers can establish consistent schedules and routines, providing visual schedules and clear, step-by-step instructions for tasks (Lory et al., 2020). This predictability helps reduce anxiety and enables students to focus better on their work.

Technological Issues

A study by Hamutoglu (2021) shows that challenges in terms of technological barriers in the education system can affect the performance of teachers. There are five teachers who have spoken about challenges in terms of technological obstacles, such as the problem of not having access to the internet at school. Teacher 11 affirmed;

"Once, when I told my students to use Kahoot!, I had to switch to paper-based activities because there was no internet connection." (Teacher 11, English).

Apart from internet access, there were three teachers who also mentioned problems in terms of software that needed to be updated.

"Outdated hardware and software glitches can disrupt the learning process, causing frustration for both teachers and students (Teacher 2, Science).

In addition, the issue of cybersecurity for ASD students in using digital platforms, whether software, applications, or websites, is also one of the obstacles for teachers. Four teachers have stated that they experienced a situation where there was an ASD student who opened an inappropriate website and ended up with a virus on the computer.

"When they see an interesting symbol or icon, they will click. But they do not know that what they have clicked has caused a virus on the computer." (Teacher 9, Mathematics).

"Every time before starting class, I will remind the students not to open or click on any advertisements that come out. They need my permission before clicking anything; they are not sure." (Teacher 6, English).

Regarding the technological barriers, teachers faced three technical challenges, which are no internet, outdated application software, and being attacked by viruses. School administrators should prioritise these three factors by increasing internet speed and working with suppliers to update all software and apps automatically or manually. Hosting an ICT week or cybersecurity awareness campaign might help educate students, especially those with ASD, about the dangers of frequently clicking on advertisements, logos, or symbols.

Transitioning Between Activities or Devices

Teachers working with ASD students also face challenges in managing transitions between activities or devices. These difficulties arise due to the unique cognitive, sensory, and social needs of ASD students. According to Vasa & Mazurek (2015), any sudden shift in activities, tasks, or environments can lead to feelings of anxiety and stress for ASD students. This is also aligned with the statement by Teacher 4;

"I once faced a problem where an ASD student did not want to continue further tasks because he found that the task that was done at that time was more fun than the next task. He opened the next task, but he did not like the task, so he went back to the previous task until the class finished" (Teacher 4, Mathematics).

"I occasionally use Kahoot for tasks. But, when I used the interactive smartboard to discuss the answer, they (ASD students) could not concentrate. (Teacher 10, English)".

A teacher also voiced that there are situations where ASD students do not have a problem continuing the task or practice to the next level, but they need help from their classmates or teachers.

"Sometimes ASD students don't know where to click and need assistance from friends or teachers to switch between activities, which takes time." (Teacher 7, English)

ASD students often benefit from structured learning environments and personalised support, which can include guidance in using digital tools. Not only the teachers, but peers act as important scaffolds to help ASD students overcome their challenges with technology (Karagianni & Driga, 2024).

Sensory Sensitivities

Allowing the ASD students to adjust settings like colour schemes, font sizes, and layouts can help accommodate individual sensory sensitivities and preferences (Groba et al., 2021). However, four teachers have reported that sensory sensitivities make it hard for ASD students to concentrate on the topic, causing anxiety, decreased understanding, and affecting their learning. Teacher 3 asserted that the light emitted through the screen can make ASD students feel uncomfortable and easily distracted.

"The brightness, flickering, or glare from screens can be overwhelming for them, leading to discomfort, distraction, or even physical discomfort like headaches or eye strain" (Teacher 3, Mathematics).

This challenge regarding bright light can be further strengthened by a study done by Nair et al. (2022), which stated that for ASD students, who might already be dealing with an array of sensory inputs in a learning environment, bright lights can be the tipping point that leads to significant distress.

"An ASD student in my class once screamed and cried because the background music on the website scared him." (Teacher 1, Mathematics).

Sensory overload can result in tantrums or outbursts of frustration or meltdowns due to sensory overload, increased anxiety, and difficulty focusing.

"If the screen brightness is high, ASD students can throw tantrums, and they do not want to continue learning." (Teacher 12, Science)

DISCUSSION

The study explores teachers' perceptions of using digital learning tools to teach ASD students in inclusive classrooms and to outline the challenges they encounter in this process. Teachers generally express a mix of optimism and caution regarding the use of digital learning tools in teaching ASD students in inclusive settings. Teachers view digital learning platforms in teaching and learning contexts as useful tools in preparing their lessons for ASD students. Technology facilitates the incorporation of visual teaching aids, multimedia resources, and interactive activities into lesson plans that are useful to the ASD students who have a need for visual teaching and learning. Teachers appreciate these resources in terms of them saving time and being efficient to improve their potential in developing flexible content that suits the individual needs of the students. Hence, research shows that whenever teachers use digital tools, the lesson plans they develop bring out better order and flexibility, thus enhancing differentiation instruction (Onyishi &

Sefotho, 2020). Moreover, one of the benefits that teachers attributed most to the use of the platforms in digital learning is their effectiveness in facilitating differentiation for the ASD students. Through these tools, teachers can deliver content in a flexible manner, where the content, the pace, or even the format can be adjusted depending on ASD students' needs. These are influential aspects in supporting ASD students who might have difficulties learning in traditional settings (Love et al., 2020). Teachers believe adaptive technology and applications offer ASD students a chance for greater interaction with every student. These tools help overcome students' communication and sensory issues using a customised educational experience.

Additionally, teachers value the importance of information technology for simplifying data management and progress assessment, which are issues inherent to supporting ASD students in mainstream settings. Digital tools offer immediate feedback to the student, which makes it easier for the teacher to assess the performance of the students. This will also help teachers to determine when students need interventions and make relevant data-driven decisions regarding instruction. Moreover, this also coincides with a study by Arizmendi et al. (2023) that the use of technology to gather data will help the teachers to keep proper records and also enables them to make the necessary changes when needed. Digital learning is also considered by the teachers to positively influence the level of student engagement. Games and multimedia make ASD students interested in learning content and do not allow them to get distracted. Technology-based interventions, like gamified learning platforms, are helpful to structure environments that are engaging for ASD students and help reduce their anxiety (Honorato et al., 2024). These tools provide encouragement as well as reward, which is important for long-term motivation.

While there are some merits associated with the integration of digital learning tools, teachers face various difficulties in teaching inclusive classrooms that include ASD students. Many teachers' main concerns include deficits in attention. ASD students commonly have issues with attention as they get distracted easily, especially when learning from digital devices or platforms. This might be challenging for the teachers to handle the lessons in which the use of digital platforms can either captivate or overwhelm them. Research suggests that ASD students may develop a precision or detail orientation; therefore, they may be rigid or slow when it comes to changing tasks or moving and to focus on the overall lesson (Ridderinkhof et al., 2020). Teachers must therefore ensure that there are no interferences and the instructional process captures the student's attention. Technological concerns such as obsolete software, slow internet connection, and the risk of being attacked by viruses make the use of digital learning by teachers to teach ASD students more challenging. Many schools still use old technologies and are deprived of sufficient funding, which may not support new applications developed for the ASD students. This presents a challenge to teachers because every learning must be done based on a period of time that has been determined by the curriculum. Therefore, if there is a problem regarding malfunctioning projectors, unresponsive software, or connectivity issues, this situation has an impact known as technostress. (Aktan & Toraman, 2022).

Another issue that is evident in the use of technology for teaching ASD students is the issue of transition between devices and activities. Routine disruption or change is another common issue that affects most ASD students, as they are highly sensitive and may feel uncomfortable when performing one task and are switched to another. Switching between the application or devices for most of the ASD students may cause anxiety, and they disengage due to their cognitive flexibility for many of the ASD students (de Vries & Geurts, 2012). To avoid such situations, teachers should ensure that these transitions are well coordinated and when establishing transitions, the use of clear and consistent cues is important. Further, sensory sensitivity also presents considerable challenges, as many ASD students have heightened sensitivity to bright screens, loud tones, or background noise produced by digital tools. This can cause them to struggle with interacting with technology-based solutions for long periods (Garg et al., 2024).

Teachers must be conscious of these conditions and should go over these sensitivities that are in the physical ambience, such as brightness of the displays or use of audio headphones, to make learning more comfortable.

CONCLUSION

The study aims to explore teachers' perceptions of utilising digital learning tools for instructing ASD students within inclusive classrooms and identify the challenges they face during implementation. Thus, by analysing these aspects, the research aims to contribute to the understanding of how digital learning can be integrated more effectively in various contexts of education. The study finds that teachers experience numerous difficulties when integrating digital learning for ASD students in inclusive classrooms, which are attention difficulties, technological barriers, sensory sensitivities of ASD students, difficulties in transitioning between activities or devices and sensory sensitivities. Despite these challenges, the teachers view digital resources as helpful in preparing lesson plans, providing personalised instruction, assisting in data tracking or progress monitoring, increasing student engagement, and also providing flexibility and adaptability. In the wider perspective, these results affirm the significance of specific training for teachers and enhancement of learning tools for the ASD students. Overcoming these difficulties may improve educational results and secure the efficient utilisation of digital learning resources to accommodate the varied demands of students with autism.

Nonetheless, this research recognises many limitations. The sample size may contain some bias and therefore may not be enough to capture the variation or different educational settings. Data was taken through the interview and has the possibility of leading to biased results, as the teachers' perceptions can skew the data. This can reduce the accuracy of data collected due to issues of reliability and validity. Moreover, one of the weaknesses of the study lies in the fact that it focuses on one region only, which is Kuala Lumpur, a big town and the capital city of Malaysia. Urban environments tend to be more affluent, and schools in big cities may have more resources compared to rural or underserved areas. Future research should use a more diverse sample of participants, and it should also include some sort of measure of validity. The study also highlights several critical implications. In a theoretical aspect, it stresses the importance of modifying the technologies to fit different learning styles, which in turn refines the knowledge about how technologies should be modified for the ASD students. In a practical aspect, it reveals the challenges teachers encounter, which include inadequate training and resources that can help design specific staff development interventions. The results indicate a need for enabling structures and financial resources. This is crucial for the proper integration of digital learning for ASD students in inclusive environments. The funding is essential to provide fair access and enhance educational achievements for these students. It would be important for future studies to consider how specialised technology interventions for ASD students work in different classroom environments. It is effective to examine the process of professional development based on specific issues in an attempt to gain a better understanding. Furthermore, research on the extended effects of digital learning on the academic and social development of students with ASD may help in gathering useful information for improving educational processes and materials. - Ultimately, the study benefits different groups of stakeholders, such as teachers, school leaders, and policymakers. This understanding aids in determining the strategies that may be employed by teachers while teaching ASD students and barriers that may arise in the process of adopting digital tools for these unique students. The data gathered may guide professional development initiatives, optimise resource distribution, and refine instructional methodologies. For policymakers, those findings explain what supports and changes are required for the implementation of inclusive education.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest

AUTHOR CONTRIBUTIONS

Nor Amalina Rusli: Conceptualization, Methodology, Investigation, Data Collection, Writing - Original Draft, Project Administration. **Meyly Kheng**: Literature Review, Data Analysis, Writing -Review and Editing, Validation, Supervision.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used standard software tools such as word processors (Microsoft Word) and citation management software (Zotero) to organize and format references. The authors used Grammarly for grammar and language clarity checks during the proofreading stage. Additionally, Turnitin was utilized to ensure academic integrity and to check for potential plagiarism. ChatGPT was used to assist with idea refinement and improving the clarity of expression. All thematic analysis, literature synthesis, and interpretation were conducted manually by the authors without reliance on AI-generated content for substantive academic contributions.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

REFERENCES

Azungah, T. (2018). Qualitative research: Deductive and inductive approaches to data analysis. *Qualitative Research Journal, 18*(4), 383–400. https://doi.org/10.1108/QRJ-D-18-00035

Aktan, O., Toraman, Ç. (2022). The relationship between technostress levels and job satisfaction of teachers during the COVID-19 period. *Education and Information Technologies, 27*, 10429–10453. https://doi.org/10.1007/s10639-022-11027-2

Allen, K. A., Boyle, C., Lauchlan, F., & Craig, H. (2020). Using social skills training to enhance inclusion for students with ASD in mainstream schools. In *Inclusive education: Global issues and controversies* (pp. 202-215). Brill. http://dx.doi.org/10.1163/9789004431171_012

Arizmendi, C.J., Bernacki, M.L., Raković, M. et al. (2023). Predicting student outcomes using digital logs of learning behaviors: Review, current standards, and suggestions for future work. *Behavior Research Methods, 55*, 3026–3054 https://doi.org/10.3758/s13428-022-01939-9

Barua, P. D., Vicnesh, J., Gururajan, R., Oh, S. L., Palmer, E., Azizan, M. M., ... & Acharya, U. R. (2022). Artificial intelligence enabled personalised assistive tools to enhance education of children with neurodevelopmental disorders—a review. *International Journal of Environmental Research and Public Health, 19*(3), 1192. https://doi.org/10.3390/ijerph19031192

Budiastuti, P., Khairudin, M., Santosa, B., & Rahmatullah, B. (2023). The use of personal learning environment to support an online collaborative strategy in vocational education pedagogy course. *International Journal of Interactive Mobile Technologies, 17*(2), 24–41. https://doi.org/10.3991/ijim.v17i02.34565.

Black, M. H., McGarry, S., Churchill, L., D'Arcy, E., Dalgleish, J., Nash, I., Jones, A., Tse, T. Y., Gibson, J., Bölte, S., & Girdler, S. (2022). Considerations of the built environment for autistic individuals: A review of the literature. *Autism, 26*(8), 1904-1915. https://doi.org/10.1177/13623613221102753

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *International Journal of Educational Technology in Higher Education, 17*(1), 1–30. https://doi.org/10.1186/s41239-019-0176-8

Çakiroğlu, Ü., Güler, M., Atabay, M., & Güler, M. (2020). Connections between learning styles and perceived cognitive load in multimedia learning: An experimental study. *Journal of Educational Technology Systems, 48*(4), 553-573.https://doi.org/10.1177/0047239519844509

Celeste, R. J., & Osias, N. (2024). Challenges and implementation of technology integration: basis for enhanced instructional program. *American Journal of Arts and Human Science, 3(2), 106-130.* https://doi.org/10.54536/ajahs.v3i2.2656

Centers for Disease Control and Prevention (2023). *Autism prevalence higher, according to data from 11 ADDM communities. CDC*. https://www.cdc.gov/media/releases/2023/p0323-autism.html

Chu, M. W., Craig, H. L., Yeworiew, L. B., & Xu, Y. (2020). Teachers' unpreparedness to accommodate student needs. *Canadian Journal of School Psychology, 35*(3), 210-224. https://doi.org/10.1177/0829573520916610

Cook, A., & Ogden, J. (2022). Challenges, strategies and self-efficacy of teachers supporting autistic pupils in contrasting school settings: a qualitative study. *European Journal of Special Needs Education, 37*(3), 371-385. https://doi.org/10.1080/08856257.2021.1878659

de Vries, M., & Geurts, H. M. (2012). Cognitive flexibility in ASD; task switching with emotional faces. *Journal of Autism and Developmental Disorders, 42*(12), 2558–2568. https://doi.org/10.1007/s10803-012-1512-1

Derbissalova, G., Shayakhmetova, A., Avagimyan, A., & Pyanova, E. (2024). Multimedia applications in special education: new opportunities for the developing of cognitive processes of children with intellectual disabilities. *Multimedia Tools and Applications, 83*(16), 49707-49721.https://doi.org/10.1007/s11042-023-17512-1

Dynia, J. M., Walton, K. M., Brock, M. E., & Tiede, G. (2020). Early childhood special education teachers' use of evidence-based practices with children with autism spectrum disorder. *Research in Autism Spectrum Disorders, 77*, 101606. https://doi.org/10.1016/j.rasd.2020.101606

ElSayary, A. (2023). The impact of a professional upskilling training programme on developing teachers' digital competence. *Journal of Computer Assisted Learning, 39*(4), 1154-1166. https://doi.org/10.1111/jcal.12788

ElSayary, A. (2024). An investigation of teachers' perceptions of using ChatGPT as a supporting tool for teaching and learning in the digital era. *Journal of Computer Assisted learning, 40(*3), 931-945. https://doi.org/10.1111/jcal.12926

Fernández-Batanero, J. M., Román-Graván, P., Reyes-Rebollo, M. M., & Montenegro-Rueda, M. (2021). Impact of educational technology on teacher stress and anxiety: A literature review. *International Journal of Environmental Research and Public Health, 18*(2), 548. https://doi.org/10.3390/ijerph18020548

Garg, R. K., Garg, P., Sharma, P., Kumar, Y., Niwas, R., Singh, J., & Singh, S. (2024). Virtual autism among children: A leading hazard of gadget exposure and preventive measures. *Journal of Education and Health Promotion, 13*, 76. https://doi.org/10.4103/jehp.jehp_1482_23

Ghafar, N. A., Rahmatullah, B., Razak, N. A., Muttallib, F. H. A., Adnan, M. H. M., & Sarah, L. L. (2023). Systematic literature review on digital courseware usage in Geography subjects for secondary school students. *Journal of ICT in Education, 10*(1), 26-39. https://doi.org/10.37134/jictie.vol10.1.3.2023

Groba, B., Nieto-Riveiro, L., Canosa, N., Concheiro-Moscoso, P., Miranda-Duro, M. D. C., & Pereira, J. (2021). Stakeholder perspectives to support graphical user interface design for children with autism spectrum disorder: A qualitative study. *International Journal of Environmental Research and Public Health, 18*(9), 4631. https://doi.org/10.3390/ijerph18094631

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers, 3*(3), 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hamutoglu, N. B. (2021). Testing the Effects of Technological Barriers on High School Teachers' Role in Technology Integration. *Asian Journal of Distance Education, 16*(1), 74-89. http://asianjde.com/ojs/index.php/AsianJDE/article/view/544

Hassan, H., Rahmatullah, B., & Mohamad Nordin, N. (2014). Towards School Management System (SMS) success in teacher's perception. *Malaysian Online Journal of Educational Technology, 2*(4), 50–60.

Hase, A., Kuhl, P. (2024). Teachers' use of data from digital learning platforms for instructional design: A systematic review. *Educational Technology Research and Development. 72*, 1925–1945. https://doi.org/10.1007/s11423-024-10356-y

Nuria, H. R. (2020). *Could light colour and source change mood in children with autism?* (Doctoral thesis, University College London).

Honorato, N., Soltiyeva, A., Oliveira, W., & others. (2024). Gameful strategies in the education of autistic children: A systematic literature review, scientometric analysis, and future research roadmap. *Smart Learning Environments, 11*, 25. https://doi.org/10.1186/s40561-024-00309-6

Kaimara, P. (2023). Digital transformation stands alongside inclusive education: Lessons learned from a project called "Waking Up in the Morning". *Technology, Knowledge and Learning*, 1-27. https://doi.org/10.1007/s10758-023-09667-5

Kalyani, L. K. (2024). The role of technology in education: Enhancing learning outcomes and 21st century skills. International *Journal of Scientific Research in Modern Science and Technology, 3*(4), 5-10. http://dx.doi.org/10.59828/ijsrmst.v3i4.199

Kanchon, M. K. H., Sadman, M., Nabila, K. F., Tarannum, R., & Khan, R. (2024). Enhancing personalized learning: AI-driven identification of learning styles and content modification strategies. *International Journal of Cognitive Computing in Engineering, 5*, 269-278. https://doi.org/10.1016/j.ijcce.2024.06.002

Kapici, H. O., & Akcay, H. (2023). Improving student teachers' TPACK self-efficacy through lesson planning practice in the virtual platform. *Educational Studies, 49*(1), 76-98. https://doi.org/10.1080/03055698.2020.1835610

Karagianni, E., & Driga, A. M. (2024). Inclusive learning and development practices for children with autism spectrum disorders and the ICT's role. *Global Journal of Engineering and Technology Advances, 18*(1), 055-067. https://doi.org/10.30574/gjeta.2024.18.1.0258

Ke, H. & AlSaqqaf, A. (2022). E-learning readiness during the school suspension caused by the COVID-19 pandemic: A case of English language teachers in Sabah, Malaysia. *Journal of ICT in Education, 9*(2), 71-86. https://doi.org/10.37134/jictie.vol9.2.6.2022

Khatab, S., Hijab, M. H. F., Othman, A., & Al-Thani, D. (2024). Collaborative play for autistic children: A systematic literature review. *Entertainment Computing*, 100653. https://doi.org/10.1016/j.entcom.2024.100653

Kurnaz, A., Meriç, A. G., & Pürsün, T. (2022). An investigation of color preferences of students with special needs. *International Journal of Progressive Education, 18*(5), 209-228. 10.29329/ijpe.2022.467.13

Kyriakaki, E., & Nikolaidis, P. (2024). The role of digital games in the education of self-control and stress in gifted children. *World Journal of Advanced Research and Reviews, 22*(1), 1450-1460. https://doi.org/10.30574/wjarr.2024.22.1.1204

Lane, R., & Radesky, J. (2019). Digital media and autism spectrum disorders: Review of evidence, theoretical concerns, and opportunities for intervention. *Journal of Developmental and Behavioral Pediatrics, 40*(5), 364–368. https://doi.org/10.1097/DBP.0000000000000664

Lory, C., Rispoli, M., Gregori, E., Kim, S. Y., & David, M. (2020). Reducing escape-maintained challenging behavior in children with autism spectrum disorder through visual activity schedule and instructional choice. *Education and Treatment of Children, 43*, 201-217.https://doi.org/10.1007/s43494-020-00019-x

Love, A. M. A., Findley, J. A., Ruble, L. A., & McGrew, J. H. (2019). Teacher self-efficacy for teaching students with autism spectrum disorder: Associations with stress, teacher engagement, and student IEP outcomes following COMPASS consultation. *Focus on Autism and Other Developmental Disabilities, 35*(1), 19–30. https://doi.org/10.1177/1088357619836767

Mohajan, H. K. (2020). Quantitative research: A successful investigation in natural and social sciences. *Journal of Economic Development, Environment and People, 9*(4), 50-79. http://dx.doi.org/10.26458/jedep.v9i4.679

Mohamad, A. I., Rahmatullah, B., Ibrahim, L. F. M., Saari, E. M., & Downing, K. J. (2022). Exploring parents' perception of online learning through a systematic literature review. *Borneo International Journal, 5*(1), 8–15.

Nair, A. S., Priya, R. S., Rajagopal, P., Pradeepa, C., Senthil, R., Dhanalakshmi, S., Lai, K. W., Wu, X., & Zuo, X. (2022). A case study on the effect of light and colors in the built environment on autistic children's behavior. *Frontiers in Psychiatry, 13*, 1042641. https://doi.org/10.3389/fpsyt.2022.1042641

Nakshine, V. S., Thute, P., Khatib, M. N., & Sarkar, B. (2022). Increased screen time as a cause of declining physical, psychological health, and sleep patterns: A literary review. *Cureus, 14*(10), e30051. https://doi.org/10.7759/cureus.30051

Oliva-Zamora, M.Á., Larreina-Morales, M.E. (2024). Cognitive accessibility in educational games: A set of recommendations. In A. Marcus-Quinn, K. Krejtz, & C. Duarte (Eds.), *Transforming media accessibility in Europe*. Springer. https://doi.org/10.1007/978-3-031-60049-4_16

Onyishi, C. N., & Sefotho, M. M. (2020). Teachers' perspectives on the use of differentiated instruction in inclusive classrooms: Implication for teacher education. *International Journal of Higher Education, 9*(6), 136-150. https://doi.org/10.5430/ijhe.v9n6p136

Putra, C. A. (2018). Utilization of multimedia technology for instructional media. *Journal of ICT in Education, 5*(1), 1-8. http://dx.doi.org/10.37134/jictie.vol5.1.2018

Phytanza, D. T. P., & Burhaein, E. (2020). The effects of tenure, teacher certification, and work motivation on special needs teacher performance. *Universal Journal of Educational Research, 8*(9), 4348-4356. http://dx.doi.org/10.13189/ujer.2020.080962

Ramos Aguiar, L. R., Álvarez Rodríguez, F. J., Madero Aguilar, J. R., Navarro Plascencia, V., Peña Mendoza, L. M., Quintero Valdez, J. R., ... & Lazcano Ortiz, L. E. (2023). Implementing gamification for blind and autistic people with tangible interfaces, extended reality, and universal design for learning: two case studies. *Applied Sciences, 13*(5), 3159. https://doi.org/10.3390/app13053159

Rashid, T., & Asghar, H. M. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior, 63*, 604-612.http://dx.doi.org/10.1016/j.chb.2016.05.084

Reeves, T. D., & Chiang, J. L. (2018). Online interventions to promote teacher data-driven decision making: Optimizing design to maximize impact. *Studies in Educational Evaluation, 59*, 256-269 https://doi.org/10.1016/j.stueduc.2018.09.006

Ridderinkhof, A., de Bruin, E. I., van den Driesschen, S., & Bögels, S. M. (2020). Attention in children with autism spectrum disorder and the effects of a mindfulness-based program. *Journal of Attention Disorders, 24*(5), 681–692. https://doi.org/10.1177/1087054718797428

Saggers, B., & Ashburner, J. (2019). Creating learning spaces that promote wellbeing, participation and engagement: Implications for students on the autism spectrum. In H. Hughes, J. Franz, & J. Willis (Eds.), *School spaces for student wellbeing and learning* (pp. 139-156). Springer. https://doi.org/10.1007/978-981-13-6092-3_8

Samsudin, I. S., & Adnan, M. H. M. (2021). Kerangka teknologi bantu untuk diagnosis hubungan kecerdasan visual spasial bagi pelajar dengan masalah pembelajaran: Assistive technology framework to diagnosis the relationship of spatial visual intelligence for students with learning disabilities. *Journal of ICT in Education, 8*(4), 113–121. https://doi.org/10.37134/jictie.vol8.sp.2.11.2021

Smees, R., Hughes, J., Carmichael, D. A., & Simner, J. (2019). Learning in colour: children with grapheme-colour synaesthesia show cognitive benefits in vocabulary and self-evaluated reading. *Philosophical Transactions: Biological Sciences, 374*(1787), 1–14. https://www.jstor.org/stable/26841002

Strnadova, A., Potmesil, M., & Potmesilova, P. (2023). Pupils' attitudes toward inclusive education. *Children, 10*(11), 1787. https://doi.org/10.3390/children10111787

Sweet, K. S., LeBlanc, J. K., Stough, L. M., & Sweany, N. W. (2020). Community building and knowledge sharing by individuals with disabilities using social media. *Journal of Computer Assisted Learning, 36*(1), 1-11 https://doi.org/10.1111/jcal.12377

Vasa, R. A., & Mazurek, M. O. (2015). An update on anxiety in youth with autism spectrum disorders. *Current Opinion in Psychiatry, 28*(2), 83–90. https://doi.org/10.1097/YCO.0000000000000133

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning–A literature review. *Computers & Education, 149*, 103818. https://doi.org/10.1016/j.compedu.2020.103818

Zolkipli, N. Z., Rahmatullah, B., Samuri, S. M., Árva, V., & Pranoto, Y. K. S. (2023). 'Leave no one behind': A systematic literature review on game-based learning courseware for preschool children with learning disabilities. *Southeast Asia Early Childhood Journal, 12*(1), 79–97. https://doi.org/10.37134/saecj.vol12.1.7.2023