

Early Intervention Tablet-Based Application for Teaching Daily Living Skills to Autistic Children

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Abstract: Tablet-based assistive learning applications have the capacity to assist learning, especially for those with disabilities. The study was conducted to explore the effectiveness of tablet-based application in a special education setting with five young autistic children as case studies, with in-depth explorations for each child's learning experiences. The Autism Aid application was designed using supportive contents from the Malaysian school curriculum, tailored for young children with autism aged 5 to 10 years and supporting students' learning. The learning lessons focus on self-management skills using cognitive theory of multimedia learning and carefully design based on the video modelling contents, text and images. The study employed a qualitative case study with data gathered from multiple sources. The study has shown that the participants were able to learn from the tablet-based application. The results have shown that multimedia elements, the human-model, and the use of tablet in the classroom affected children's learning outcomes. Video applications have been beneficial as instructional tools for children with autism, especially in motivating and supporting their learning endeavours. Findings have shown that the video modelling application has played an important role in shaping the learning and observational process empowering children to achieve high levels of performance.

1 INTRODUCTION

Technology is a powerful tool for enhancing learning, enabling individuals to solve problems and achieve learning goals. Technology has the capacity to make a substantial difference for learners, especially for those with disabilities. Studies have indicated that technology is most often used to deliver information in a way that has a positive impact emotionally, physically, and cognitively for this group of learners. For example, tablet-based applications have shown beneficials to encourage individuals with disabilities for their learning activities positively (Dattolo et al., 2016). Consequently, technology has emerged as a form of treatment for individuals with disabilities, serving as a secondary option after medical treatments under the term 'Treatment Technology' (Dattolo et al., 2016). Technology is capable of aiding children who are diagnosed with autism spectrum disorder (ASD).

ASD is a brain function disorder typically identified during the first two to three years of a child's life. ASD is characterized by difficulties in three main areas, namely social interaction, communication and language skills, and the presence of stereotyped, repetitive behaviours, along with restricted activities and interests (Kodak et al., 2020). ASD is not an illness but rather a long-term developmental disability (Kenny et al., 2016). Autism has a strong genetic basis, with first-degree, which is related parents that they might sharing part of the genetic chromosomes for ASD, or some of its components in the Deoxyribonucleic Acid (DNA). Booth and Happé (2010, p. 378) and Dillenburger (2011, p.1119) noted that despite the "discovery of certain genetic linkages, presently there are no medical tests that reliably identify individuals with ASD". Brain development and function have been the focus of research in ASD for many years. Based on research, neuropathologist have concluded that

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neuro-developmental disorders are evident in children with ASD (Sauer et al., 2021).

Research has also demonstrated that autistic children can decode social situations which aid in the retention of these experiences and enable them to recall them in future interactions (Ormond et al., 2018). Miller (2016) highlighted that autistic children are commonly recognized as visual learners because of their strength and ability to decode visual information better than other sensory inputs. This makes tablet-based applications an effective educational tool for visual learning by autistic children. In this study, video modelling was used to influence the autistic children's skills adaptability through visual contents, especially with a human model. During the learning process, the autistic children observed the human model and through the process of action and imitation. The model played a crucial role not only in demonstrating the behaviours but also in motivating the young autistic children to achieve their goals by helping them perform the behavioural tasks. This method proved supportive for autistic children who otherwise may have limited knowledge, experiences, and opportunities to develop and learn the skills independently.

1.1 Research Objective and Question

The objective of this study was to develop and explore the effectiveness of a tablet-based application (known or called as "Autism Aid") in addressing the learning challenges faced by autistic children on learning imitation, delay response and lack of visual representation. The focus of this study was on learning imitation or demonstration of basic daily living skills. The Autism Aid application was designed and developed based on specific criteria after an in-depth review of existing research on application design specific for autistic children. To accomplish these objectives, two research questions (RQs) were constructed, and they are: 1. What are the significant factors that influence the perception of autistic children toward learning via the Autism Aid application? 2. How do the interactions of autistic children with the Autism Aid application enhance their learning of the skill-based tasks.

2 LITERATURE REVIEW

2.1 Cognitive Theory of Multimedia Learning

Mayer's Cognitive Theory of Multimedia Learning (CTML) focused on the use of two separate sensory channels, namely the visual and auditory channels, was applied in the design of the educational video contents for autistic children. By engaging both channels, the learning process is tailored to the specific needs of autistic children and enhances their ability to process and retain information (Mutlu-Bayraktar et al., 2019). Video Modelling as a teaching strategy with autistic children; it is a pedagogical approach for teaching autistic children, which utilizes playback technique combining visual and audio technologies to produce dynamic and engaging materials.

Learners can watch video contents repeatedly and proceed at their own pace which enhances their understanding and retention. Additionally, these videos often feature demonstrations delivered by experts, providing learners with direct, modelled instruction. Videos play an important role in stimulating student motivation and enhancing learning outcomes. Video modelling has been shown to improve autistic children's abilities, particularly in the context of autism education (Baras, 2018). This strategy involves autistic children viewing and observing a live model perform a skill, which thus directs their attention toward imitating the observed actions. The videos used in this context often include short clips containing graphics in the form of dynamic visuals, audio elements, sound, and written texts, all designed to optimize the children's learning experiences.

The CTML posits that visual information enables learners to "select relevant information" comprising of words or pictures, "organize [them] into coherent mental representations" and "integrating the information with relevant prior knowledge activated from long-term memory" (Mayer & Alexander, 2016). Mayer (2024) stressed that proper design and development of learning material will improve the learning preforming of the students. The best method for learning is through reshaping and activating information memory, by testing on the learners' performance in a new learning situation. According to Constantin et al. (2017), three basic elements are crucial for learners to succeed in learning through video tutorials: i) content should be short and segmented into manageable chunks; ii) it

should use modality and personalization to cater to different learning styles; and iii) it should include narration that is conversational in tone. These elements help in designing educational content that is both engaging and informative and facilitate easier assimilation and retention by learners.

2.2 Imitation and Developing Skills

Imitation skill, which is essential for learning, is best defined as the act of copying other people's behaviour. This skill is particularly valuable in observing and replicating behaviours. Imitation is a powerful mechanism for learning social behavioural skills and cultural transmission for young children. However, research has indicated that autistic children often exhibit deficits in imitation, which causes difficulties in maintaining attention, behaviour and mimicking (Fage et al., 2018). Through observational learning or imitation, children can acquire new skills that are applicable in real-life environments. Imitation skill, which is essential for learning, is best defined as the act of copying other people's behaviour.

This skill is particularly valuable in observing and replicating behaviours. Imitation skills are necessary for teaching and developing learning processes in autistic children. Imitation is a powerful mechanism for learning social behavioural skills and cultural transmission for young children. However, research has indicated that autistic children often exhibit deficits in imitation, which causes difficulties in maintaining attention, behaviour and mimicking (Fage et al., 2018). Several studies on imitation (Vivanti & Hamilton, 2015; Miller, 2016) have underscored its role in laying a social foundation by advancing stages of understanding. The key to the successful teaching of autistic children is to engage them in interactive activities such as conversation and joint attention and connecting these to motivation at every completed sequence of task, activity or meaningful gesture.

2.3 Tablet-Based Application in Education

The use of tablet-based applications in educational settings is increasingly prevalent, especially in teaching children. These applications serve as tools for learning by providing information in structured ways to facilitate learning. The content in these applications are often designed following specific pedagogical strategies, such as presenting information from simple to complex. This approach supports the contextual presentation of learning

materials, enabling learners to gradually build and expand their knowledge. The use of tablet-based applications in education is increasingly recognized as an enhanced learning and teaching strategy to meet the demands of 21st-century learning. The use of these applications is particularly beneficial in improving the quality of life and enhancing social communication and independence for autistic children. Software applications have been shown effective in delivering information clearly and concisely, giving detailed information about each necessary step in the learning process for autistic children (Algoufi, 2016).

Software applications, which are built with interactive multimedia forms such as video and audio, can cater to various learning styles and are especially valuable for young autistic children. These multimedia elements also significantly impact learning and cognitive functions. Furthermore, the intuitive design of tablet-based applications means that users do not require prior knowledge or training to benefit from them, making them especially valuable for children with autism. Assistive technology, a tool that is designed specifically for individuals with disabilities, has shown promise in helping autistic children focus, engage, interact, retain information, and perform. In their study, Purnama et al. (2021) explored the use of assistive technology in the form of a technology-based educational application to support autistic children in their learning. In their study, the interactive visual support educational application ran on a tablet-based device. The findings from their study showed that the software application successfully motivated the children to interact and engage, especially in situations where expert teachers were unavailable.

Khan et al. (2023) conducted a quantitative pilot study in Malaysia to investigate the factors influencing the behavioural intentions of autistic children toward technology use in the classroom. Their findings highlighted the crucial role played by the Ministry of Education in Malaysia in identifying the strategies for technology integration in schools. Their study also revealed the roles that technology can play in reducing the barrier between learners and the school system and in enhancing the productivity and efficiency of the education management system. By focusing on the development and design of technology-based educational applications for use by teachers and learners, the ministry can implement strategies that enhance the effectiveness of the teaching and learning process. Based on their findings, Khan et al. (2023) noted that the most advantageous period for implementing the use of

technology with ASD children is during the early stages of their education.

Early exposure and initiation to technology used for learning is beneficial for autistic children as it can help to enhance learning and improve their chances of success in education. Moreover, the evidence-based practice of using technology-based application has been shown to contribute positively to the development and improvement of autistic children's skills and cognitive levels (Linh & Azar 2019). Similarly, Chettaoui et al. (2022) reported that technology-enhanced learning increases learners' understanding and knowledge acquisition in different subjects across various educational domains. Smail et al. (2024) have conducted systematic review to explore the use of tablet-based video among young autistic children. The review of the studies was intended to show evidence-based support on practical use of tablet-based video app for instruction and how it can be effectively used in the school education and teaching young autistic children. Based on Bandura's social learning theory (SLT, Bandura, 2016), when the child resented a model, he/she can clearly retrain and relate to engage in task activity with motivation to accomplish tasks. Therefore, the finding from the studies have showed that the use of video modelling enhanced children's skills. The video modelling techniques have taught children how to do the task and found that they retained the knowledge.

As well as the visual effect of the video model was more supportive and facilitate the learning skill acquisition without causing strong anxiety or emotional reaction which have been commonly observed in some young autistic during teaching and interactions.

Social stories of toothbrushing education versus video-modelling based toothbrushing training on oral hygiene was conducted among male students aged 7–15 years old with autism spectrum disorders in Tehran, Iran (Piraneh et al., 2023). The researchers conducted quantitative pilot study where they evaluated and compared the effectiveness of use social stories versus video-modelling for better learning with autistic learners. The process, guideline and construction of the methods have implemented to seek the effects of different training modes on the learners' behaviour. The finding of the study by Piraneh et al. (2023) has showed the efficacy of video modelling compared to social stories in autistic children as visual teaching method as well as video modelling is practical teaching method with autistic learners.

3 METHODOLOGY

3.1 Designing a Tablet-Based Application for Autistic Children

The Autism Aid application was designed using materials from the Malaysian school curriculum, tailored for young children with autism aged 5 to 10 years, who are enrolled in Malaysian preschool and elementary schools (Refer to Figure 1). The curriculum, approved by the Ministry of Education Malaysia, encompassed a wide range of modules and academic content to be taught in schools by teachers, including skills, activities, strategies, concepts, and contents. These elements directly impact the autistic children's learning outcomes. The use of any form of visual support system in autistic education, in this research, it is tablet-based assistive visualised technology, is to be used for autistic children, with the guides of autism principles and guidelines for the children education. Figure 1 shows the requirements and content alignment with the individual learning pace of each child.

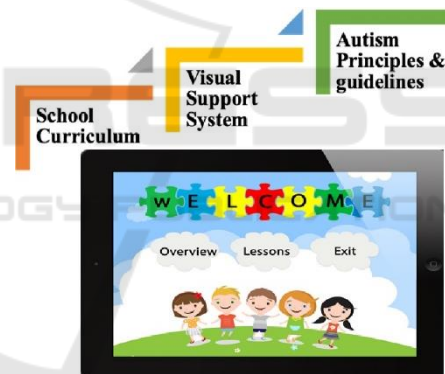


Figure 1: Identification of key principles for the design of “Autism Aid” - mainly on alignment with curriculum.

This process involved determining the children's learning requirements and delivering materials in a manner that ensures mastery of the specified skills. For children with autism, the curriculum extends beyond purely academic pursuits to include the teaching of functional and appropriate skills that would help them lead a productive life. In this study, the lessons identified from the curriculum were to focus on self-management skills. It is a core part of curriculum requirement for autistic children, namely the everyday independent living skills such as performing the brushing of teeth and ablution before praying. The term ‘self-skills’ or ‘self-management function’ is often used to describe the actions or skills that are required to perform daily living skills

independently (Flynn & Healy, 2012, p. 432). The use of the Autism Aid application can help children with ASD make fewer mistakes and errors while performing these tasks and steps, even though they may have difficulties with imitation skills. The application was designed and developed based on the children's cognitive level, the school curriculum, and the guidelines and principles of software design tailored specifically for the autistic children.

The key scenes of Autism Aid are shown in Figure 2. According to Mayer and Alexander (2016), there are three conceptual approaches in the instructional design of tablet-based lessons under the theory of multimedia learning, namely the weight of texts, the length of instructions, and the type of images. These design elements have been considered when designing the application, especially in maintaining the individual user's attention and in achieving the objectives (Pinillos-Patiño et al., 2020).



Figure 2: Autism Aid Application with key scenes and video modelling.

3.2 Case Study with Individual Autistic Child

This study adopted a qualitative case study approach with reference to Yin (2018)'s guiding principles of case studies. The sample of this study consisted of individual cases of young autistic children from a learning pre-school. The case study profile method was utilized to examine the effectiveness of the Autism Aid application within an educational setting. The data collection method adopted for this study comprised three methods. The first involved direct observations of actual lessons during the classroom sessions, where the researcher was present to observe the teaching process and the interactions between the child and the teacher. The second method comprised using observation notes to monitor and track each child's target behaviour during the sessions. The third

method involved conducting content analysis of the video observations, where video analysis transcripts were used to evaluate the setting throughout the study. These transcripts helped the researcher to understand the natural interactions and task-based reactions of the participants.

3.3 Participants

This study involved a total of five (5) young autistic children, both male and female, aged between 5 to 10 years old. They attended a preschool in Kuala Lumpur, Malaysia, where the English language is the medium of instruction. The project team consisted of the first author, the school management, and the schoolteachers, all of whom are fluent in English. The participants were selected by the researcher with the recommendations of the school management. Ethical procedures are crucial for obtaining initial approval for a research study, especially for studies involving human participants and sensitive information. To protect privacy and ensure confidentiality, the children's data will be kept anonymous in the researcher's database. All procedures were addressed and managed according to the school's policy. Table 1 shows the list of research participants and their age.

Table 1: Children's Information (Age).

Child Participants (Arbitrary name)	Age
Case Study 1: Sean	8 years old
Case Study 2: Kalash	4 years old
Case Study 3: Li	6 years old
Case Study 4: Vijay	5 years old
Case Study 5: Akmal	4 years old

The children in this study varied in terms of age, personality, intellectual level, traits, and their specific diagnosis. This study examined the effectiveness of video-modelling (imitation) for teaching fundamental daily living skills to autistic children. The study specifically addressed a significant domain of self-management which was identified as the dependent variable while the independent variable was the video modelling technique (point-of-view video modelling). This approach aimed to identify the correlations between the children's demographics, the variables involved and the children's performance, as well as to assess the influence of the visual components of the modelling.

3.4 Procedures

The project spanned a duration of five months, during which the researcher initially informed the teachers about how to use the application for teaching. Data collection methods included: 1) observation notes for each child (refer to Appendix A); 2) interviews with schoolteachers mainly to assess the usability of the application with autistic children, and 3) analysis of the children's documents.

3.5 Materials and Learning Environment

The teaching and learning environment were carefully prepared and arranged to accommodate the specific needs of the children's learning space. The classroom was equipped with child-sized tables and chairs and included all materials relevant to the sessions. During the sessions, a Samsung tablet-device was used to display the video models of the tasks. The tablet was positioned at an appropriate eye level for the child to ensure optimal visibility and engagement. Further details on the classroom setup can be found in Figure 3, which includes illustration of the classroom setting.

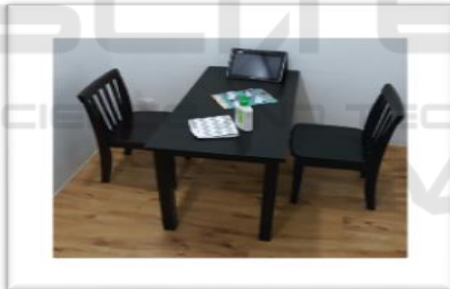


Figure 3: Classroom setting with Autism Aid.

4 ANALYSIS & FINDINGS

The data indicated that all child participants engaged in the video modelling sessions through eye gaze and body movements while watching the video model performed the task. A key factor contributing to the children's engagement was the similarity between the children and the model in the video in terms of age, features, and personal characteristics or traits. This resemblance likely made the video content more relatable for the child participants and contributed to the children's comfort levels while watching the videos, thereby making their learning experience more engaging and relevant. Additionally, the design

of the video model, which utilized the video-point-of-view perspective, was helpful in demonstrating the tasks from an angle close to that of the child viewers. This approach allowed the children to view and observe the skills acted out by the live model as if they were performing the skills themselves, thus focusing their attention and enhancing their understanding and ability to imitate the observed actions. Video modelling, as used in this study, often includes short clips containing graphics in the form of dynamic pictures, audio, sound, and written texts. These components work together to facilitate learning of the content by presenting skills and knowledge to autistic learners in an accessible format. This method aligns with the principles of social learning theory, which posits that most human behaviours are learned by observing models or life experiences that demonstrate the desired behaviours. Since autistic children often learn better through visual interaction, the emphasis in the design of the educational content should be on the interaction between learners and the learning tasks.

The design of the lessons in the tablet-based application can be categorized into two main strategies: (1) direct visual support, which provides clear and immediate visual cues, and (2) strong reinforcement, which helps reinforce the learning. Both strategies allow the autistic children to better understand the lessons, comprehend the actions or procedures, and achieve mastery of the tasks through video observation and cognitive organization. Additionally, the video modelling segment was designed to include video clips that featured a model performing specific tasks, with the tasks broken down into smaller, manageable steps, which were played sequentially. This structure helps organize autistic learners' cognitive memory, which enables them to replicate and acquire the demonstrated behaviours effectively. Table B1 and Table B2 (refer to Appendix B) have summarized the observational data gathered in the study, highlighting what were observed from each individual autistic child. Table B2 shows teachers' observations and their feedback on the child. See Appendix Table B1 Case Study Results based on the Observation Notes and Table B2 Sample data of Children's Performance from Teachers' Feedback.

5 DISCUSSIONS

The objectives of this study aimed to design and develop a tablet-based application, for young autistic children, as well as to examine how young autistic

children engage and interact with video modelling tasks. Literature has pointed out the effectiveness of technology as a supporting tool in early education for young children with autism, (Purnama et al., 2021; Khan et al., 2023). The early stages of an autistic child's life are the most crucial for implementing and integrating technology to enhance learning outcomes and increase the chances of educational success, as these technologies provide the necessary exposure during the formative years (Khan et al., 2023). This following section presents the discussion on the findings to provide answers to the research questions established for this study. To help with the structure of the discussion, the research questions are recapped and used as a guide in presenting the findings.

RQ1: What are the most significant factors that influence the perception of autistic children toward learning via the Autism Aid application?

Social Learning Theory (SLT) conjectured that most of human behaviour is learned observationally through modelling. Modelling occurs when an individual imitates the skills or tasks that they observed or have been presented to them. Bandura (2016) in his SLT defined imitation as occurring through four stages of observational learning, comprising attentional, retention, motor reproduction, and motivational processes. SLT has been widely applied on humans (children) who are not characterized by cognitive problems. Based on Bandura's work, SLT is considered one of the most modern theories in this era (Beauchamp et al., 2019). The concept of this theory is centred on the consequence and expectations based on the influence of self- efficacy, goals, motivation, and structural factors that facilitated the learning results (Beauchamp et al., 2019).

Video Modelling

Video modelling is identified as one of the best strategies to teach children how to accurately imitate behavioural skills. Video modelling is particularly beneficial for teaching children who are deficient in certain skills. Based on SLT, modelling occurs when an individual imitates the skills or tasks that they have observed or that have been presented to them. Bandura, in his SLT, defined imitation as occurring through four stages of observational learning: attentional, retention, motor reproduction, and motivational processes. SLT has been extensively applied to children who are not characterized by cognitive impairments. Based on Bandura's work, SLT is considered one of the most modern theories in this era (Beauchamp et al., 2019). The core concept

of this theory revolves around the consequences and expectations influenced by self- efficacy, goals, motivation, and structural factors that facilitate the learning outcomes (Beauchamp et al., 2019).

In this study, the video application used is a visual presentation that contained both words and graphics which helped the learners to accomplish the learning objectives as it was able to develop the autistic children's cognitive abilities and the behavioural skills. Used in combination with appropriate methods of pedagogy in the real classroom, the video application can be used to teach autistic children the learning skills they need to master. The findings in this present study corroborated those of Hong et al. (2016) and Mayer et al. (2016), where the visual learning materials were found to be an effective visual technique in teaching instructions to autistic children. The process of retention depends on children's ability to code or structure the information in an easily remembered form or to rehearse the model's actions mentally or physically. Hence, the autistic children's ability to retain information, organize and store it in working memory, and later perform the skills they observed is an indication of successful learning performance. This finding of the study supports the use of video modelling as visual teaching method, has high effective learning results that can be observed on children task behaviours. This outcome like the Piraneh et al. (2023) and Smail et al. (2024). Video modelling as main factor has provided immediate response to the children interaction, which has followed by an opportunity to perform the behaviour independently, encouraged the child participants to perform the task behaviour. This finding is consistent with that of Pi et al. (2022), where it was observed that the autistic children were able to recall and apply the behavioural tasks, resulting in positive learning outcomes. Similarly, research by Curran, (2017) highlighted how Bandura's SLT elucidates the actual dynamic effect of self-efficacy, behavioural action, and environmental impact on autistic children's learning and performance of behavioural tasks, in addition to explaining the interplay with visual presentations, which in the case of this current study was presented in the form of video modelling.

RQ2: How does the interaction of autistic children with the Autism Aid application enhance their learning tasks?

Multimedia Components and Learning

The analysis on the data gathered through direct observation and video analysis on the children's attitude showed that tablet-based video applications could be used as a tool to educate and teach

behavioural skills to autistic children without the obstructions typically associated with conventional teaching methods. This approach, coupled with the use of technologies, has proven instrumental in removing barriers and enhancing learning outcomes for autistic children (Khan et al., 2023; Chettaoui et al., 2022; DiYanni et al., 2022; Dattolo et al., 2016; Ismaili & Ibrahimi 2017). Furthermore, tablet-based applications have contributed to developing methods for teaching and delivering knowledge in auditory and visual forms. Multimedia components are important elements which were used in this study to enhance the autistic children's learning skills. These components, which included text, picture, video and audio, enabled the young autistic children to engage and interact with the video modelling application and imitate the task behaviour successfully. In this study, the elements of multimedia presentations and the use of these components with the autistic children were investigated. The content was designed with multimedia components with the aim of helping the young autistic children build mental representations of the behavioural skills for meaningful learning.

The primary goal of integrating the multimedia components was to enhance the children's understanding and assist them in learning the behavioural skills. These multimedia presentation components enabled the young autistic children to engage and interact with the video modelling task content. The key element in the multimedia design was to build a connection between these forms and to enhance the autistic children's deep learning and understanding of the video content presented. The concept of using multimedia components was to increase and enhance effective learning. The multimedia presentation components incorporated in the application have helped enhanced the ability of the autistic children to understand, think about and remember the content, including the aspects related to language learning. This finding supports the use of multimedia application in children's education, particularly in improving young autistic children's cognitive skills (Mutlu-Bayraktar et al., 2019). Furthermore, it also offers valuable insights into the development of more efficient learning instructions. Additionally, the integration of various multimedia components has been shown to support the teaching and learning processes of preschool young autistic children, positively affecting their cognitive engagement and interaction with the learning content presented in the video application, which can be considered a resource for teaching and learning (Mrachko, 2015).

According to multimedia learning theory, the design of educational materials should focus on techniques that minimize unrelated processing and reduce extraneous cognitive load, especially for individuals who have limited memory capacity and should not be burdened with unnecessary elements that detract them from learning progress and educational objectives (Mayer & Alexander, 2016; Mutlu-Bayraktar et al., 2019). The main goal of multimedia principles is to build meaningful learning connections between the different elements, such as words and pictures (video) and to improve cognitive processing so that each principle can be connected. The Autism Aid application's content was designed using video modelling to create a bridge between the information presented and the cognitive processing required for successful learning. These design choices support the CTML, which posits that autistic children process information through their senses, requiring them to pay direct attention to the video model, decode the visual information, store it, and later, retrieve it from memory for recall when needed to perform the skill during the practical session. Another study by Mayer (2024) supports the finding of this study that design of video-lessons app has helped to overcome obstacles and barriers of imitation difficulties a real the life situation. According to the CTML, the human brain is naturally inclined to receive and process sensory information from the eyes and ears. For young autistic children, who are predominantly visual learners, their brains are adept at retaining visual images of pictures and printed text, as well as maintaining "auditory memory that briefly holds spoken words and sounds as auditory images" (Sorden, 2012, p.3).

5.1 Implications of the Study

The teaching principles and teacher training programmes should be aligned with these new technological developments to leverage on their benefits for both educators and learners. This study has shown that the integration of tablet-based applications can lead to improved teaching methods for autistic children, with their acceptance and willingness to use such tablet-based applications underscoring their feasibility and practicality in educational settings. The study has led to the focus on the potential practical benefits of tablet-based video application for learning, with hands-on experience to reinforce and foster comprehension for autistic children within the school context and potentially beyond. Teachers have started using tablet applications in the classroom as a valuable teaching

tool, especially for special education with autistic children. The finding of this study could act as a catalyst for the Ministry of Education to consider the potential of adopting Autism Aid for teaching young autistic children. The multimedia cognitive theory can be applied with normal learners; however, this study has used with autistic children, and it shows how the multimedia channels of auditory and visual modes are able to support autistic children. Integration of the Autism Aid application in the classroom lesson plans help to improve the autistic children's performance, independence, cognitive abilities, and learning achievement (Williams-Brown & Hodkinson, 2020). The practical implication of this finding for professionals is that they can, leverage the appropriate content delivery feature of the application to enhance the increase in the learning skills of autistic children. It provided pathways to reduce the anxiety and complexity of learning behavioural skills for children with autism.

5.2 Limitations

This study has faced some limitations which include: 1) the size of the participants (children) involved in the study was quite small; 2) the teachers interviewed have limited understanding of the use of the tablet-based application in teaching behavioural skills; 3) it was difficult for the researcher to find and recruit research participants to be involved in the study. This difficulty was exacerbated by the fact that the researcher was limited to attending the school for one day a week. It would have been good to see some interviews with the autistic children themselves to get their voice and perspective. Based on the schedule set by the school management, the children could be assessed only on Fridays, thus limiting the researcher's access to potential participants.

5.3 Future Study

This study was primarily qualitative in its research design. Thus, for future study, quantitative or mixed method research approach could be applied in the research methodology. This might help in gaining new insight and better understanding of the phenomenon. This study only involved autistic children and some support from their teachers. Future studies could include parents of autistic children as participants so that the perspective of the parents can be obtained. Co-designing the video modelling application with autistic individuals as well as parents of autistic children would be a useful step to ensure that the application is tailored and suited to the needs

and requirements of autistic children. To direct future research, curriculum developers from the Ministry of Education, educators, and those involved in professional development must understand the importance of this technology in supporting both the teaching and learning process, the practical implementation. The finding of this study could act as a catalyst for the Ministry of Education to consider the potential of adopting Autism Aid tablet-based applications for teaching young autistic children.

6 CONCLUSIONS & THE CONCEPTUAL FRAMEWORK

The study focused on the use of educational applications for teaching autistic learners and specifically examined the effectiveness of the Autism Aid tablet application which was designed to incorporate video modelling tasks to the autistic children. Figure 4 show the conceptual framework derived from this study. The use of case study methods provided deeper insights into the teaching methods used with the children during the application's implementation in the classroom, especially on video modelling tasks (Refer to Figure 4), with support from multimedia learning theory. The pedagogy of using tablet technology that facilitates the clear delivery of information (should be in sequence) within certain educational principles through the support of Social Learning Theory (SLT), a popular theory of learning by Bandura (2016). Overall, the Autism Aid application, which functioned as a multimedia educational tool and a direct instructional support for (daily) skills-based learning, effectively facilitated the acquisition of

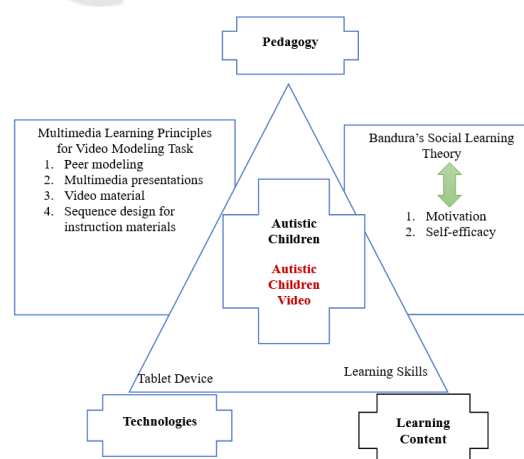


Figure 4: The conceptual framework of Autism Aid application.

behavioural skills among young autistic learners. The findings showed that once the children comprehended and understood the video modelling content, they benefitted from the learning materials. Additionally, the children's success in replicating the behavioural tasks also affected their self-efficacy, which is crucial for independent learning and future success. Learning efficacy and motivation can be improved when tablet-based applications are used as the assistive technology in autistic education.

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APPENDIX A

Table A1: Data of children's performance based on teachers' feedback.

Name	Age and Gender	Teachers' Feedback
Case Study 1: Sean	Male, 8 years old	After some time, he was able to focus and observe what he saw in the video-modelling. The teachers mentioned that he was focused on plying with the modelling application and followed her instruction to the model task. In the practical session Sean was able to apply the model task.
Case Study 2: Kalash	Female, 4 years old	Although she was non-verbal autistic, the teachers said that she is improving. She was able to apply some accurate steps based on the video as well as able to interact with the application.
Case Study 3: Li	Male, 6 years old	He is high function autistic. Based on the teacher's feedback. He was engaged in the video modelling task and able to arrange the exercise on his own according to the video sequences.
Case Study 4: Vijay	Male, 5 years old	The teacher mention that Vijay needs more time to understand the concept of the imitation. He needs the teacher assists too.
Case Study 5: Akmal	Male, 4 years old	Akmal is described as high function autistic child, and capable to communicate verbally. The teacher noticed his action form the first sessions. Based on the teacher's observation, he was able to complete the entire step on his own.

APPENDIX B

Table B1: Observation notes of the children during data collection (sample only).

Task Analysis of the Target Behaviour	Video-Modelling	Respond To the Sequence	Child's Reaction
Get the brush Get toothpaste Open tap water Wet the brush Put the toothpaste on the brush Close the water Brush your teeth Open the tap water Rinse your mouth Immediately wash your brush Close the tap water	Imitating body movement (✓) Imitating spoken words and using language Join attention Retention the task skill (✓)	Incorrect response Correct response Verbal prompt (✓) Partial physical prompt Independent	He/she is quiet Following the video model instruction Engaging in the video task Able to generalize the skills

Table B2: Case study results based on the observation.

Name	Age	Observational results
Case Study 1: Sean	Male, 8 years old	Sean was able to do the whole sequence of steps independently. In addition, Sean was able to pay more attention to the video and engaged with the teacher. His performance was excellent as he was able to follow the teacher's instruction and able to repeat some sentences.
Case Study 2: Kalash	Female, 4 years old	Kalash is a non-verbal autistic, but she was able to comprehend the video task and perform the tasks. She was able to pronounce the words repeated to her.
Case Study 3: Li	Male, 6 years old	Li is a high function autistic and was able to perform all the tasks perfectly. Li was also able to understand the emoji reward of "Good job".