An Exploratory Qualitative Study AR Self-Care Flashcards

Norhidayah Adnan*
Department of Media and Communication Studies,
University of Malaya,
Kuala Lumpur,
Malaysia
Corresponding author
Email: ava190032@siswa.um.edu.my

Siti Ezaleila Mustafa*
Department of Media and Communication Studies,
University of Malaya,
Kuala Lumpur,
Malaysia
Email: ezaleila@um.edu.my

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**These authors contributed equally to this study*

ABSTRACT

Technology can help educators assist the learning and teaching process in the classroom. This focus needs more encouragement for preschool children who are prone to autism in the context of self-care. These autistic children need to be focused on self-care to prepare them to go to school, as a daily routine, and the basic needs of their social skills. This technology can give them a more enjoyable learning atmosphere with interaction and excitement to use applications and tools. These two contexts have been given early exposure from home. However, the lack of development of teaching materials for these children is significant because of the lack of time and expertise in developing this learning and teaching aid application. The development of teaching aids that are on the market today refers more to blind and mute children, such as studies in the learning system for them that have been widespread. This study aims to examine the appropriate self-care content for autistic children and develop a self-care flashcard application designed with the use of augmented reality technology; the purpose of the development of a self-care flashcard application from educators by personal interview approach states that this study can help make it easier for educators to control the learning environment in the involvement of autistic children to understand self-care in the classroom. Findings identify that personal hygiene and self-feeding skills such as brushing teeth, eating, and bathing are essential for fostering independence in autistic preschool children; these skills align with structures and repetitive teaching methods instead of using traditional flashcards to AR flashcards application as their unique learning styles.

Keywords*: Augmented Reality, Assistive Technology, Autism, Teaching Aid*

INTRODUCTION

Background Research

In the current digital revolution era, technology makes it easier for us to convey information, acts as a medium of communication, helps facilitate daily work, closes ties between countries, creates exciting lessons, and simultaneously provides a good effect in the teaching and learning environment. Technology uses scientific knowledge for practical purposes, can solve problems involving humans and machines, and helps human life or industry (Sheikh et al., 2023). We use technology in various places, for example, at work and in school, for communication, transportation, learning, manufacturing, obtaining data, and many more. This shows that technology is also human knowledge involving tools, materials, and systems. Technology is usually used to produce products tailored to the current needs of humans and industry.

The emergence of the COVID-19 outbreak in 2020 has opened space for everyone to apply technology more in their daily lives (Milan & Lemana II, 2023). This is because its spread can be prevented and controlled by the absence of close physical contact between humans and the closure and restriction of staying indoors, which only contributes to using technology as a communication medium to obtain channels for help at that time. Therefore, this technology has significantly been expanded and encouraged in the early education of children with ASD in Malaysia because education must be enjoyable and not burdened despite different delivery methods. The government's initiative to create online learning is necessary and a step towards digital transformation (Ahmad Muhaimin, 2023). Many educators use teaching aids and materials that align with the current situation to ensure that the teaching syllabus can be delivered as well as possible.

After going through the pandemic, we have become accustomed to adapting technology in learning. In line with the *Dasar Pendidikan Digital (DPD)* (Malaysia, 2023), which wants to produce digitally fluent students and have the values and ethics of using information and communication technology (ICT), the use of technology can help teachers facilitate the teaching and learning process in the classroom (Aminamul Saidah et al., 2023). As teachers, we need to have a variety of teaching techniques for students with the help of technology to attract their interest in classroom activities, especially for students with *murid berkeperluan khas (MBK)*. Analyze the characteristics of students' learning needs with development strategies and improvement of the Education system.

Preschool MBK aged four to six years are the earliest to be emphasized on technological teaching aids to help them remember learning easily and quickly and create edutainment concepts in the learning environment. Self-care subjects should be exposed early to prepare them to manage themselves before entering the Year 1 school environment. For example, how they use the toilet, learn about colors, eat nutritious foods, eat appropriately, brush their teeth, brush their hair, and shower, which should be made a daily routine for self-care (Golubović et al., 2022). They need to learn self-care skills to increase their independence, reduce caregivers' dependency, and promote general health, hygiene, and safety (Golubović et al., 2022; Matson, 2023).

Flashcards are one practical teaching aid for educators teaching MBK using the repetition method in the classroom. Attractive visuals will improve understanding and attract attention when carrying out activities in the classroom. According to Thuy et al.(2004) digital flashcards are technology-based learning media that contain pictures with animations to provide information or a certain amount of knowledge and contain sounds that can help improve the understanding of preschool MBK learning.

Problem Statement

Based on previous studies (Suhaimi & Alias, 2022; Suhaimi & Shaffeei, 2023), learning Self-Care Skills in the *Program Pendidikan Khas Integrasi (PPKI*) found that most educators still use conventional or traditional methods that fail to attract the interest of PPKI students in understanding the learning syllabus, which leads to several shortcomings in using teaching aids. There is no expertise in developing technological BBM; educators need to be more skilled in using visual, auditory, and kinaesthetic (VAK) materials (Suhaimi & Alias, 2022), and they need to gain training in handling digital BBM. Therefore, most educators face problems developing teaching aids and take a long time to produce them themselves (Sani et al., 2023).

In the Malaysian market, many technological BBM devices are more likely to be aimed at blind, mute, and deaf children and less so at preschool children with autism. Self-care flashcards on the market are conventional, namely printed flashcards, and they contain various flashcards according to the content of the topics highlighted. Their flashcards do not have moving multimedia elements, as a previous study (Hayes et al., 2010; Rutherford et al., 2023). stated that moving visual support and apparent and exciting activity visuals will be more likely to build an engaging learning environment that improves the motor skills of ASD children and teaches them. Various technological devices are limited and only consist of tablets and computers (Urrea et al., 2024).

Research Objectives (RO)

The research objectives used in this study are as follows:

RO1 To study the content of self-care that needs to be emphasized for preschool autistic children.

Self-care skills, including personal hygiene, dressing, eating and drinking, toileting, and others, are important for them to improve the quality of life of preschool autistic students. However, these children often face challenges acquiring these skills due to sensory sensitivity, communication difficulties, and motor coordination issues. However, the emphasis on early intervention in teaching self-care skills through structured teaching methods can help and encourage them to be independent in their activities. Based on previous studies, visual support and step-by-step instructions can assist in the learning process, making it easier for MBK. Understanding the most effective areas of self-care can inform the creation of targeted interventions that address the unique needs of this population.

RO2 To develop a self-care flashcard application using augmented reality (AR) technology.

Developing a self-care flashcard application is important to improve the quality of life of autistic children from age 4 to 6 years old and to help educators prepare themselves with teaching aids. Traditional methods of teaching self-care skills always face challenges in their engagement and effectiveness. Recent advances in technology, significantly augmented reality (AR), will be able to offer innovative solutions for MBK educators. AR technology creates interactive and immersive experiences that can be tailored to their learning and teaching needs. This study has demonstrated the potential of AR in educational settings for MBK. For example, an AR-based flashcard application was developed to improve the speaking ability of autistic students, showing significant effectiveness and validity in improving communication skills (Hastuti & Salsabila, 2024). In addition, AR applications were designed to help children with ASD maintain focus by combining flashcards with videos and animations, thereby increasing engagement and learning outcomes. By developing an AR-based self-care flashcard

application, the goal was to create teaching aids to assist all educators in supporting the acquisition of important daily living skills for autistic preschoolers in preparation for them before entering the school world.

Research Questions (RQ)

This study aims to answer the following research questions:

RQ1 What specific self-care skills should be prioritized to support the development of independence in preschool autistic children?

Educators face unique challenges in teaching self-care to preschool autistic students, where these students require motor coordination, sensory sensitivity, and communication. After they learn and practice these self-care skills, they have increased their ability to manage daily routines and build self-confidence more independently. They can reduce the burden of intervention on their educators and caregivers and prepare them before entering the school world. This study aims to identify self-care topics that need to be emphasized to them, such as brushing teeth, eating alone, bathing, and others. The findings of this study will be the basis for the development of teaching aid applications in line with the needs and wishes of preschool autistic students.

RQ2 What are the key design features and technological considerations for developing AR self-care flashcard applications?

The research questions aim to explore the key design features, elements, and technological considerations needed to ensure the effectiveness, usability, and relevance of developing this application for educators. Educators need teaching aids that are tailored to the needs of individual students. The educator determines to select, modify, and personalize self-care tasks. We need to consider the design element of navigation, visuals, compatibility with different devices, and minimal setup requirements. The findings of this study will empower education by providing appropriate features into how technology can enhance learning and teaching about self-care, bridging the gap between traditional methods and modern interactive learning approaches. This application is envisioned as a resource to foster independence in children with ASD while supporting and assisting educators in delivering effective and meaningful education.

LITERATURE REVIEW

Teaching Aids for Students with Special Needs

Teaching aids for children with ASD are designed to facilitate learning, increase engagement, and support the unique educational and developmental needs and desires of these students. Typically, teaching aids are designed to address the sensory, thinking, and communication challenges of most students with this problem by enabling them to better understand and acquire new skills. Teaching aids are important for creating an effective and caring learning environment for children with ASD. By addressing teaching and learning styles, challenges, and strengths, these BBM empower them to achieve academic performance, better socialization, and successful life skills while fostering inclusion and independence in daily activities.

Preschool special needs students are unique students. The learning approach must be more effective and varied regarding visual understanding, learning level, and the effects after learning by analyzing the characteristics of needs and improvements in subject content. Previous studies (Macoskey, 2023) have explained that visual support can improve the performance of level 1 autistic students in vocabulary mastery and recognition. Therefore, the implementation and use of visual training will help these children have fun throughout the learning and teaching process (Thuy et al., 2004). It is very important to encourage them to be more focused and provide a more enjoyable teaching and learning environment in addition to aiming to provide understanding to them.

BBM has a positive effect on improving self-care skills for these students because of its capabilities, the presence of visual structures, and repetitive learning methods tailored to their needs in the form of flashcards. Flashcards are very important for preschool children with ASD because they strengthen memory, improve concentration, encourage active participation, and identify individualization.

The Use of Technology

Mobile applications on phones and tablets have become a daily necessity for humans today. Everyone has the right to access information and use available technology, but not everyone has the same opportunities. The use of technology in education, especially for *murid berkeperluan khas (MBK)*, needs to be improved by providing knowledge and gaining experience for educators in handling BBM. Feedback from them in handling tools using multimedia teaching aids is very important in renewing and applying technology in its latest development (Nor Aainaa & Mohd Norazmi, 2023). The need for technology will further enhance more effective learning and teaching that focuses on a comprehensive understanding of practical self-care in the classroom or at home.

This study (Urrea et al., 2024) addressed the efficacy of technology-based intervention in improving vocabulary learning in children with ASD. Assistive technology devices, which refer to electronic or digital devices, applications, or software that can help improve specific skills, should be highlighted to MBK starting from preschool in Malaysia, too. Many educators have recognized this intervention for applying technology in training to specific areas, such as social communication, academic skills, facial recognition, and communication skills. learning process. They make their learning experiences more interesting, joyful, and interactive, which has a positive effect on improving the quality of their learning.

Multimedia Elements for AR Application Development

Developing AR self-care flashcards for autism educators involves integrating personalized multimedia elements to meet the unique teaching and learning needs of children with autism spectrum disorder (ASD). Incorporating life-like 3D models allows students to visualize self-care tasks tangibly, facilitating understanding and good retention. Studies (Hashim et al., 2022) on AR applications in education emphasize the importance of realistic simulations in improving learning outcomes. Multimedia teaching aids elements such as pictures, diagrams, and videos can provide concentration and are easier to understand (Macoskey, 2023).

Since AR is a rapidly growing field and many users often find themselves using and experiencing AR for the first time, it is important to develop an intuitive product by including clear and precise visual instructions. Augmented reality applications are for teaching purposes. The development of AREmotion is to assist therapists and parents in guiding ASD children to learn about facial and emotional expressions. This AR-adapted book (Miningrum et al., 2021) enhances the recognition of emotional expressions,

provides an interactive and appropriate learning medium for them, and can increase their social skills with AR, namely animation, audio, and video.

Teaching *wudhu* in the form of AR to ASD children, this finding (Pradibta & Wijaya, 2017) revealed that the AR applications used during the study facilitated learning, increased interest, and curiosity in the subject matter, provided significant understanding through their three-dimensional representations that appeal to multiple senses, and offered a sense of realism by allowing students to interact with virtual objects in real-time.

Animated visual aids for ASD children namely Sorari: Sakeun Kanyeri improved their communication and socializing skills (Az-Zahra et al., 2023). The ability of autistic children to improve vocabulary learning is through AR technology flashcards, where this study highlights the collaboration and intervention of educators and parents to adapt to their level of ability. The cARD toolkit consists of flashcards, boards, and applications that use 2D visual elements on the surface of the cards and 3D visuals for AR animation display on tablets (El Shemy et al., 2023).

METHODOLOGY

This study is a qualitative study according to Creswell & Poth (2016) to explore the content of self-care topics and the development of AR technology flashcards that are appropriate for the needs of MBK, especially preschool autistic children. The one-on-one and in-depth interview session was conducted to answer the research questions aimed at obtaining views from educators who often deal with preschool autistic children. The list of interview questions was used as an interview instrument and a guide to answering questions that refer to several parts of the interview questions. Returning to the aim of this study to help educators develop teaching aids that will provide the latest learning methods in line with their needs as preparation before stepping into the school world. The interview was conducted online because this study was conducted from the COVID-19 pandemic era, this interview was recorded by screen laptop recording. The time allocated for the interview for sampling was not only to be recorded but also achieved, challenged and strengthened within a minimum of 30 mins and a maximum of 45 minutes (Jamshed, 2014). All participation and sampling personal information are confidential, and the information is coded as participant only and does not violate university research ethics. For the initial findings of the study, all qualitative data received was transcribed and analyzed using the NVivo software application.

A total of 3 educators who are experts in the field of MBK were selected to be interviewed as a sampling; the characteristics of the educators interviewed should be up-to-date knowledge and experience in teaching and educating these children. According to the study (Sani et al., 2023), this expertise and insight will help obtain important and comprehensive content on self-care topics and develop self-care flashcards using AR technology with appropriate multimedia elements. Table 1 shows the sampling description, which is systematically coded to hide personal information. The samplers were coded as "participants," and numbers from 1 to 3 indicate the sampling code. (see table 1).

Table 1. descriptions of ASD educator and coding

No.	Date of Interview	Job Description	Year(s) of Experience	Coding
Participant 1	4th June 2021	Special Education Teacher	12	P1

Participant 2	4th June 2021	Special Education Teacher	12	P2
Participant 3	5th June 2021	Special Education Teacher	14	P3

Interview Instrument

This study used thematic analysis, referring to Self-Care Skills and the VAK model, namely visual, auditory, and kinaesthetic. Several interview question structures were designed and categorized according to themes and categories in Table 2. Each question was considered to collect and analyze information from the sampling.

Table 2. Interview Questions

Themes	***Categories***	***Questions***
Self-Care Skills	Personal Hygiene	What are the skills for their hygiene?
	Self-Feeding	Are eating and mealtime skills taught in class?
Visual	Colour	Do soft colours visually give soothing vibes for them?
	Illustration	Which illustration they prefer, retro cartoon style or anime cartoon style? (examples of illustration are attached for reference
	Animation	What types of animation can attract their interest? 2D animation or 3D animation?
Auditory	Spoken step-by-step instructions	Do learning instructions about self-care skills need to be done step-by-step by help from narrator?
	Background Music	Should background music be included in the animation? Does it distract or help them?
Kinaesthetic	Teaching Material	What types of teaching aid do you use in classroom?
	Attentiveness	How long can autistic children focus in a single learning session?

ANALYSIS & RESULTS

This section describes the findings of the personal interviews, presenting their analysis of the verbal responses during the interviews. Three sample participants were interviewed online via the Google Meet application for 30 to 55 minutes. Their responses were categorized according to themes: (i) Self-Care skills, (ii) Visual, (iii) Auditory, and (iv) Kinaesthetic. The interview transcript details are provided as follows.

Self-Care Skills

Table 3 shows the coded responses from the three sample participants according to the theme of Self-management skills. This theme contains the categories of (i) personal hygiene, (ii) self-feeding

Table 3. The interview coding in theme self-care skills

Information	Self-Care Skills	
	Personal hygiene	**Self-Feeding**
P1	Understand how to wash hands (after using the toilet, before eating, after playing outside), brush teeth, toilet train, dress and undress, and brush hair.	Learn to use utensils (spoon, fork, knife), drink from a cup or straw, clean up after meals, and introduce proper nutrition plates and safety skills.
P2	Brush teeth, use the toilet properly, bathe, and brush hair.	Eat properly, introduce food groups gradually to expand a child's diet, drink water, sit appropriately at the table, and clean up the table after meals.
P3	Practice putting on and taking off clothes, shoes, and socks, brushing your teeth, using the toilet, brushing your teeth, washing your hands, washing your face, and cutting nails or hair regularly.	Introduce balanced diets, know how to scoop food onto a spoon or fork, sit properly at the table, eat properly at the table, clean up after meals, avoid choking hazards, and recognize foods that are too hot or cold.

Based on interviews with three participants, participant 1 (P1) reported that autistic children need to prepare themselves by learning self-care skills before they enter first grade. Participant 2 (P2) and Participant 3 (P3) agreed with P1's statement.

> *"Most of them will be screened for their level of self-care by the expert before they can enter School or therapy centre."* (P2)

> *"They must be well-known about hygiene, know how to eat by themselves aligned with good manners when eating."* (P3)

All participants stated that these children must master personal hygiene skills such as bathing, brushing their teeth, dressing and undressing, brushing their hair, washing their hands, and using the toilet. This participant was asked whether they learned how to eat and know healthy dishes in preschool. All three participants gave the same argument, agreeing that every preschool child aged 4-6 years presented with the skills to eat on their own, correctly using the utensils provided, sit properly after the food arrives, drink water from a cup, know the nutrition of a healthy diet, clear the table after eating and wash the dishes after eating.

Multimedia Element: Visual Flashcard

Table 4 shows the coded responses from the three sample participants according to the visual theme. In this theme, there are categories consisting of (i) colour, (ii) illustration, and (iii) animation. Visual examples were attached to them consisting of 2 concepts: retro cartoon (figure 1) and anime cartoon (Figure 2)

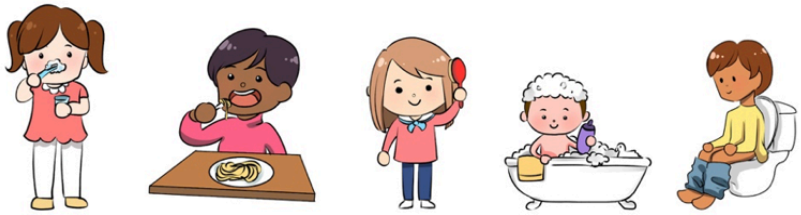

Figure 1. Retro cartoon illustration concept style
(Source: Author's personal collection)

Figure 2. Anime cartoon illustration concept style
(Source: Author's personal collection)

Table 4. The interview coding in theme visual

Information	**Visual**		
	Color	**Illustration**	**Animation**
P1	Blue, green, grey	Anime cartoon style can be a commercial	3D animation is more interesting and easily influenced by the cartoon TV program
P2	Blue, pink, pastel, somehow bright colour	Anime cartoon style, interesting, cute	3D animation, much enjoy; looks like real things
P3	Any natural colour, pastel colour	Anime cartoon style, influenced by a friend who is watching famous Japanese anime	3D animation, familiar with current trends, relevant and accessible style

Soft colours point out to grab attention and soothe ASD children's learning experiences. P1 stated, *"Blue is often associated with calmness, inventing a peaceful atmosphere, reducing anxiety and agitation."*. Furthermore, *P*2 and P3 both say that pastels' hue always facilitates their emotions.

> *"When we combine soft colours like pastel colours with other elements like the presence of light and soft texture, it will help stimulate a sensory-friendly environment."* P2

> *"Baby blue, mint green, blush pink, peach, and lilac are soft colours."* P3

All three agreed that the flashcard's illustrations were anime cartoon-style, and the AR display when the card was scanned was 3D animation.

Multimedia Element: Audio

Table 5 shows the coded responses from the three sampling participants according to the auditory theme. Within this theme are categories consisting of (i) spoken step-by-step and (ii) background music.

Table 5. The interview coding in theme audio

Information	Auditory	
	Spoken step-by-step	**Background music**
P1	Narrators are needed to explain the steps of self-care skills in an organized, clear, and easy-to-understand way; the use of English is more appropriate, and they quickly catch on.	It is helpful, but the audio level can be adjusted while playing.
P2	Yes, a narrator is needed to explain the chosen skills; predictable steps can reduce anxiety and increase confidence in completing class activities.	Depending on the individual's need, some people like music, some do not, but we can still highlight music in a low tone.
P3	The choice of a narrator will help ASD children interact with the phone or tablet screen display.	Background music is somehow good for some ASD children; it can function as a subtle guide for them to take part in the animated interaction. It can draw attention to important moments and sensory and emotional input of the story while providing a more enjoyable experience.

Audio has a good effect in teaching these children to master self-care skills. The study findings from the three participants found that support from the narrator to talk about the steps of the chosen skills will help increase self-confidence. When the learning process repeats, this will increase their memory and practicality.

> "*Children with ASD today are already synonymous with using mobile phones or tablets when doing activities or playing games. Every game instruction is in English, making them more efficient in understanding and accepting instructions in this language."* P3

> *"Predictable instructions such as what they practice in class should be emphasized during application development."* P2

The next question concerns the characteristics of using music as an animation background. Can it help or distract attention during the teaching and learning process? According to the statements from the three participants, background music is needed in developing animations.

> *"We need a button to control the music volume during class activities."* P1

> *"The use of this music depends on the individual or the level of autism the students have."* P2

> *"They will be more interested and aware of the emotions displayed in the animation."* P3

Kinaesthetic Learning

Table 6 shows the coded responses from the three sampling participants according to the kinaesthetic theme. This theme has categories consisting of (i) teaching material and (ii) attentiveness.

Table 6. The interview coding in theme kinaesthetic

Information	Kinaesthetic	
	Teaching material	**Attentiveness**
P1	Visual aids with sensory materials, picture books, and flashcards.	According to their autism level, they will focus on one activity in class for a maximum of 15 minutes.
P2	Depending on the subject matter, social stories, flashcards, soft fabrics, or any texturing surface,	Each activity requires a break time so that they do not get bored and have a tantrum by session.
P3	Flashcards, storybooks and songs, arts and crafts, role-play,	Warming up, learning, break time, refreshing, repetition.

Producing appropriate types of visual aids for teaching aids is important because the teaching and learning methods can be implemented in an orderly manner according to the ability level of preschool children with autism spectrum disorder (ASD). All three statements from participants state the argument for teaching flashcards as a medium always used in their *Pembelajaran dan Pengajaran (PnP).*

Children's attention to a single learning process depends on their learning ability. Therefore, each child will quickly lose concentration if their learning is not interesting and innovative.

> *"There are three levels of children with ASD, namely Level 1: the mildest level, able to independently with minimal support; Level 2: a mid-range level, requires substantial support; Level 3: the most severe level, requires very substantial support. Level 1 and Level 2 tend to focus for 15 minutes."* P1

> *"It is better if each learning or activity is broken down into several sessions and requires pause time."* P2

> *"Learning is more fun if we start with structured and organized instructions, have a repetition method so that they remember and practice and attract their attention because they can focus for the longest in 10 - 20 mins."* P3

CONCLUSION

This research has explored the initial findings of developing an AR technology-based self-care flashcard application adapted for MBK preschool children with autism spectrum disorder (ASD) in Malaysia. This study aims to identify the types of content on self-care skills that are important to fill in this application. Furthermore, this study aims to identify key design elements and technology considerations as teaching aids, emphasizing multimedia elements such as visual, interactive auditory, and movement. Based on the

preliminary findings from the thematic analysis, integrating and combining interactive, visual, and auditory components in developing an AR self-care application can create a more enjoyable, engaging, effective, and personalized teaching and learning experience.

This study explores the development of an Augmented Reality (AR) technology-based self-care flashcard application that aims to support the learning system of preschool autistic children in learning important self-care skills as preparation before moving on to school. The two research questions are as follows: (RQ1) What specific self-care skills should be prioritized to support the development of independence in preschool autistic children effectively? Moreover, (RQ2) What are the key design features and technological considerations for developing an AR self-care flashcard application? Preliminary findings based on thematic analysis provide valuable insights into the content and design of the AR technology flashcard application.

In addressing and resolving the first research question (RQ1), the study was to identify basic self-care skills consisting of the categories: (1) personal hygiene and (2) self-feeding grooming; the study findings found that brushing teeth, eating, brushing hair, bathing and using the toilet were the skills chosen because they can make themselves more independent and free to carry out daily functions as children with autism. The structured nature of the content and the repetitive way it is used make it suitable for inclusion in teaching aids in line with the unique learning style of preschool children with autism.

Regarding the second research question (RQ2), the study emphasizes the importance of incorporating features and design elements of multimedia that are accessible and relevant to them. Multimedia elements that are suitable for the development of this AR self-care flashcard application through thematic analysis are: (1) visual: the use of soft colors tranquil calm and provide a clear focus; the type of illustration display on the flashcard should be designed with the concept of anime cartoon and 3D animation display on the mobile screen after the AR scan, (2) auditory; the use of self-care skill instructions should be done in a step-by-step framework assisted by voice settings to be easy, fast and at the same time attract their interest in learning, incorporating with background music should also be refined and highlighted so that the atmosphere of the 3D animation display is not dull and lastly (3) kinaesthetic; innovative and effective teaching aids for educators assisted by augmented reality (AR) technology and maintain focus during class activity to this group within 10 – 15 minutes duration with guide from the educators.

This study confirms that the AR self-care flashcard potentially improves the development of independence in MBK preschool children with ASD, preparing them for primary school. By focusing on essential self-care skills and utilizing augmented reality (AR) technology combined with thoughtful multimedia design, this application is a valuable teaching aid for educators. Future research should evaluate the application in class activity settings to verify its effectiveness in enhancing learning outcomes. Additionally, the application's unique features can be refined based on user feedback.

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