Development of a Mobile Application Using Augmentative and Alternative Communication and Video Modelling for Autistic Children

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Abstract

Purpose: The aim of this project is to report on a mobile application which has integrated Augmented and Alternative Communication and video modeling approaches. A usability testing has been conducted on the developed application.
Design/methodology/approach: The authors have developed a mobile application, AutiAct. In order to do so, an interview has been conducted with teachers. Observations have been made with 4 ASD children aged 7 to 12 years, each of whom has different types of severity, while usability tests and interview questions have been conducted with 3 teachers from the National Autism Society of Malaysia (NASOM) to test the effectiveness of AutiAct.
Findings: A mobile application, AutiAct, has been developed through the introduction of video modeling and Augmentative Alternative Communication approaches to assist autistic children in their everyday routine. The procedure in the application is simple and can be followed step by step for autistic children. Based on the testing, all the respondents have 100% agreed that AutiAct is an appropriate tool to assist and enhance autism children with their daily life skills. Results also have shown that video modelling and AAC are an important tool to be used to improve the abilities of autistic children.
Practical implications: Results have shown that AutiAct is reliable to help autistic children improve their independent skills so that they will depend less on their parents as they grow older and that it also embeds a character building for autistic children to help them shape their personality and characteristics.

Keywords: Mobile application, Augmented and Alternative Communication, Video Modeling, Autistic Children

Introduction

Autism Spectrum Disorder (ASD) is a mental disorder that affects the communication and behavior of a person at an early age. However, as symptoms and initial signs may appear in the early stages of development, social deficits and behavioral patterns may not be recognized as ASD symptoms until the child is unable to meet the social , educational, occupational and other important life-stage requirements (Dijkhuis et al., 2020). Children who suffer from ASD are more likely to have difficulty in communicating and interacting with people around them

(Crowell et al., 2019). They will also have limited interests and repetitive behaviours that can be so easily distracted by anything that can attract their interests. ASD may be a lifelong disorder, but treatment and services may improve the ability of a person who has been diagnosed to function as a normal person. Children with ASD have struggled with their social communication impairment. Their auditory skills are their biggest flaw, while their visual sensory abilities are their main quality. They have difficulty remembering or recognizing what happens in each situation. Communicating with other people is difficult for them or it is also difficult for other people to understand what they needed. Wan Fatimah & Iman Nur Nabilah (2015) claimed that, in improving their skills, independence skills will enable them to include communication and social skills.

Most of the current mobile apps that have been developed focus on how to carry out their daily routine or teach them how to express their emotions. These autistic children have trouble reading what others think or feel because they cannot understand social clues, such as voice tone or facial expressions, However, they can watch other people turn their faces up for clues about acceptable actions. Unfortunately, there are only few of the current mobile apps that have built characters into their apps. Research has also shown that using the mobile applications could have attracted an autistic child for longer periods of time. Furthermore, current teaching material is a lack of adequate or necessary therapeutic effect for the students (Azahari et al. 2017).

The paper will therefore discuss the development of mobile applications that have integrated Augmented and Alternative Communication (AAC) and Video Modeling (VM) approaches. The application will focus on embedded moral values and ASD children with autism severity at level 2.

Literature Review

Technology has been the main driver of day-to-day activity and productivity for humans in the last decades. Mobile applications are the most interesting technology that can be used to help ASD children improve their skills because they came with devices such as tablets and mobile phones that can be used as a teaching aid for ASD children to be more focused and interested in learning. ASD children usually respond well to the visual approach that has been used to help them improve their skills, and it is also easy for them to understand and imitate them. According to Valencia et al. (2019), advances in information technology will influence teaching skills by complementing rather than removing traditional classroom instruction.

Technology has gradually taken part in the everyday life of humans and for most people, a day without technology will become impossible. It has literally been used in every sector that includes education. It helps make the job easier to handle and become more productive. With children with ASD, they require technology to help them carry out their everyday lives and interact more effectively with those around them, because they have trouble communicating their desires or feelings. Therefore, education can now become more interactive and stimulating with the rise of technology.

Through the aid of technology, schooling has now been enhanced, so it can boost a student's success. A student can search for information on the internet using the technology. Children with ASD, can now study using a computer. It can be better than studying with a teacher in a typical classroom because the teacher cannot concentrate solely on one student. This is because children with ASD require a great deal of care and supervision to teach them to improve their abilities. It can be very difficult because they have different forms of symptoms and are all special in their own way. However, parents, the specialists and teachers are always help them to improve their quality of life, no matter how different they may be from other normal people.

Therefore, helping them carry out their daily lives with a mobile app that is interactive and stimulating will be able to help them to focus effectively.

Improving autistic children's skills can be quite challenging, as each of them has different symptoms and each child is unique. The learning, reasoning, and problem-solving skills of people living with ASD can also vary from talented to seriously impaired. Every day, these autistic children face many challenges, such as difficulty in communicating their feelings and emotions that often make them act aggressively towards people around them, especially their parents. With minimal supervision from their parents or caregivers, this project aims to improve their independent skills by helping them to carry out their daily life activities.

Video modeling

Video modeling approach is a form of teaching in which a person watches a video of someone performing an activity and mimics the activity itself. Video modeling requires a professional confederate demonstrating a specific skill on videotape. According to Watkins et al. (2018), this videotape will be shown regularly to a subject who can perform the task in real-life environment. Ashoba & Seyedeh (2019) have reported, autism children attend video models rather than live models as it helps them reduce the level of anxiety and depression associated with certain social experiences. Video modeling can be used to activate the visual senses and children with ASD are a visual learner who learn best through visual instruction. It removes the needs of person-to - person interaction that can cause anxiety and stress to children with ASD and allows them to focus on the video about what they are taught. Visual modeling technique will be used in project creation to allow the ASD children to demonstrate themselves performing the task that will be demonstrated to them in step-by - step. Through guidance from their parents they should be able to learn more effectively and practice it by themselves.

According to Seray et al. (2019), there are four types of video modeling that can be used and applied which are simple video modeling, video self-modeling, point-of - view modeling and video prompting. Basic video modeling is the one chosen which will be used as a test creation technique for the mobile application. This can be identified when another person or other people demonstrate a specific expected behavior and shown to the learner through a video. Video self-modeling is a positive method in which it aims to develop new skills and improve the current skills of autistic children. Point-of - view video modeling defines a particular and transparent predicted action that is videotaped and displayed to the learner from the learner 's perspective. For instance, the video shows two hands attempting to tie the shoelaces, but it's filmed from the learner 's perspective. Finally, video prompting is when the desired behavior or activity is broken down into separate measures to be demonstrated to the learner and videotaped.

Augmentative and Alternative Communication

Augmentative and Alternative Communication Approach or also known as AAC is a type of communication used instead of or in combination with conversation. The use of AAC has proven beneficial to individuals with ASD in recent decades (Louiza & Christopoulou 2017). AAC devices can provide a way to communicate its wishes and needs while allowing the individual to engage in meaningful communicative exchanges with others in their environment. It helps people unable to interact effectively as a regular person. This encompasses an immense variety of methods to assist or replace spoken contact. There are 2 major AAC types which are unassisted systems and assisted systems. Unassisted machine makes use of body language, movements, facial or sign language to communicate with men. Aided systems used either simple or high-tech instruments or equipment. Touching images on a tablet screen is one of the high-tech supported systems and will be introduced in project creation.

Therefore, the main objectives for including the AAC include to be able to spontaneously generate words / sentences / sentences that are not planned or decided by their communication partner. Since AAC can provide non-speaking individuals with ways to greet others, ask questions, collect information from others, participate in socially appropriate / anticipated interactions, make remarks, remember past events, tell stories, display sympathy, it will be adopted in the development of the mobile application.

Related Work

AutiSay, as shown in Fig 1, is developed by Voon et al. (2016) for the children with autism who have difficulty in verbally communicating with others. This has also been designed to be versatile and to capture meaning and information specific to autistic children with ease. For the app, there will be two modes of login: one for parent and the other one for the child to login. The parent login serves as an administrator because they can monitor all material in the program according to the needs of their child and that will allow them to better understand what their child wants. AutiSay has a customizable feature which allows the use of parent login to input for step- by - step tasks. However, AutiSay does not help to improve the independencies of the child. All the activities will rely on their parents, who will need to carry out their everyday routine. This will just make the parents to communicate more about their needs rather than the child.
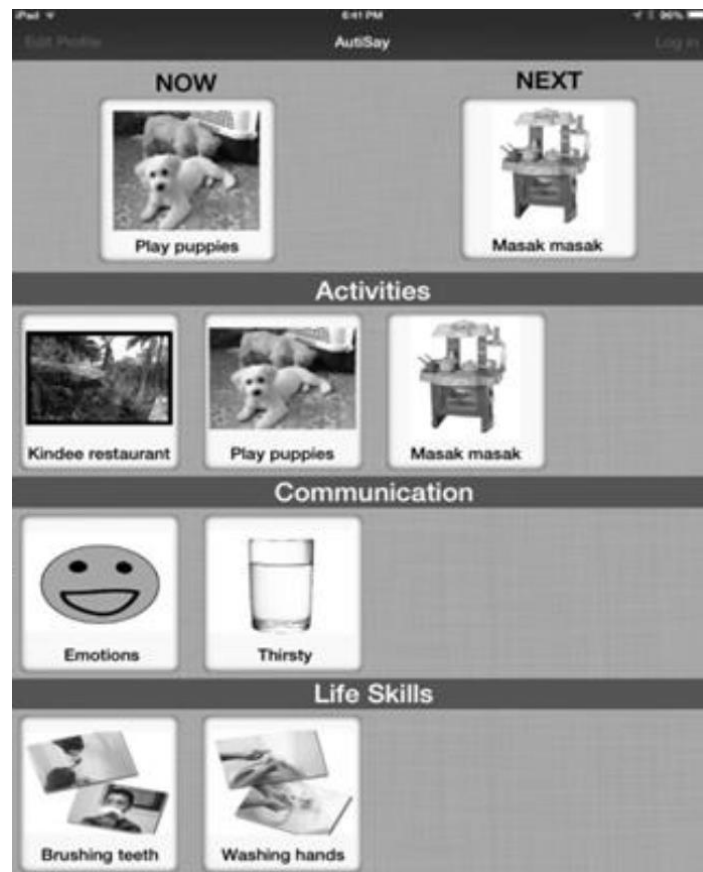

Figure 1: Interface design of Autisay

WordToob (https://apps.apple.com/us/app/wordtoob) is a smartphone application created by John Halloran that helps autistic children to learn from the various viewpoints and explain the sense of vocabulary. If a user taps an image like a word, a short video will appear explaining

the context of the word to help them understand it more easily. However, WordToob has too many elements on a single interface and the autistic child can be too crowded to concentrate on many things at once. This is shown in Figure 2.
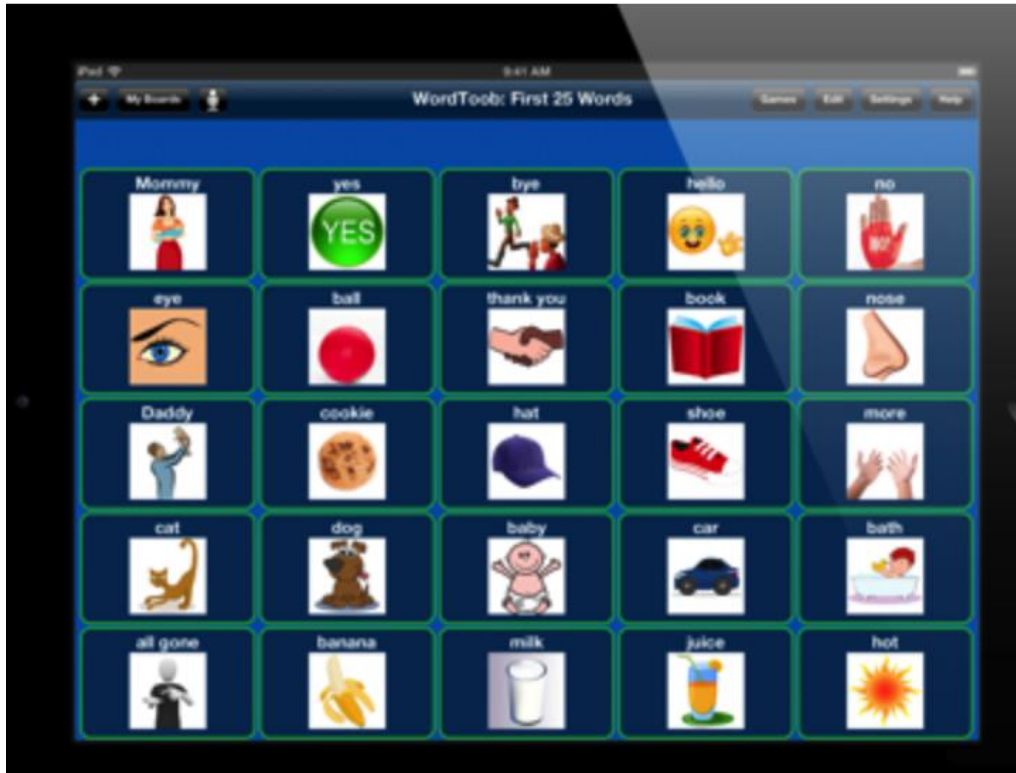

Figure 2: Interface design of WordToob

Little Routine developed by Iman Nur Nabila, is an interactive application which teaches the autistic child based on their everyday surroundings (Wan Fatimah & Iman Nur Nabilah, 2015). The children need to choose which location of routine they want to follow. It helps to improve their independent skills, but the system will not allow them to record themselves to imitate the action provided in the system, so it will not be effective in improving their skills for them. The mobile app received some feedback and advice to add more animations and jiggles because it was slow and too easy to get ASD kids to concentrate on the game.

Life Skills Winner as depicted in Figure 4, teaches autistic children social and life skills, as well as individual special needs (https://abledata.acl.gov/product/life-skills-winner-app). This was meant for the individual who is suffering from memory loss, autism and having attention problems. The program provides the users with step-by - step instructions to follow in a game format. Their tasks vary from brushing teeth which is the self-skills and social skills where they provide instructions the right way to talk and communicate with people.
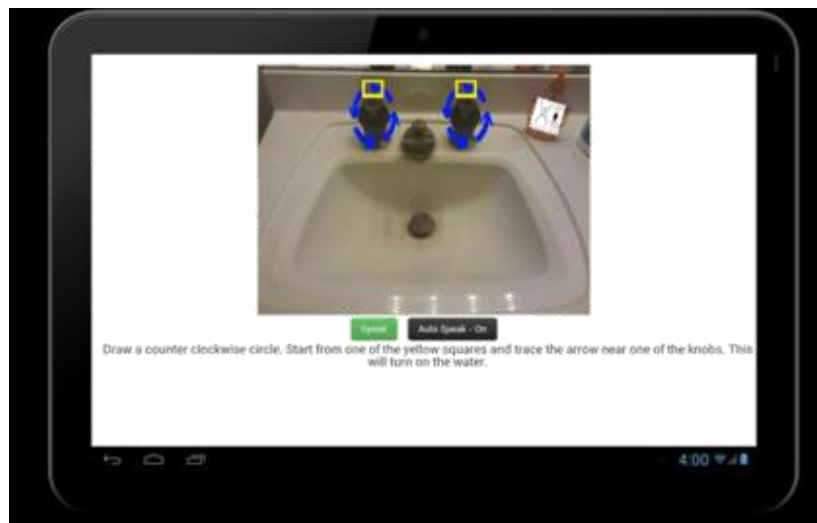
Figure 3: Interface design of Little Routine

Figure 4: Interaction game in Life Skills Winner

Table 1 provides a comparative study of few existing smartphone apps created to support autistic children with communication skills and everyday life skills.

Table 1: Comparison of current mobile application

Name	Category	Platform	Age	Presentation type
AutiSay	1. Activities 2. Communication 3. Life Skills	1. iPad	5-12	Animation
WordToob	1. Vocabulary 2. Behaviour 3. Face Expression	1. iPhone 2. iPad	All age	Animation
Little Routine	1. Life skills	1. Android	5-12	Human
Life Skills Winner	1. Social skills 2. Life skills 3. Face expression	1. iPad 2. iPhone 3. Android	All age	Animation

Method

A mobile application, AutiAct, has been developed using React Native, an open source mobile application framework that was created by Facebook. React components cover existing native code and communicate with native APIs through the declarative UI paradigm and Javascript provided by React using HTML. Video modeling and Augmentative Alternative Communication (AAC) approaches are implemented for the mobile application in order to assist autistic children in their daily routine. Each concept is based on the product criteria gathered from Autism Centre 's teachers literature reviews and interviews. This also offers an engaging platform for autistic children to develop and improve their social skills and create character. An interview with 3 National Autism Society of Malaysia (NASOM) teachers was conducted to collect knowledge on how autistic children are acting and practice their everyday routine or self-skills. An observation was also conducted at NASOM with 4 autistic children aged between 7 and 12 years with varying symptoms of autism to see whether they will adopt the step-by - step guide demonstrated by AutiAct.

Results and Discussions

AutiAct

The purpose of AutiAct is to help children with autism fulfil their routine of everyday life without intervention from their parents or teachers. AutiAct is developed and has been integrated with a combination of video modelling and AAC. AutiAct allows an individual to watch a video performing a routine daily action such as washing hands, brushing teeth, and washing face. The user may choose to imitate the action in the video and save the video if they want to revisit it later and watch the performance. The children must pick which module they want to know, and they will play it for them. AutiAct has 3 simple, medium, and hard-wearing modules. -- module has different routines, depending on its level of difficulty. This mobile application offers an immersive experience as a video shows all the activities that will be shown to the autistic children. They can practise and mimic the routine by registering themselves for assessment of their parents or teachers in the application where the captured video will be saved in the 'Performance Video' tab. Figure 5 displays the prototype flow, which consists of daily routine.
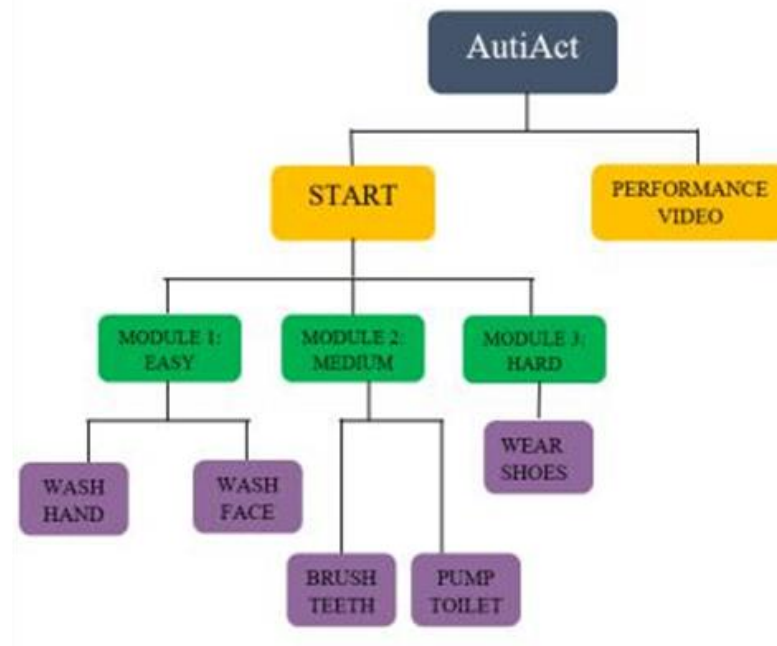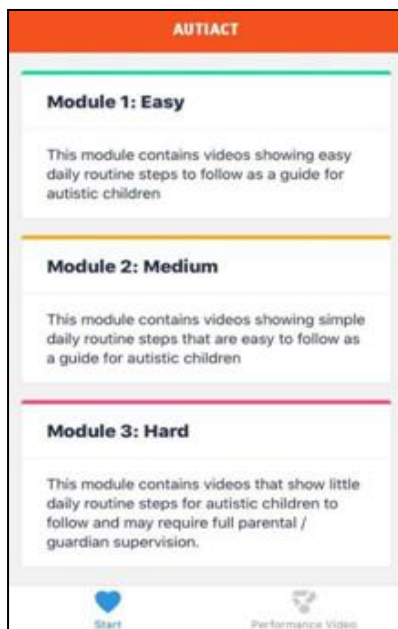
Figure 5: AutiAct Flow

Figure 6 (a) shows the app's main page showing 2 tabs with different feature types that are 'Start' and 'Performance Video.' AutiAct consists of 2 languages which are in English and Malay and will be set up in accordance with the language of the apps. Figure 6 (b) shows the routine training video.

(a)

(b)

Figure 6: Interfaces of Main Page and Routine Training Video

All the repetitive videos shown to autistic children consist of step - by - step video. This way will assist them to learn effectively. They will be able to understand each move they have learned, and it will be easy for them to mimic the action when they decide to record themselves doing the routine. The strategy is successful in helping ASD children to develop their self-skills and their independence skills.

Interview

The purpose of the interview was to examine the actions of children with autism, to obtain a deeper understanding of the behaviour of children and to ask for their help during the usability testing of the mobile app. The teachers accept that each autistic child behaves differently in school, depending on their severity. Some children with mild severity may follow the instructions provided by their parents or teachers, but some of them do not follow the instructions easily. Autistic children are more likely not to obey guidance while they are at home. They can also easily be distracted, which can be caused by several factors, such as the climate. The normal steps taken to teach them effectively are to make them concentrate and maintain eye contact with them. They also need to regularly practise their behaviours and strategies learned at school the same way they do at home because they do not have the capacity to perform various activities or steps at a time. They would be autonomous if the action they were taught at school was the same action they were taught at home.

Autistic children have not been able to take so many different acts or moves. According to the teachers, most autistic children have social abilities to mimic people's behaviour. Typically, autistic children mimic the teacher's interaction or actions at school, and it is really important for teachers or even parents to monitor their conduct while they are in front of autistic children to ensure that they emulate the correct behaviour. Video Modeling and AAC are an important tool to be used to improve the abilities of autistic children. In their view, the move taken in the video must be very straightforward for autistic children to grasp the message and should not be too long to avoid confusing them. Autistic children are more drawn to vibrant and real-life representations as they can increase their learning interest. It is more effective to take advantage of an image they have already learned, such as in their house.

Observation

Observations are made to observe the reaction of autistic children to the AutiAct mobile app. 4 autistic children aged 7 to 12 years have been selected to experience the AutiAct. 3 of the children have moderate autism symptoms while one is under severe level. The mobile app was shown to autistic children. First, they are shown the step-by - step guide. At first, three of them watched the video, but only one of the children with very mild intensity is not distracted from watching the video from the beginning to the end. These children can mimic the behaviour of other people from the videos shown to them.

Usability Testing

Teachers assessed the mobile app on efficiency, effectiveness and user satisfaction based on observation of children with autism when performing usability testing. They were asked to answer the questionnaire to express their evaluation on the AutiAct. The questions are adapted from Wan Fatimah et al (2015). The description of the findings of the questionnaire is shown in Table 2.

Table 2: Results of Usability Testing

No.	Statement	R1	R2	R3
Efficiency				
1.	AutiAct would be easy to understand by children with autism.	Agree	Agree	Agree
2.	Videos in AutiAct are easy to understand and clear	Agree	Agree	Agree
3.	It took too long to understand the message	Neutral	Disagree	Neutral
Effectiveness				
4.	The voice that spoke out the instructions are clear and easy to understand	Neutral	Agree	Agree
5.	Do you think the student should record themselves imitate the action shown to them?	Agree	Neutral	Agree
6.	The step by step video played in AutiAct are easy to understand as video modelling approach for autistic children	Agree	Agree	Agree
7.	The picture and the model used in the video are a good AAC approach for autistic children	Agree	Agree	Agree
User Satisfaction				
8.	I liked AutiAct	Agree	Agree	Agree
9.	I would recommend AutiAct to autism children	Agree	Agree	Agree
10.	AutiAct is an appropriate approach to assist and enhance autism children with their daily life skills	Neutral	Agree	Strongly Agree

Conclusion

The paper addressed the development of the mobile application, AutiAct, which adapted video processing and Augmentative and Alternative Communication approaches. The findings also confirmed the usefulness of video modelling and Augmentative and Alternative Communication in the application. The app can be used by autistic children to help them carry out their everyday routine. Future recommendations include to use of actual photos on the activity icon instead of clip art or cartoon. The improvements should also include the use og colourful or bright colour on the user interface to gain focus from autistic children. Thses are important to ensure that autistic children will be attracted and to capture their attention.

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