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Jawi Alphabot:
A Jawi Teaching Robot for Children with Autism

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ABSTRACT

The children who have disability in their social interaction and communication are categorized as children with autism. Often autistic children are facing challenges in independent living causing many concerns toward teaching and learning for the autistic children. As a result, therapists and educators of autistic children are facing distress when teaching the autistic children as it is harder to retain their attention during the learning process. Hence, there are some researchers suggest robotic approach as clinical tool to assist therapist especially teachers in teaching session with autistic children. Therefore, this research is focusing on developing a robot to teach the basic Jawi modules to the autistic children. The objective of this paper is twofold, presenting: (1) the ways Jawi Alphabot is programmed to perform teaching, and 2) the attentive assessment results that shows the effectiveness of robotics intervention in learning Jawi among the autistics. Besides, a module for the teacher and the children is also available as a guideline for them to implement this robotic learning process. During the experimental design testing, the autistic children are divided into two groups (i.e. control group and experimental group) and were given different intervention in learning Jawi. The intervention in learning Jawi are: 1) traditional method and 2) robotics intervention method. The results are discussed with evidences that highlights how robotics intervention could alleviate attentiveness in learning among the autistic children.

Key words : Autism, Autistic Children, Jawi, Robotics Intervention

1. INTRODUCTION

As stated in [1], Autism Spectrum Disorder (ASD) is characterized by the general abnormalities in social interactions and communication, as well as severely restricted interests and highly repetitive behavior. Some theories try to describe the reasons why the autistics keen to interact with technological tools. For examples, the autistics children tend to have difficulties in identifying the mental states of others such as beliefs, desires, intentions, imagination and emotions that may cause some difficulties in interacting with others [2]. Therefore, it is too difficult for them to discern social human or human interactions and thus, prefer technological tools to simplify their interactions and make it more predictable. With some considerations, several autism specialists suggest that autistics tend to learn more from interaction with technology rather than from the interaction with human beings. Thus, robots might have the potential to be used in ASD therapies as mediators between human models and the autistics [3].

The choice for a robot mediated approach to psychological intervention for ASD children is justified by several advantages. Firstly, according to [4], children with Austism will be become more responsive reaction when they are administered through technology rather than a human. Other than that, robots can be programmed to gradually increase the complexity of the tasks, by solely presenting relevant information. Moreover, information can be repeated in the same format, without trainers getting fatigue. Lastly, according to [5], robots are product that is programmable, controllable and non-judgmental thus makes the autistics feel comfortable to be with.

2. RELATED WORK

Educators of autistic children especially teachers went through a specific training on ASD as part of their curriculum and work [6]. Today, there have been many awareness programs by on autism and more responsibilities come together in teaching the autistics, which indirectly raising many educational challenges [7]. Many of teachers faces psychological distress when dealing with autistic children regardless of the school setting. Therefore, this study aims to addresses the challenges and difficulties that requires constant perseverance when educating the autistic children through the introduction of robotics intervention.

According to the current syllabus used in 'Kurikulum Standard Sekolah Rendah Pendidikan Khas Malaysia' (Masalah Pembelajaran) prepared the by Ministry of Education of Malaysia, there are several methods that involves in teaching the autistic children at school, that include:

A. 'Belajar Melalui Bermain' (BMB)

Aims to attract the students' interest and attention during learning process through 'learn and play method'.

B. 'Pengajaran Bertema' (PB)

Themed and topic chosen by teacher must be relatable with the students' environment.

C. Mastery Learning Skill

Approach used to help the student to know and improvise their ability and willingness.

Through these approaches, a teacher's role varies which include: creating a positive atmosphere for the learning process; explaining to students about their role in doing certain task or exercises; ensuring the learning material is in the right place; and also share the feelings and thoughts with student without controlling them during the learning process. Although, with many approaches and methods used in educating the autistics, researches are suggesting technological intervention to be applied into the current autistic education practices. Therefore, many have recommended for robotics approaches to be part of education and therapeutic tools. Moreover, many clinical interventions have started to include robotic approaches as part of the education and therapy for the autistics [8]. Many researches and programmers have developed various kind of robots with aim to improve the learning skills of the autistics. Many are focusing on developing robots that are interactive and have the ability to communicate with the the autistics with the aim of improving the outcome of therapy. Nonetheless, none of them are found to be developing a robot that assists teachers in teaching basic Jawi letters for the autistics. Therefore, due to the limited robots that could teach Jawi, a comparison has been made based on functionalities of other robots that are built and meant to teach the autistics (refer to Table 1).

Table 1: Comparative Studies of Existing Robotic Technologies

Specifications	Milo Robot	Roboteach	Rainbow Jawi Application	Jawi Alphabot
Purpose and Functionality	-To improve cognitive, emotional and social Interacts with children - Express emotions for child to Identify [9][10]	- To assists teacher and therapist teach expression to improve social and communications skills - Interacts with children [11]	- To teach Basic Jawi letters by using mobile devices. - Teaching process is through video player [12]	- To teach basic Jawi letters to child through writing and pronounce - Detect colours that represent the letters - Helps both teacher and children interacts better with each other - Students will have assessment according to the encoded group of letters from the module provided - Mark will be given and recorded in to record child performance.
Product materials/ design	Nao Robot	Lego EV3	Android Mobile Application	Lego EV3
Unique proposition	Humanoid, sound	Sound, colour sensor	Sound, Animation	Colour sensors, sound, practical learning approach
Price Range	Expensive	Medium	Low	Medium

3. SOME COMMON MISTAKES

Our preliminary interviews with teachers has shown that Jawi skills are important for the autistics. This is due to the fact that learning and recognizing basic Jawi letters is a crucial step towards grasping the skills of writing and reading Jawi. Moreover, teachers also highlighted that teaching basic Jawi letters would be helpful for the autistics to develop and improve their skills to redraw and pronounce the letters correctly. Thus, from the interviews conducted, it was evident that teaching basic Jawi letters is found to be significant in teaching and learning the autistics. In addition, a few interviews were also conducted with selected parents and guardians. It was found that all of them were supportive towards the idea of having a robotic approach in teaching and learning basic Jawi.

Based on the positive feedback gathered from the interviews, the Jawi Alphabot is developed. It was developed using LEGO Mindstorm EV3, a programmable robotic kit which uses LEGO building part and a little CPU called programmable brick. The prototype is as shown in Figure 1.

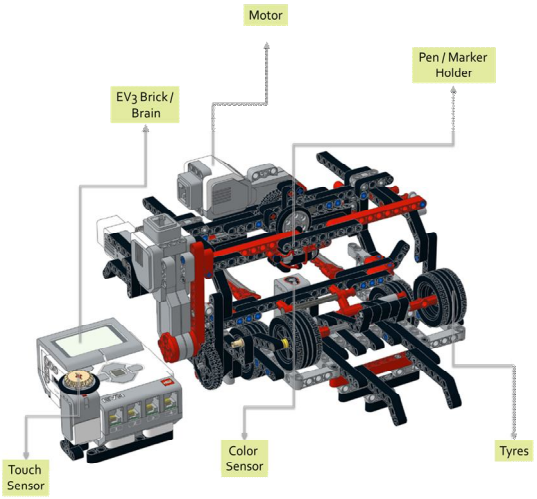

Figure 1: Jawi Alphabot

There are 30 basic Jawi letters taught by the Jawi Alphabot. The Jawi letters are divided into six modules. Each module consists of five letters as shown in Figure 2. The modules will help the autistics to better grasp and remember the letters. The letters in each group were assigned based on the different pattern of the letter itself. It was learnt that having a different pattern would help the autistics to better recognize each of the letter and not being confused. For example, the first module shown in Figure 2 has the letters 'ا ب ج د س' which are all having different illustrations. Further, each Jawi letter is represented by a colour code as shown in Figure 2.

Figure 2: Group of Jawi Letter Encoded

The Jawi Alphabot is built with two unique functions that assist teaching and learning as further explained in the following paragraphs:

Printing **-** It is the function that will wait for the user to enter the Jawi letter and print the letter that are encoded. If the sheet is not already in the printer, it will first operate the paper feed motors to pull a sheet of paper into the printer. The function can be stopped by pressing the center button on the EV3. This will return the pen to the resting position and feed the printed sheet of paper out. If the function is cancelled manually, user will have to reset the pen position manually and usually have to recalibrate it. The function of printing is depicted in a flowchart shown in Figure 3.

Scanning **-** This is the program that will be used to scan the color of the letter card and identify the letter that are encoded. This program is designed for assessments after the learning process. Before scanning the card on the color sensor, user needs to select first the letter that need to be tested. After the user clicks on the letter then the user has to put the card letter on the color sensor, and it will identify the letter on the card through the colour detection. The function of printing is depicted in a flowchart shown in Figure 4.

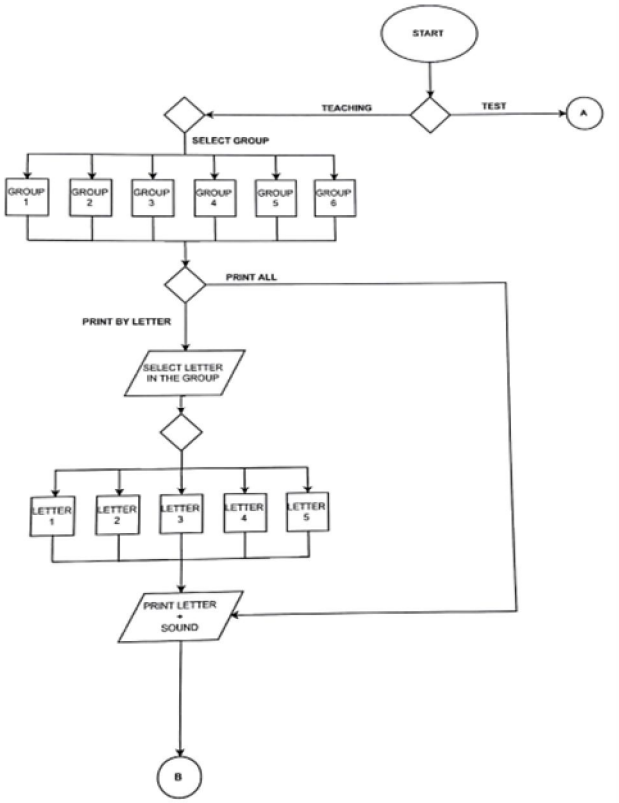

Figure 3: Jawi Alphabot Flowchart for Calibration and Printing

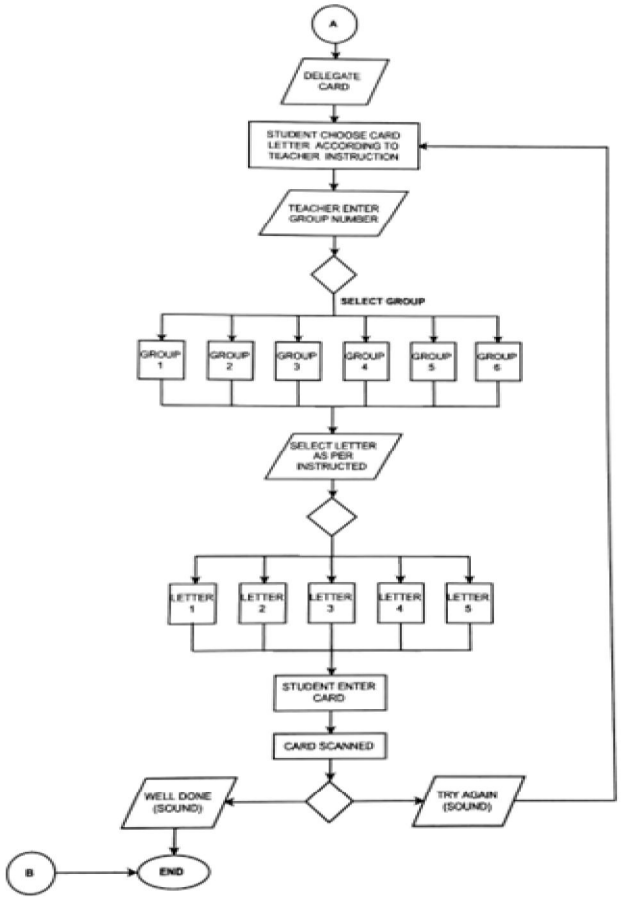

Figure 4: Jawi Alphabot Flowchart for Scanning

4. RESULTS AND DISCUSSIONS

An assessment was conducted at two public schools that has special needs stream classes. In the first school which is SK Sultan Yussof Batu Gajah, Perak Malaysia, four autistic respondents aged between 10 and 11 has participated. The second school was SK Coronation Park, Ipoh Perak Malaysia and four autistic respondents aged between 12 and 13 has participated. They are divided into two groups which are the experimental and control groups. A traditional method of learning Jawi was performed to the control groups while the robotics approach was performed to the experimental group. The assessment and observations took approximately 2 hours. Each student from different group were given time to learn using the approach planned, and their concentration level and focus were observed. The attentiveness level is one of the indicator used to measure effectiveness as the autistic students were incapable of answering the assessment questions by themselves and need close supervision from the teachers. The results on attentiveness are shown in Figure 5. Referring to Figure 5 and 6, Student Group 1 is referring to the control group while Student Group 2 is referring to the experimental group.

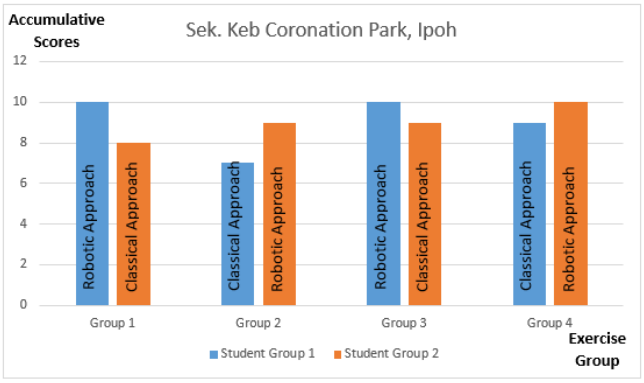

Figure 5: Attentiveness Assessment Results at SK Coronation Park, Ipoh

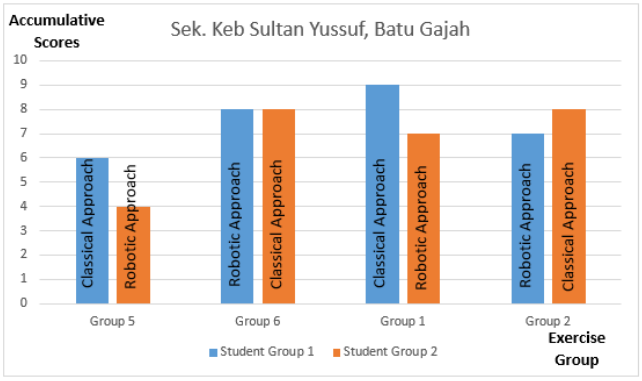

Figure 6: Attentiveness Assessment Results at SK Sultan Yusuf, Batu Gajah

Robotic Approach Scores	**Mean**	9.5	**Median**	10
Classical Approach Scores	**Mean**	8.25	**Median**	8.5

Figure 7: Mean & Median score by each group for each session for SK Coronation Park, Ipoh

Robotic Approach Scores	**Mean**	7.75	**Median**	8
Classical Approach Scores	**Mean**	7.25	**Median**	7

Figure 8: Mean & Median score by each group for each session for SK Sultan Yussuf, Batu Gajah

The results have shown that the students' attentiveness is better when learning using the robotic approach. It was concluded that the autistic kids have longer focus time-span during the teaching and learning session with the Jawi Alphabot. Therefore, results have shown that autistic students have shown a positive reaction in learning using the Jawi Alphabot. It was also observed that the students were attentively listening and focusing to the robot for a longer period of time. With that, this study posits that robotics intervention brings effectiveness in teaching and learning Jawi in terms of attentiveness.

Furthermore, from the observation conducted, it was seen that the autistic students have interacted with the robots well. They were seen to be attracted to the robot and listening to it and looking at the movement conducted by the robot. This has made let them play with the robot and at the same time learning the Jawi letters. The learning time was increased, and students were sitting attentively and found motivated to learn. Lastly, the module prepared as guideline for teachers, therapist and parents were reviewed by selected teachers in both schools. They agree that the module is understandable and easy to be referred to. Hence, this study concludes that robotic intervention has a significant potential in helping the autistics students and their teachers in teaching and learning.

5. CONCLUSION

Jawi Alphabot was tested on eight children with austism with the aim to improve their attentiveness level towards the teaching and learning of Jawi. It was found that Jawi Alphabot is able to increase the focus level of the students towards the teaching session as compared to the traditional or classical approach. A robotic approach can be a great assistive tool for special education teachers and therapists in dealing with autistic children. Jawi Alphabot has the potential to be an assistive tools in teaching Jawi to autistic children to compliment the current teaching and learning method used in public schools in Malaysia.

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