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The improvement of autism spectrum disorders on children communication ability with PECS method Multimedia Augmented Reality-Based

Taryadi¹ and I Kurniawan²

^{1,2}Dept. of Information Technology, STMIK Widya Pratama Pekalongan, Indonesia,

Email: tari_ball@stmik-wp.ac.id, ichwan.kurniawan@gmail.com

Abstract. This research was done to examine the usage of PECS method (Picture Exchange Communication System) multimedia augmented reality based as a learning alternative in training the communication of autism children. The aim of this research were developing an approach to improve the communication ability before and after an intervention with PECS multimedia augmented reality method. The subject of this research were 12 autism children in Inclusion school in Pekalongan region. The experiment method was used with the single subject research approach. The research resulted that the average ability level in communication before and after the treatment has shown 47% while during the treatment the average level is 65%. Whereas there is an improvement after intervention stage with the average of 76%..

1. Introduction

Communication is an activity of transferring message to other people by using (a) vocal gesture, and eye movement combine with the attention to the object or people; or (b) by conventional gesture or symbol (such as, saying words or language symbol). [1]. the three main functions used in communication in pre-linguistic period are attention, collective attention, and body movement. [2]. These three matters become the basic composer of communication ability, on account of these there process, children start to understand information of their world, also understanding that other people perspective may be different from them. Furthermore, children will develop more complex communication ability such as: asking help, negotiation, commenting, as well as social communication. [3].

One of the characteristics of child development with autism spectrum disorders (ASD) is lack of communication development. And in fact, the often complain raised by parents when they take their children to autism therapist is a communication barrier. Communication barrier causes a difficulty in children learning and their behaviour seems to be uncontrolled. The stage of communication is not running smoothly in ASD child. Furthermore the communication environment is an important relation to get the outcome in gaining the bonding with ASD child.[4][5].

In addition to the communication barrier, social mutualism has also become one of the weaknesses of autism child. Some researchers have shown that the improvement of the stage of communication is by improving collective attention and moving will release the behaviour of ASD child communication. [6].

Unfortunately, it is a difficult matter to gain and train the collective attention communication in ASD children. The motivation to start the collective attention is a skill from social attention and social interaction. [3]. The collective attention activity occurred by the response from the children and a part of interest or positive influence, not by verbal response. Despite of that teacher cannot ask children to pay attention if they do not start the attention, thus treatment is needed to the ASD child teacher to start the attention. [7].



Method of communication intervention is Picture Exchange Communication System. Since PECS is not involving the social interaction or an understanding by the support of an adult, thus it will be useful for the learning of ASD children. The general treatment to the children gives a significant effect to them. The research on ASD children showed that the accuracy of PECS method in session of communication is requested. [8].

Most of the autism children have better visual memory than auditory memory. Autism children are able to understand and remember more through visual learning or visual thinking, by visual learning they tend to be easily concentrate and understand such learning. The use of media with visual strategy can possibly be implemented in teaching the communication ability.[9]

Based on the concept of PECS method, an augmented reality multimedia will be developed for autism child in communication learning. The application is expected to be able to support an autism child in improving the communication skill and gives an effective practical value. Herein, the augmented reality multimedia application with PECS method is such way of intervention in improving the autism children in communication skill.

The aim of this research was to see how far the usage of PECS method that is developed by augmented reality multimedia technology may support the improvement of the ASD child communication.

2. PECS for ASD child

PECS (Picture Exchange Communication System) is an approach in communication training using verbal symbols. [10]. PECS is designed by Andrew Bondy and Lori Frost in 1985 and started to publish in 1994 in the United States. At the early times PECS was used for pre-school students with autism syndrome and other unusual condition related to the communication problem. PECS was used by the student whose language development is not good and the one who is not having a willingness to communicate to others. In subsequent developments the use of PECS has expanded to the age stage and so on. [11].

In regard to PECS, it is not automatically children will be talking, but by the support of pictures or symbols hence the understanding of the verbal transferring language can be clearly understood. At the early stage, children are introduced with non-verbal symbols, whereas at the final stage of PECS usage, children are motivated to be able to speak. Despite PECS is not a program for autism children in teaching about how to speak, it is believed that it will support them to speak. [12].

Yoder and Stone made comparison between children that used PECS and other system. It is resulted that autism children that were trained by PECS become more verbal than others. PECS will become much more effective in supporting the autism child become more verbally if it is implemented under six years old. [9].

3. Multimedia Augmented Reality

Augmented Reality (AR) is either direct real-time interface or indirect of a physical appearance from the real object by adding an online object which resulting an additional information on the existing object. This AR is gathered the real things and the existing virtual object, this virtual object is just adding the real object and not replace it, while the purpose of this AR is to simplify the real object by inserting the online object thus the information is not only for the user interface but also for user who are not connected directly to the user interface from the real object, such as live streaming video. The main tools for AR are displaying, input tool, tracking, and computer. [13].

Recently AR is growing rapidly and there has been many application or library used in developing AR. AR needs video streaming with camera used as the source of input picture, then to track and detect the marker. The 3D model will appear after the marker has been detected. The 3D model is made by the software for 3D design. [14].

AR has been implemented in many fields, such as education, medical, entertainment, military, design, robotics, and many others. AR has also been applied on tools used by people like mobile phone. [15].

AR has been used in Education as modelling in learning media out of the class. Any material that needs modelling may be built by AR with the expectation gives more understanding to students. As one

of the examples is AR may be used in human body modelling to make the sense more real. [16]. In addition, AR can also be used in modelling the solar system in science subjects. There are many AR applications that have been developed as a supporting media in student learning activity.

4. Research Model

This qualitative research, the research focusing on the understanding based on the certain research methodology tradition to explore the human problem or social problem in natural base. The design used were A---B---C which consists of treatment—treatment---effect treatment. The further step is to record the behaviour measurement before treatment, during treatment and after treatment thus the effect of the treatment will be yielded. The effect of the treatment is shown in behaviour recording graph.

The research design is to observe one target of behaviour change in a person or a group of people with its focus. The first stage is an observation or baseline stage. Recording the subject behaviour before any treatment given was done in this stage. After the baseline composed, the treatment was given to the subject and recorded the subject behaviour during the intervention in order to give way or may reach certain criteria. The next stage was to see the effect of the treatment comparing to the baseline performance. The easiest way to see the effect of the treatment is by behaviour recording graph. The further stage is to record the behaviour measurement before the treatment, during the treatment, and after the treatment thus the effect of the treatment will be shown. The effect of the treatment will be displayed in behaviour recording graph.

After the PECS has done, the next stage is data analysis with descriptive qualitative method. The analysis was done to determine the description of PECS treatment in improving the stage of communication in ASD child. The collected data was analysed by visual analysis, which interpreting the result of the graph data accurately and meaningfully by seeing the behaviour change happened based on the displayed graph.

Qualitative analysis was done by visual inspection analysis to see the change time by time and yielded the M score from daily observation of the behaviour. Visual analysis is done to know the success frequency of behaviour in asking subject either in baseline stage or during intervention PECS stage I up to IV as well as to know the duration needed by the subject in requesting the wanted item by making sentence strip and give to the communication interlocutor independently. Qualitative analysis was done to the data obtained from the observation, interview, sharing and it also covers discussion with parents or therapist.

5. Result And Discussion

Multimedia application as the treatment for ASD child has built augmented reality technology. The developed application may run in android based gadget. The outlook from augmented reality multimedia for ASD child learning can be seen in Figure and Figure 2.

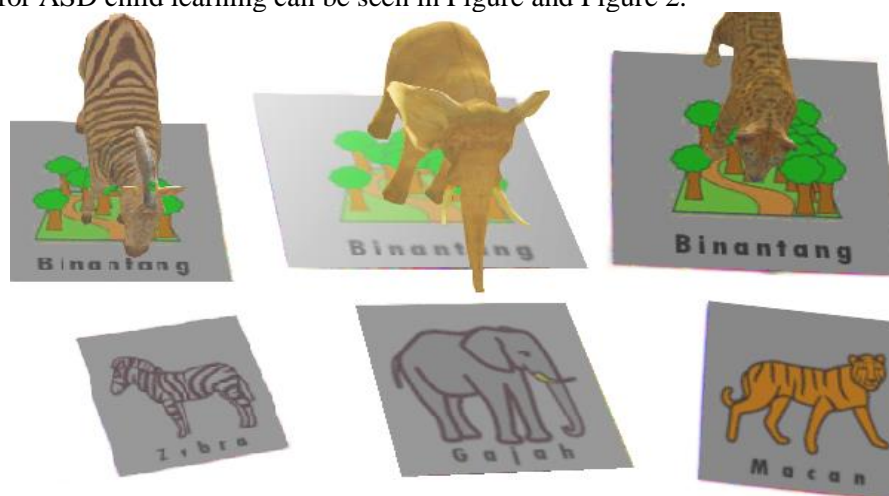


Figure 1. The multimedia outlook of augmented reality for animals

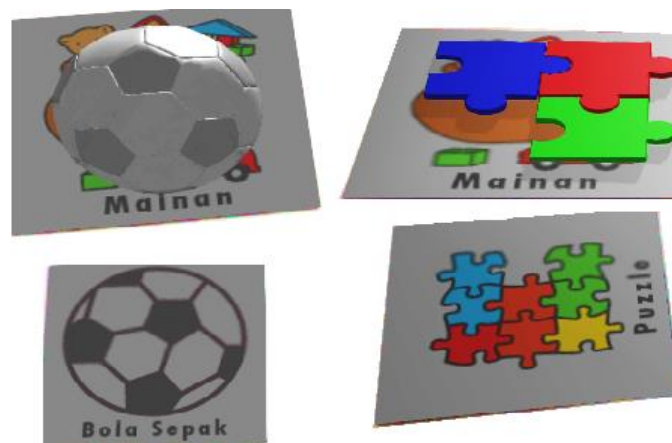


Figure 2.Multimedia outlook of augmented reality for toys

The examining process was done by teacher to ASD child, where teacher is willing to do the intervention to ASD child using android based gadget media. The Multimedia will be shown to the children to show the media and help in communication. The examining process may be seen in figure 3.



Figure 3.The intervention process of ASD child with augmented reality multimedia

Based on the previous result, during and after the intervention done to ASD child with augmented reality multimedia may be seen on figure 4. The result of inter-observer agreement calculation during the PECS implementation on children shows the average score is 76%. Thus it can be concluded that the observation done by observer is reliable.

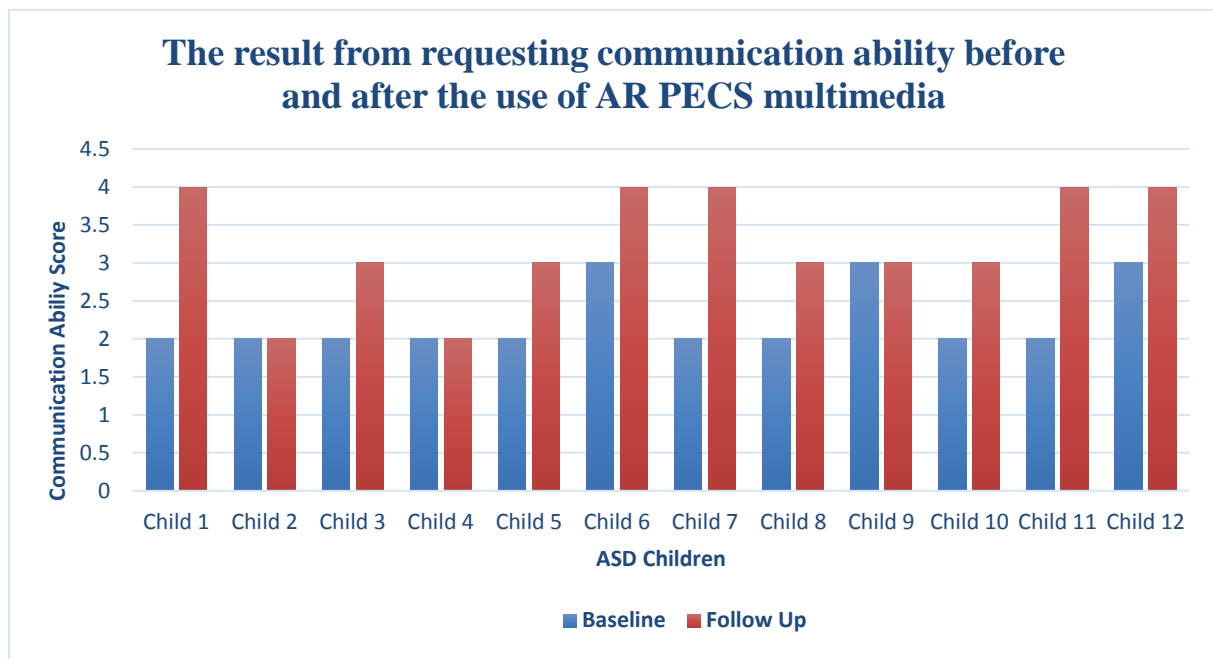


Figure 4.The difference between communication ability before and after treatment

Figure 4 shows the results of tests that have been done on 12 children with autism. Test results showed that there was a significant improvement in the autistic children's communication ability after being treated with multimedia augmented reality. The increase achieved an average of 76% of the communication skills of children before treatment.

The improvement of communication ability happened in all research subject from requester stage to early communication stage, but one subject did not improve and requested to stay at requester stage level. The result of participation ability in asking communication through media of augmented reality multimedia with PECS can be seen on figure 5.

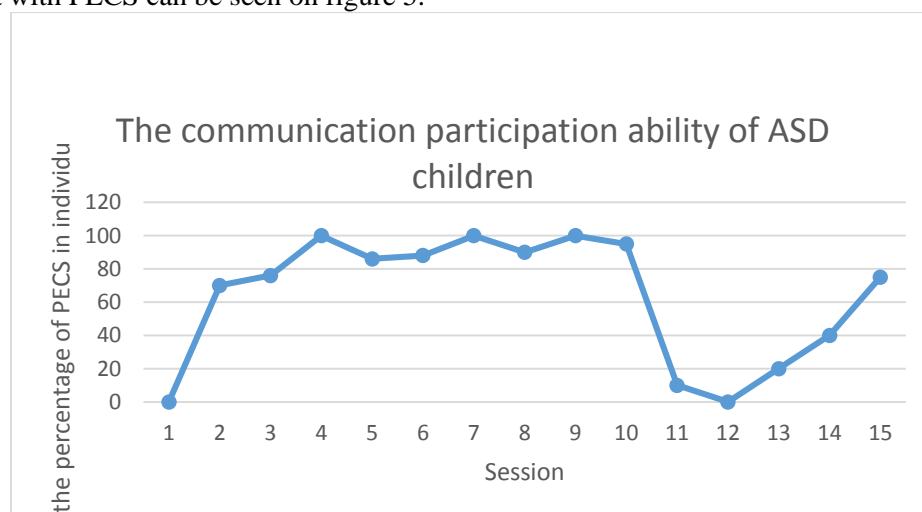


Figure 5.The average ability of ASD child communication participation

The conclusion of the above explanation may be seen on Figure 5 that the ability of requesting through picture exchange need 15 session with 230 trial. The result of requesting communication ability through picture exchange show improvement in advance despite there are decreasing exchange ability at the beginning of stage 4 due to participant needs to make an adjustment at the early stage related to the numbers of shaping process at phase IV and raise continuously at session 15 until it reach the

independent exchange of almost 70%. The most assistance used is complete assistance that is therapist helping physically and a bit verbal help like calling name.

There are three factors influencing speed in learning PECS, they are kinds of items that motivate each individual at initiating communication, the use of the concrete symbols as the real ones, requesting centred learning that emphasized more to motivation and reward given to the autism child to communicate functionally.

By the different condition of each subject such as spectrum level, cognitive, behaviour, and different emotion, the subjects have their own ability in improving the communication ability and PECS phase. The reinforcement of children has also influence on their willingness in requesting or communicating to other people. However it's different with the subject that has an interest to the reinforcement, it will be more easily in stimulating to do the requesting communication. The fluctuate condition is also bothering the child in the process. Building the routinely in autism children is such important thing in learning something. [17].

In general, autism children learn or finish any task more easily by concrete and structured ways than the abstract ones. PECS has structured and levelled stages. The usages of PECS picture that exchange with the items are more easily understood than verbal and auditory stimulus.

The education given to autism child needs to be done in stages from the smallest one continue to the bigger and more complex and so forth until the children are able to socialize with the non-disabled children. [9].

6. Conclusion

Based on the result comparison of communication ability before, during and after the treatment process to ASD child by using PECS method augmented reality multimedia based, it is yielded that there is an improvement of communication ability from requester stage to early communication stage.

Some influencing factors in improving the communication ability of the participant are the interest to the teacher, physical condition such as hungry, full, sleepy, and their autism spectrum level. In addition, it best gives the children understanding ability and children personality characteristics such as cheerful, active or introvert and hypoactive or hyperactive. The surrounding factor has also strongly influence on improving the communication ability of autism child such as supporting condition and huge motivation from the family will support a lot, but ignoring condition to the child will obstruct the improvement of communication ability.

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