Development of Fine Motor Skills for Early Childhood Based on Augmented Reality

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Abstract. Movement is the most important element in children's motor development. Fine motor skills are body movements that use small muscles and require concentration between the eyes and hands, such as folding, cutting, and knitting. Positive social skills in children the impact of good motor development. The problem that arose so that this research was carried out was the lack of learning media to develop fine motor skills in early childhood education. The use of augmented reality media that is designed attractively can provide opportunities for children to explore their knowledge, and their ability to develop their potential. The potential that can be developed is not only physical development but also language and social interaction with the surrounding environment so that they become individuals with strong character into adulthood. The purpose of this research is to develop children's fine motor skills by using Augmented Reality-based learning media. This study used a mixed qualitative and quantitative method, with a research and development (R n D) approach using the Lee and Owen model. Data collection techniques by observation, interviews, literature document review, and documentation. The findings of this study provide results stating that Augmented Reality media has a very positive influence on fine motor development in early childhood. The results of the one-on-one trial resulted in a score of 3.75%, the results of the small group test obtained a score of 3.82%, while the results of the field trial on 20 PAUD children scored 4.23%. There are 6 motor learning developed in this study, including the following: 1) holding writing instruments correctly; 2) imitating making vertical, flat, and oblique lines; 3) tearing the paper into shape; 4) cutting to form a straight pattern; 5) folding shapes from paper, leaves, and patchwork; 6) coloring according to the theme of the picture. Thus, augmented reality media has proven to be effective in improving fine motor skills in early childhood.

Keywords: Development · Fine Motor Skills · Early Childhood · Augmented Reality

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1 Introduction

The development of motor, language, and social-emotional skills is a very important period in preschool [1]. During this time, children's skills grow and develop very rapidly, often referred to as the golden age from 3–6 years old [2]. Children develop basic skills and functions during the preschool period [3]. Playing is an activity that spends a lot of time for children to explore the environment around them. Exploring, playing, and manipulating objects or tools in daily activities is the development of fine motor skills in infants and children in their early life [4, 5]. While growing up, the development of children's fine motor skills is continuously influenced by individual interactions, tasks, and their environment [6]. An important aspect of the acquisition of fine motor skills is that it begins with the mental development of children because children's fine motor skills can be carried out in work and daily activities, namely through education, play, and social participation [7]. (By playing, children can explore their motor, language, and social skills. At this time the right stimulation can increase growth and development properly according to the stages of development.

Universally, fine motor criteria in education have not been established for school readiness. Understanding that is more important in preschool and kindergarten readiness before learning in the classroom is like learning earlier from the environment for children's fine motor movement activities [7]. Adapting to environmental changes is very important to maintain the ability of an accurate motor movement system [8]. Several different learning systems are considered to involve adaptive behavior [9–12]. Children will experience learning disorders or difficulties in learning, namely the ability to communicate and social and personal skills are the impact of delays in the development of gross and fine motor skills [13]. In addition to experiencing learning disorders, delays in physical development can result in impaired coordination of development, alertness, arousal, lack of sleep, visual feedback transformation and emphasis, hand-eye coordination, pen holding, pen pressure when holding it, dominant versus non-dominant hand, tracing, freehand drawing, spiral drawing, reading, typing [14]. The importance of proper stimulation for all the aspect of child development is the main goal for children to become independent and able to survive for a long time his life span into adulthood.

There are various ways and methods to stimulate children's development through play activities and by using still or moving media. One way to develop children's fine motor skills is to use moving media or learning videos that can display audio and images in 3D (3 dimensions). Virtual media that describes real life is augmented reality media. Combining the real and virtual worlds such as traditional games and interactive computer games is very beneficial for children [15]. It combines three properties, namely the real world and the virtual world, provides interaction, and presents three-dimensional objects (3D) [16]. Augmented reality describes the virtual world and the real world simultaneously aimed at its users. Even though the virtual world has several advantages such as 3D which has many communication channels, and useful interactions [15, 17], provides hands-on experience and rewarding opportunities.

Improving the fine motor development of early childhood can be done by designing an augmented reality media that is interesting and can motivate children to learn. Making animal introduction media into interactive learning media to attract children's interest, based on the introduction of AR using Unity 3D because animated augmented reality

supports and includes animation, text images, audio, and video on mobile devices. This learning media can help early childhood education teachers introduce names, shapes, and animal sounds to children [18]. English learning can also be designed using augmented reality technology found in mobile applications that introduce words to test the progress achieved by children of various ages and can achieve very good effectiveness [19]. In this paper, an augmented reality design is designed to improve fine motor development in early childhood by using unity.ar application which is downloaded on a mobile phone to make it easier for children to follow the steps and development contained in AR media.

The virtual laboratory design referred to here is a design designed using augmented reality software to facilitate students in electro-pneumatic practicum learning activities. With the convenience of the media as an introductory message from the teacher to students, it is hoped that the learning objectives can be achieved optimally. The use of virtual reality as an adjunctive learning tool to traditional engineering education methods has positive and beneficial effects on cognitive, skills-based, and affective learning outcomes [20]. The application of augmented reality for the implementation of education is expected to increase students' interest in new material in the formation of education [21]. Artificial natural conditions with a complete physical depiction of 3-dimensional images make it easier for children to communicate well. When students enter an artificial virtual world with AR media that has been made, they can learn directly as in the real world.

With various sensory tools, humans can correct and manipulate and interact with objects in the virtual environment as in the real world [22]. Santiago Criollo [23], describes the development of AR starting in the 1990s with a definition that is from the superimposition of parts of the virtual world into the real world [16]. When using AR media, users will always be connected to the real world at the same time users can interact with all complex information [24].

Designing a virtual laboratory with augmented reality media in this electro-pneumatic practicum activity for VHS students majoring in Engineering Electronics. In designing a virtual laboratory with augmented reality media for practical electro-pneumatic learning activities with 8 circuit designs. In each circuit design, an explanation is given on how to assemble pneumatic circuits and simulate pneumatic electrical circuits to minimize errors in practice. With the hope that students can easily learn anywhere and anytime and can save time and money so that practicum learning can run well and be conducive.

The novelty of this research is focused on the development of fine motor physical aspects in early childhood by using augmented reality media with the Unity application. AR downloaded on Smartphones, Using Augmented Reality media will attract children's attention and interest in being able to follow learning.

2 Research Methods

The design of this study used a mixed method, namely qualitative and quantitative, where data collection and data analysis techniques were used together to explore and find results [25]. This condition motivates researchers how to design data that is relevant to the importance of researching the stages of the study. This mixed approach has a

variety of study guides. This mixed design was chosen as the most appropriate method for this stage of research, and with the right process. In general, researchers collect and analyze data using quantitative and quantitative methods, a mixed design will be carried out next. Mixed design can be developed by placing the quantitative stages into the qualitative stages, and can be done in both qualitative and quantitative stages.

The research conducted is research and development which is often known as Research and Development (R & D). Research and development in Education is a process for creating and validating Educational products such as media, methods, and models according to the needs of the field [26]. In the process of developing Augmented Reality media, this study adapts the Lee & Owen [27], Model with 5 stages of development starting from needs analysis, front-end analysis, design, development, implementation, and evaluation. Qualitative research was used to see the process of children's fine motor learning by utilizing AR media. The quantitative method is used to see the increase in children's fine motor skills after utilizing AR media in learning. The following are the stages of research conducted in the development of fine motor augmented reality in early childhood (Fig. 1).

Lee Owen [27], started the development process by conducting analysis, to systematically find basic (fundamental) information about one or more objects. The stages of the research carried out are as follows:

1. First Stage (assessment/analysis)

   The first stage is the stage of assessment and analysis. This stage is divided into two parts, namely:

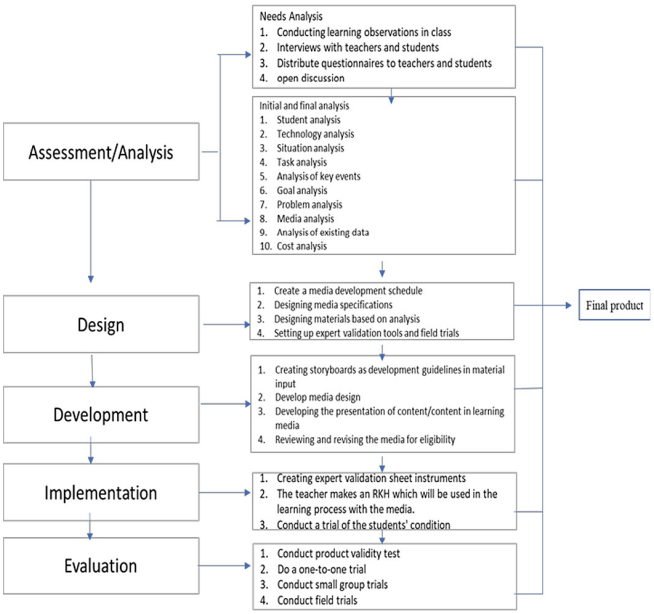

Fig. 1. Stages of research and development of fine motor skills using augmented reality media

a. Part one needs assessment. In the needs, the analysis section finds out the gap between the real conditions and the desired conditions. This needs analysis can be done by observing the learning process and interviewing teachers and distributing response questionnaires to students. The instruments that can be used are interview guides and interview guides to limit questions and observations of things you want to know not to widen.
b. The second part of the initial and final analysis (front-end analysis). At this stage collect complete information about what will be developed. The things done at this stage include student analysis, technology analysis, situation analysis, task analysis, important event analysis, objective analysis, problem analysis, media analysis, existing data analysis, and cost analysis.

2. Second Stage (Design)

   This design, the stage is a series of activities in making a media development schedule, designing media specifications to be developed, designing the structure of the material to be developed based on the results of the analysis, and preparing the necessary tools in audience validation and testing.

3. Third Stage (Development)

   This stage develops media by translating product specifications into a physical form which includes making storyboards as a guide for the use of media in learning materials, developing media designs to be used in the learning process, developing the presentation of content to be presented in learning media, reviewing or making necessary improvements so that learning media is feasible to be implemented in the learning process, media packaging.

4. Fourth Stage (Implementation).

   The implementation stage is the stage where the validation of media experts and material experts is carried out. The instrument is a validation sheet or validation instrument. After the media is declared appropriate by the expert, it is then tested on students. This stage consists of small-group trials and large-group trials. Before the trial, the teacher made the RKH. Small-group and large-group trial activities involve students as subjects in the trial. Small group trials involve several samples of students who are taken based on the level of understanding of the material or learning outcomes achieved through grade data from the class teacher. The large group trial involved students in one class, but students who took part in the small group trial were not included in the large group trial. Fifth Stage (Evaluation).

5. Fifth Stage (Evaluation).

   At this stage, the researcher evaluates the designed media. The designed AR media is first tested by learning media experts who can determine whether it is valid or invalid to see its feasibility for one-to-one tests, small group tests, and field trials. The expert test was carried out with media experts.

The advantage of this development model is that it can be said to be a procedural model with a sequence of steps in the process arranged systematically and each development step has a clear description of the development steps. Parts that are interconnected and systematically organized from stage one to stage five and cannot be carried out randomly in their application, must be sequential step by step. For its application, we cannot carry it out according to our wishes, whichever part we like first. Because of

the five stages of this model, it is very simplified and easier than other model designs. Having the characteristics of being simple and regularly organized makes it easy for this model to be used in the development of learning in education.

3 Result and Discussion

3.1 Result

The design of augmented reality media after being declared feasible by media experts with a score of 4.2, shows that fine-motorized AR media is feasible to use. Material experts and learning design experts. The results of the assessment from material experts got a score of 4.82, which was categorized as very good and the media was declared suitable for use in the physical development of fine motor skills in children aged 5-6 years. The results of the assessment from the learning design expert got a score of 4.54, getting a very good category, this is Augmented reality media for children's physical motor development worthy of use in learning. The results of research conducted on children aged 5-6 years at Pertiwi Kindergarten, Punggur subdistrict, Central Lampung.

1. The results of one-to-one tests on students

   This one-to-one test was carried out with 3 students to see whether the augmented reality media developed could attract and motivate students to take part in learning. Based on graph 2, it can be seen that the results of the one-to-one assessment of students got a score of 3.75%. The score shows a good category. Thus augmented reality media designed for fine motor development can improve children's fine motor skills. The skills developed include: 1) students can hold a pencil correctly; 2) students can write vertical, flat, and oblique lines; 3) students can tear paper into a shape; 4) students can cut straight patterns; 5) students can build shapes from paper, leaves, and patchwork; 6) students can paint according to the theme of the picture (Fig. 2).

2. Small group test results

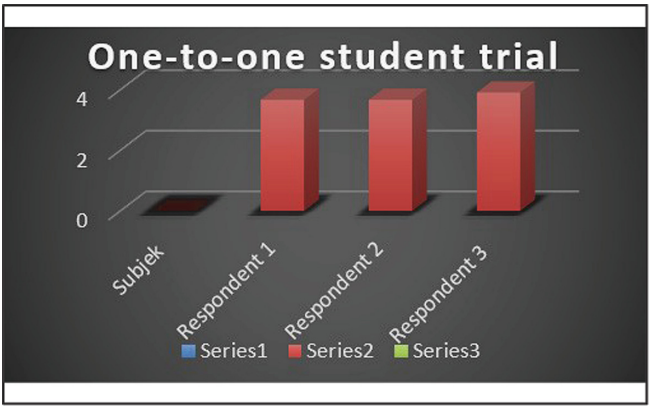

Fig. 2. Student one-to-one test diagram

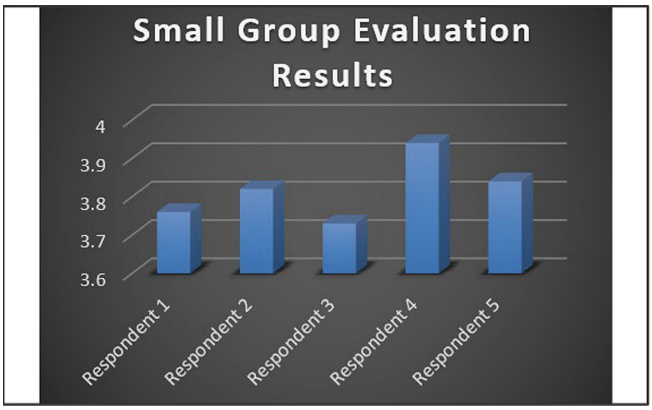

Fig. 3. Student small group test diagram

Small group trials were conducted on 5 students who were not students who took part in one-to-one trials. Obtaining the results of the small group trial in Fig. 4, it is known that the evaluation results show a score of 3.82%, thus it can be said to be good. Based on these scores, it is stated that augmented reality media can develop early childhood motor skills (Fig. 3).

3. Results of field trials

Field trials were conducted on 20 children. And each child is also not the one taking the small group exam. The results of field trials showed a score of 4.23%, which means very good. Augmented reality media is designed to develop fine motor physical skills in early childhood, and augmented reality media is very effective and efficient. Based on the diagram in Fig. 4 with the score shows that children feel comfortable and fun and don't get bored quickly because they learn new things that provide direct experience.

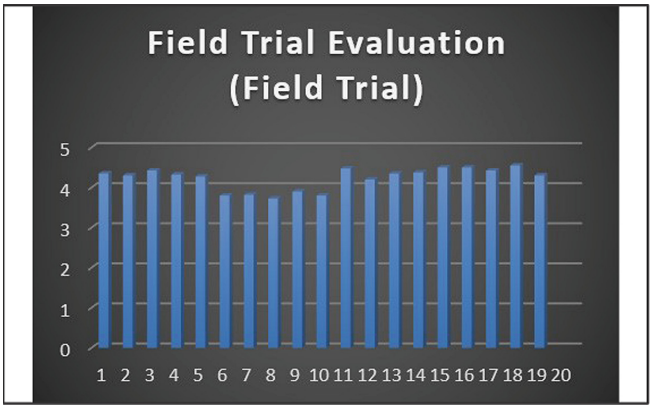

Fig. 4. Field Trial Diagram.

3.2 Developed Augmented Reality Media Design

In the augmented reality media developed, there are stages in improving children's fine motor skills with each explanation and audio so that children are interested and motivated to take part in learning activities. In learning activities using augmented reality media, it is hoped that it can develop children's fine motor skills, assisted by the teacher in operationalizing the augmented reality media contained on smartphones with unity.ar application, after the camera on the smartphone, is directed at the marker to be scanned, there will be real-like images. Learning with AR media provides a meaningful experience for children, especially when visually watching images that move and look real, this will be something interesting for children. Flashcards and AR media significantly increase vocabulary in learning and children's activities increase by really enjoying using AR media [28]. Introducing children's knowledge about animals can be done by utilizing the developed AR media, it can also introduce various animal foods and needs [29].

When learning is carried out, students are motivated and enjoy learning foreign languages with pleasure on realistic-based material through games, using AR media designed to subjectively assess English subjects [30]. The existence of augmented reality media makes it easier for teachers to convey material that is difficult to explain to children using only verbal language. The presence of augmented reality media provides a pleasant and not boring atmosphere. Children and parents can use AR media design with audio that appears real to develop basic knowledge [31]. This learning media that uses augmented reality produces a positive response among users. Children are enthusiastic about perceiving stories by providing good appeal, during learning activities with 3D images [32]. Children can be stimulated properly, for their cognitive development when using augmented reality media that display real images so that children's curiosity increases for critical thinking.

4 Conclusion

Augmented reality media is not a new thing in the world of education but has been developing for a long time. Augmented reality media is undergoing continuous changes to provide the best in Education. Research on augmented reality is experiencing rapid development every year. If initially augmented reality media only developed in industries, now it can be used to support success in learning that providing facilities that display real- life images that make children interested and very enthusiastic in participating in learning.

Because basically, the way of thinking at the age of 3–5 years is still from concrete to abstract. Thus, this augmented reality media can provide a clear picture for children and is effective in improving children's fine motor skills at an early age.

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