

**DEVELOPMENT OF AUGMENTED REALITY (AR) INTERACTIVE
STORYBOOK “BERSIH DIRI BERSAMA MARE” BASED ON
ANDROID TO STIMULATE MOTOR DEVELOPMENT OF
CHILDREN AGED 4-5 YEARS**

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Abstract

Media storybooks based on Augmented Reality can be used by teachers to stimulate motor development about personal hygiene in children aged 4-5 years. The purpose of this research is to produce Augmented Reality interactive storybook media products that are validly tested by media and material experts with categories, effective, efficient and interesting in their use. The type of research used in this research is the type of Research & Development (R and D) research. The assessment criteria are aspects of efficiency, effectiveness and attractiveness. The instrument of quantitative data analysis technique was obtained from the validity of media experts and material experts. The results of accumulated validity from several experts yield a percentage of 97.75% which means it is very feasible to use. The trial used small groups and large group tests with the criteria for assessing effectiveness, efficiency and attractiveness with the results of 87.7%. The accumulation of data from the results of expert validation and group trials was 91.5%, which means that the media is feasible to use. Quantitative data was obtained from the results of interviews with kindergartens in Blitar. The researcher found that the interactive augmented reality storybook about self-cleaning with mare had three eligibility criteria, namely being effective, efficient and attractive to stimulate motor development about personal hygiene in children aged 4-5 years.

Keywords: *Augmented Reality, Interactive Storybooks, Children's Motoric Development*

1. INTRODUCTION

People often refer to childhood as "the golden years," because it is during this time when children's brains are already fully formed and so they are able to grow and develop physically. For parents and teachers alike, it's essential that they offer their children with the proper stimulation and encouragement throughout this period of rapid development. Children under the age of six are considered to be in the early stages of childhood. According to paragraph 1 of article 28 on System Law National Education No. 20/2003, a child who lives within the age range of 0-6 years is considered to be in the early stages of childhood. Fadhillah (2014) claims that children between the ages of 0 – 6 are able to accept the stimuli offered by their surroundings and educational environment. At the earliest ages, children's potential for development may be clearly observed in areas such as their ability to express themselves in words or gestures, to think logically and to express themselves in other ways. According to Suyadi (2020) it is believed that the brain of a newborn infant contains approximately 100-200 billion nerve cells or neurons at the time of birth.

The utilization of interactive learning media stimulates new thoughts and ideas for everyone who receives it, and media is the most significant tool for attaining learning objectives. Sending a message to learn is made easier using media learning (Frannita, 2015). Children's attention must be piqued by the messages presented in educational media. Media is defined as a communication medium used in the learning process to transmit educational materials and information so that students might be interested in participating in the teaching presented by the teacher (Kustiawan, 2016). Children's creativity should be stimulated in the classroom through the use of effective teaching methods. Today's learning medium must be fascinating and constantly evolve to keep up with technological advancements in order to keep knowledge seekers interested and engaged. Using this medium, information is delivered to a broader audience in a way that maximizes the senses. Humans utilizing products and computers as applications engage in two-way communication through interactive media (Larasati, 2020).

Furthermore, the researcher conducted interviews with "N" teachers about the media used to stimulate motor skills in the area of personal hygiene. The teacher explained that the media used were only two-dimensional media, such as picture boards and activities in textbooks, because storybook media in accordance with clean and healthy material in children is still limited in school environments (W,N, 051121). Besides that, the most crucial problems in the use of storybook media are (1) the lack of story books that contain children's teaching materials; (2) the fact that teachers still have limited time, making storybook media ineffective in their use; and (3) the fact that children always engage in their own activities, such as chatting and playing with friends, when participating in learning activities using storybook media. In education system, learning media is anything that can be used to transfer messages from sender to recipients, with the expectation that this will result in stimulating thoughts, feelings, interests, and children's attention during the learning process (Istiqomah, 2017). Consequently, teachers rarely utilize media from storybooks into their lesson plans. Children must be drawn to the teacher's instructions by using media to draw their attention if at all possible. According to Dewi (2017) the media is not negatively affecting to children because it has an educational function, employs simple instruments, and has varying degrees of difficulty based on the capacities of the child.

Following the findings of UNESCO surveys undertaken in 2016, Indonesia was found to be at a low level in reading, as evidenced by the results of published studies under the title "The World's Most Literate Nations," which indicates that Indonesia ranks 60th in the world (Cahyani & Rasydah, 2020). The lack of innovation in story books is causing children's interest in reading to fade. Most story books only show 1 dimensional and 2 dimensional objects, which causes today's pupils to become bored when reading because the books they are received are not interesting. According to Sumarmi (2018) storybooks are illustrated media that include characters that are simple, easy to understand, and clear. Early childhood is already skilled in using smartphones, so it is believed that incorporating smartphone media into storybook learning media will make storybook learning media more engaging (Asmawati, 2021). With the development of story books using smartphones that apply 3 dimensional technology, with the hope of making early childhood more interested in learning about clean and healthy behavior through story books in different ways and models. Storybooks are illustrated media that are provided in easy content in a single unit (Suharni & Wahyuni, 2020).

An illustrated story book is one of the visual media that has its own appeal for children; as a result, children's excitement for participation in lessons will improve as a result of using storybook media (Ngura et al., 2018). Based on the issues, research is being done to develop interactive story books with Augmented Reality technology that can be used to teach young children about proper hygiene. It is intended that this media, which incorporates Augmented Reality technology, will have a positive effect on children's awareness of clean and healthy behavior. Virtual and real worlds can be combined in augmented reality, allowing users to experience the real world in a new way. Because this technology is real-time and interactive, children can better grasp the meaning and significance of the book's content (Atmajaya, 2017).

Teachers can use this Augmented Reality-based storybook media to teach children about clean and healthy behavior. Early childhood learning environments will be more enjoyable if educational media are more interactive. Adzka & Muwandani (2019) ujang stated that picture story books can boost children's motivation to learn, foster their imagination, and give entertainment for children. This media aims at encouraging clean and healthy behaviors in children aged 4-5 years old through the dissemination of knowledge via book media. It is expected that with the use of augmented reality-based stories, children will gain a better understanding of the media's aim and purpose. According to Arifin (2015) The benefit of story books is that they are a form of story that teaches children character values through illustrated imagery. Augmented Reality is a technology that allows for the real-time presentation of things and the provision of more comprehensive information to children.

Motor development is a critical component of the growing-up process that occurs during the early childhood years. According to Nuridayu et al. (2020), motor development is the process by which a child acquires the ability to move his limbs. Healthy and clean living habits are imparted in children at an early age, as early childhood includes children who are prone to sickness (Fatimatuzzahro, 2016). The process of children's growth and development cannot be repeated, thus understanding of personal cleanliness and health behavior must be fostered from a young age onward. A healthy and clean lifestyle in the home, school, and community can be attained through implementing health and personal hygiene practices on a regular basis. Personal hygiene is one factor that is covered in motor development of children, in the regulation of the ministry of education regarding early childhood in *Permendikbud* Number 137 of 2014 article 10 paragraph 1 concerns health and safety behavior.

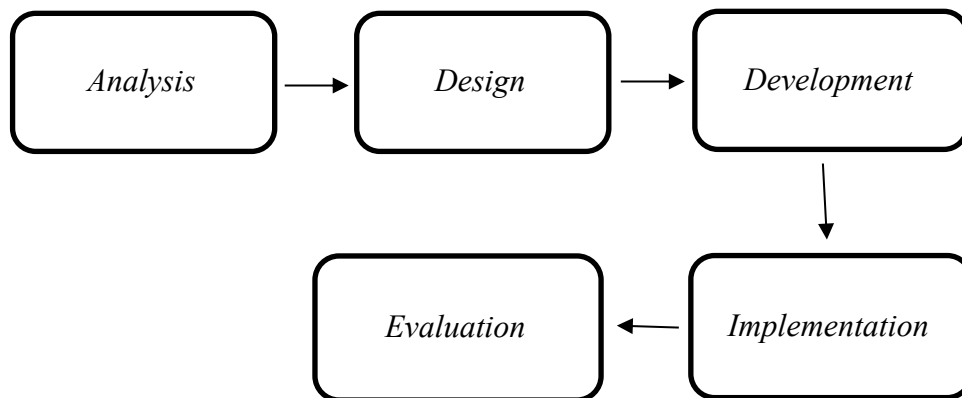
Related to learning media with the concept of playing and learning using Augmented Reality media, there are three previous studies. In the first research, Aprilia & Rosnelly (2020), titled Media Application for Introductory Learning Numbers and Letters for Early Childhood Using Augmented Reality, the introduction of numbers and letters was accomplished through the use of flashcard media that displayed a model of letters and numbers using augmented reality technology. Early childhood in this study, the level of efficacy of media in teaching is rather high, and it has the potential to enhance early childhood literacy. The second study, Development Flashcard Based Media Augmented Reality on the Animal Sea Recognition Material, was conducted by Utami et al (2021). Researchers used flashcard media combined with Augmented Reality technology to teach children about sea creatures in this study. The research has discovered interesting information on underwater animals as a result of the findings.

Augmented Reality is an innovative technology that blends virtual world with the actual world, AR technology is a combination of 3-dimensional things and the real world (Garzon, 2021). Augmented Reality technology is technology which combines 3-dimensional objects with the real world have objects that can be displayed in real time and can be run using a smartphone, AR is a technology that can help the learning process well. Augmented Reality technology is technology which includes 3-dimensional things with the actual world with objects that can be presented in real time and can be done using a smartphone, AR is a technology that can enhance the learning process well. Matt Dunleavy and Chris Dede (2021) explain that Augmented Reality able to give improvement learning experience based on two frameworks theoretical mutually work, namely contextual learning theory and constructivist learning theory. According to Vakaliuk & Pochtoviuk (2021), the benefits of Augmented Reality technology for education include being a medium that attracts children's learning interest, becoming an alternative learning media for teachers who are more attractive, giving a more attractive impression in providing learning, and providing new experiences for children in learning about currently developing technology.

The researchers developed this android-based Augmented Reality story book with the goal of assisting instructors in introducing storybook learning media that use Augmented Reality technology to encourage motor development in 4-5 year old children. In today's technological world, Android is a mobile operating system. Users of the Android operating system can more readily access system functions such as data transfer, data processing, and open information sharing. This service can be run on Android using a system that was established and designed within the default Android application (Wang et al., 2020). With the android system, it is expected that the learning process employing augmented reality technology can develop children's learning interests. A virtual object is brought into the physical environment through the use of AR (Augmented Reality) (Osadchyi, 2021). In the Android system there is the term maker marker, which is a black line that is obtained by operating the system that is used to display data or images (Wibowo et al., 2021). Basically, motor development is quite essential given to children. With the story book “*Bersih Diri Bersama Mare*”, it is hoped that children will be able to grasp how to clean themselves independently. With this book, it is intended that children would be able to copy behavior and be able to use it in everyday life.

2. RESEARCH METHOD

Type of research utilized in this research is the type of Research & Development (R & D) since it adapts to the objective of this media, which is to build media story book based on Augmented Reality with the title “*Bersih Diri bersama Mare*”. As for the model development that employed is the ADDIE model. Sugiono (2015) emphasizes that the R and D method is a method research utilized to acquire a product certain and assess the effectiveness of the product. In model ADDIE research has five stages, the following are the stages as given in chart form:



Source: (Sugiyono, 2015)

Figure 1 ADDIE Development Stages

There are two categories of data used in this study: quantitative and qualitative data. Interviews and questionnaires were used to collect data in this study. Analysis qualitative and quantitative analysis are two types of data analysis techniques used in research. Data from validation results material experts, validation media experts, users, and observation notes results were processed using qualitative data analysis techniques. While quantitative data analysis is combined with data processing collected from a questionnaire, the data are descriptive percentages about the effectiveness, efficiency, and attractiveness of the researcher's product. Using the assessment grid, collect qualitative data as follows:

Table 1 Validation Sheet Indicator for Materials Expert

No.	Aspect of Evaluation	Indicator	Amount
1.	Effectiveness	Appropriate content/material with the aim of learning	6
2.	Efficiency	Contents/materials make it easier for children to recognize personal hygiene	6
3.	attractiveness	Contents/materials attract children's interest in learning about personal hygiene	6

Table 2 Validation Sheet Indicator for Media Experts

No.	Aspect of Evaluation	Indicator	Amount
1.	Effectiveness	The media is suitable for learning media	6
2.	Efficiency	Media takes less time and money	6
3.	attractiveness	Interesting media and easy for children to use	4

Table 3 Child Observation Sheet Indicator

No.	Aspect of Evaluation	Indicator	Amount
1.	Effectiveness	Media can train children's ability to understand personal hygiene	5

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2.	Efficiency	Media is easy to use by children aged 4-5 years	2
3.	attractiveness	Media attracts children's interest in using story books	3

The data analysis technique used in the research on the development of interactive storybooks, *Bersih diri bersama Mare* from evaluation data experts to test quantitative and qualitative product percentages. The data analysis technique uses the technique of Akbar (2013)

The data analysis technique used in the research on the development of interactive storybooks of “Bersih diri Bersama Mare” based on expert evaluation data for quantitative and qualitative product tests of percentages. Meanwhile, the data analysis technique uses the technique of Akbar (2013).

$$V = \frac{Tse}{Tsh} \times 100\%$$

Note:

V = Validity

TSe = Total score empirical (acquired)

TSh = Total score expect

100% = Constant

Table 4 Product Effectiveness Level Convention

Criteria Achievement	Level Effectiveness	Description
81.00% - 100.00%	Very effective	Could used without any repair
61.00% - 80.00%	Effective enough	Could used but needs improvement small
41.01% - 60.00%	Not enough effective	Recommended not used because it needs a major revision
21.00% - 40.00%	Ineffective	Cannot be used
00.00% - 20.00%	Very ineffective	Can not used

3. RESULT AND DISCUSSION

Media creation for interactive storybooks "*Bersih Diri Bersama Mare*," an Augmented Reality project that was carried out during the construction of application follows the ADDIE development approach, which consists of five stages:

Analysis stage in the analysis stage obtained several factors, namely: 1) analysis needs, 2) audience analysis, 3) material analysis. Based on the needs analysis data, it was found of that the researcher wanted to develop interactive augmented reality storybook media of “*Bersih Diri bersama Mare*” with effective, efficient and interesting categories. Based on the audience analysis, the results showed that 1) the children in kindergarten that the researchers studied had an active character and liked new things, especially about

technology; 2) children in kindergarten are still rarely given material about personal hygiene through books; 3) children in kindergarten have a playful character and are happy with interesting new media. According to Ngura et al. (2020), a storybook is a work created in a simple language style utilizing the style chat and includes an unified image to convey facts, which can help children develop their abilities. Motor development is a process that occurs as a result of an individual's responses to organized, coordinated, and integrated movements (Khadija, 2020). The results of the material analysis indicate that the material employed in the interactive storybook about self-cleaning with Mare emphasizes the significance of personal cleanliness.

The planning stage (Design) is where the media design for the interactive augmented reality tale book "Bersih Diri Bersama Mare" is completed. This includes cover design planning, story book content design, augmented reality material design, and cover design which is a depiction of an augmented reality in which artificial information is added to the normal world perceived by the senses via technology and can be viewed directly with the eye (Osadchyi et al (2021)).

Development Stage at, at the development stage, researchers use Android-based augmented reality technologies to create goods that have been compiled and built utilizing applications. According to Vakaliuk & Pochtoviuk (2021), the benefits of augmented reality technology for education include the ability to engage children's interest in learning. The development stages include the creation of a storybook user application, the creation of an augmented reality design, the combination of storybook picture designs, the verification of augmented reality operations, and the printing of books.



Figure 1. Storybook of “Bersih Diri Besama Mare”

Implementation Stage, during which the augmented reality storybook product of “Bersih Diri bersama Mare” is tested. The trial enrolled three children aged 4-5 years for the small group test and fourteen children for the randomly selected large group test. The data obtained during this implementation stage is used to evaluate the product's input from users, namely the teacher's assessment of children's learning outcomes following their use of the interactive augmented reality story book media " Bersih Diri bersama Mare". User evaluation data and

ideas for product enhancement are used as a guide for final product development. Further, evaluation data and user ideas are assessed to establish the effectiveness, efficacy, and attractiveness of storybook media.

Evaluation stage, is carried out to evaluate the results of the application of the augmented reality storybook media of "Bersih Diri bersama Mare" which has been developed by paying attention to input data and suggestions for product improvement by users and data on children's learning outcomes using storybook media. If necessary, changes will be made to the final result. With learning media, children can deliver messages that can increase children's thoughts, feelings, attention and willingness to study (Rusdiana (2014).

Presentation of trial data comes from the results of material expert validation, media expert validation, small group trials and large group trials.

1. Validation Results of Material Experts and Storybook Media Experts

Table 5 Results from Validation of Material Experts and Media Experts

Effectiveness Aspect	Results (%)
Material Expert	100%
Media Expert	96.6%
Efficiency Aspect	Results (%)
Material Expert	100%
Media Expert	90%
Attractiveness Aspect	Results (%)
Material Expert	100%
Media Expert	100%

Material expert validation results in terms of 100% effectiveness factor, 96.6% media expert validation. On the aspect of 100% media efficiency and material experts with 90% results. Interesting aspects, media experts and material experts with a score of 100%. From the exposure above the percentage is above 61% so according to interactive storybook experts augmented reality " Bersih Diri bersama Mare" in terms of effective, efficient and attractive is very feasible to use.

2. Small Group and Large Group Trial Results

Table 6 Results of Small Group and Large Group Trials

Aspect	small group trial	Large group trial
Effectiveness	80%	89.2%
Efficiency	100%	85.7%
Attractiveness	88.8%	82.5%
Amount	268.8 %	257.4%
Mean	89.6%	85.8%

In the above exposure, the accumulation of small groups and large groups has a score of 87.7% which has very valid criteria.

3. Expert Recapitulation and Large and Small Group Test

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Table 7 Results Para Recapitulation Expert and Group Test Small and Big

No	Criteria	Total of Score	Maximum Score	%
1.	Effectiveness	129	140	92.1
2.	Efficiency	91	98	92.8
3.	Attractiveness	91	101	90
Amount		311	339	274.9
Mean		103.6	113	91.5

Based on the results of recapitulation from material expert validity tests, media expert validity, small group trials and large group trials with three assessment criteria namely effectiveness, efficiency and attractiveness, obtained a percentage with an overall result with a total score of 274.9% with an average of 91.5%. The results of the data analysis reached a very valid criteria, because it was between 81.00% - 100%. Augmented reality interactive storybooks "Bersih Diri bersama Mare" can be said to be very effective, efficient and attractive.

The purpose of expert analysis of product feasibility studies is to assess the appropriateness of developed media. The data on the feasibility of a product is examined using formulas consistent with earlier explanations. The findings of the expert feasibility test will define the next steps prior to conducting a small group experiment. The data on product feasibility testing provided by material experts and media experts in the preceding discussion serves as supporting evidence for determining the product's level of feasibility. The findings of the data presentation are summarized to assist in determining the amount of product qualification that has been established fully. The findings of the product feasibility tests are summarized in Table 4 below.

Table 8 Product Feasibility

No	Criteria	Total of Score	Maximum Score	%
1.	Effectiveness	129	140	92.1
2.	Efficiency	91	98	92.8
3.	Attractiveness	91	101	90
Amount		311	339	274.9
Mean		103.6	113	91.5

Based on the results of summary from material expert validity tests, game development experts' validity tests, small group trials, and large group trials using three assessment criteria, namely effectiveness, efficiency, and attractiveness, a percentage with an overall score of 274.9 % with an average of 91.5 % was obtained. The data analysis results met a very valid criteria, as they ranged between 81.00 % and 100 %. Therefore, It may be argued that augmented reality interactive storybooks "Bersih Diri bersama Mare" are really effective, efficient, and attractive.

The revision of the augmented reality interactive storybook of "Bersih Diri bersama Mare" was carried out based on suggestions and comments from the experts. The following describes the revision of the story book by the experts. (1) Revision based on the advice of material experts a. the story book should be given instructions for use so that it is easier for

users to operate the story book; b. the story book is better to be played in turns so that the observer can easily observe each child; (2) Revision based on media expert advice; a. the story book should provide an application that can be downloaded easily; b. the story book should be marked with any material that can be scanned by the marker.

4. CONCLUSION

This augmented reality " Bersih Diri bersama Mare" interactive storybook is well worth using in motor learning about personal hygiene in children aged 4-5 years. Eligibility criteria on augmented reality " Bersih Diri bersama Mare" interactive storybook products are obtained through results from material validation, media expert validation, small group trials and large group trials. The results of the validation of material experts and media experts 91.5% overall achieved a very viable or valid criteria with a percentage of 90.3%. Test a small group of 3 children with assessment criteria in terms of effectiveness with a score of 80%, 100% efficiency and 88.8% attractiveness. Meanwhile, a large group of 14 children tested effectiveness with a score of 89.2%, efficiency of 85.7% and attractiveness of 82.5%. The accumulation of small and large group trials resulted in a total score of 91.5% which means it is very feasible or valid for children aged 4-5 years to stimulate motor development about personal hygiene in children. Recapitulation results from material expert validity tests, media expert validity, small group trials and large group trials with three assessment criteria namely effectiveness, efficiency and attractiveness, obtained a percentage with an overall result with a total score of 274.9% with a mean of 91.5%. The results of the data analysis reached a very valid criteria, because it was between 81.00% - 100%.

A revised product review of augmented reality interactive storybooks " Bersih Diri bersama Mares" has its advantages and disadvantages. The advantages of this interactive storybook include: (1) Storybooks stimulate motor development about personal hygiene in children; (2) Storybooks using the incorporation of augmented reality technology that is in accordance with the developments in modern times; (3) This storybook is designed according to the needs of children regarding the introduction of personal hygiene. The disadvantages of this interactive storybook game include: (1) the game is limited to the age of 4-5 years; (2) The trials were limited to 14 children; (3) The developed game focuses only on the motor aspects that lead to personal hygiene. The results obtained from data analysis with eligibility criteria are effective, efficient and attractive so that games can be used in stimulating the balance of children aged 4-5 years.

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