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Implementation of Thematic Textbook Products Based on Augmented Reality

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Abstract

Learning about the theme of self in kindergarten is often applied to book media such as text and two-dimensional images only. In this case, it causes learning to be less than optimal so that a learning medium is needed that can help kindergarten students understand the basic characteristics of the shape of the textbook in two dimensions by showing the shape of the object in three dimensions. The purpose of this development is to produce textbook products that have been equipped with Augmented Reality technology in the subject of self for kindergarten class A. The method used in this research is a type of development research known as Research & Development (R&D). The development model used is the Lee & Owens model which has been adapted to the needs of the research. The responses from media experts and material experts received positive responses after the trial. While the product utilization trials were carried out on Class A kindergarten students. And the results obtained overall Augmented Reality Kindergarten thematic teaching book media products on the material of oneself are feasible to use in learning.

Keywords: augmented reality; mathematics; module; puzzle.

INTRODUCTION

Innovative education is a must in the world of education. Many efforts are made aimed at renewal in education. Minister of Education and Culture number 65 states that changes in the standards of primary and secondary education processes and systems in learning and learning assessment are very necessary to do, this is a form of implication of changes in these standards (Permendikbud, 2016). this policy takes the form of updating the 2013 curriculum with the aim of creating an Indonesian society capable of thinking productively, affective, innovative, and creative through the development of knowledge skills, attitudes and skills in an integrative manner.

One of the efforts made in achieving the objectives of the learning process effectively is the presence of learning resources for students, such as module books for students or learning support books. In addition, the availability of varied learning media will be very beneficial for children to meet the diverse learning characteristics of students. Material preparation is an important essence in learning, content material must be relevant to the concepts being studied (Orlich et al., 2012). Therefore, one of the learning resources that can be utilized is modules.

Modules are teaching materials containing relevant, brief and specific content with the aim of achieving learning objectives. As one type of teaching material, it has the characteristics of self-learning principles (Meyer, 1978). Self-learning is a way of active learning and

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participation for the development of knowledge in each individual with no attachment to the presence of teachers, school meetings and school colleagues.

In learning mathematical concepts, children go through 3 stages, namely iconic, symbolic and enactive. iconic is the stage of learning by utilizing images, symbolic is understanding by manipulating symbols, and the enactive stage is the stage of learning by manipulating concrete objects or objects. Meanwhile, according to (Piaget, 1976) the level of thinking development of elementary school age is still concrete operational, that in learning concepts, children are given activities that have real object relationships that can be accepted by their minds. Physical objects can help students to connect between their visual understanding and their sense of taste, as well as relate to their spatial and help students focus attention (Billinghurst, 2002). So it is important to manipulate objects in mathematics. Learning mathematics is a process of reconstructing concepts and principles, not stopping in terms of just learning that seems static and passive, but the learning process must be active and dynamic (Rusnandi et al., 2016).

From the results of observations and interviews at Tunas Mukti Pedurungan Kindergarten and Nasima Islamic Kindergarten Seamarang, it was found that learning activities carried out at Tunas Mukti Pedurungan Semarang Kindergarten and Nasima Islamic Kindergarten Seamarang thematic theme 4 material build space. One of the basic competencies to be achieved is that students are able to understand three-dimensional images and shapes and students are able to draw and shape three dimensions. However, it was found that the learning activities are only guided by printed books and the lecture method is still not optimal in meeting the differences in students' diverse learning styles. In addition, the material in the printed book is considered less than optimal because in understanding the material of building space, concrete visualization is needed which is not enough just text and images. Media in the form of books as media and AR technology supplements can help teachers convey material with 3D visualization in printed books, making it interesting and easier to understand the material (Abdillah et al., 2020). In order to overcome these problems with the advantage of combining the real world with the virtual world, AR technology has great potential as a support for learning activities in education and improving the quality of learning during the process (Nincarean et al., 2013).

Based on the explanation of the above problems, additional supporting books such as a combination of modules with Augmented Reality technology on the Android platform are considered sufficient to meet the needs of the context of material presentation. So that it can provide students with convenience and flexibility when exploring abstract objects that are projected in 3D. Not only that, the differentiator of this Augmented Reality module development product with previous research is the addition of a Puzzle mechanism feature on the marker so that when 2 markers are put together there will be a net-net animation reaction depending on the object of the type of space being projected, so that students learn more fun, interactive and interesting.

METHOD

The research method used in developing Augmented Reality modules uses the development model procedure by Lee & Owens. For this research method, the use of this method is considered appropriate because it is equipped with instructional design in the development of questionnaires and includes experience responses from users so that media products that are suitable for use can be produced. Then the object of research is at Kekancan

Mukti Semarang Kindergarten and NASIMA Semarang Kindergarten. The following is the flow of development stages by Lee & Owens.

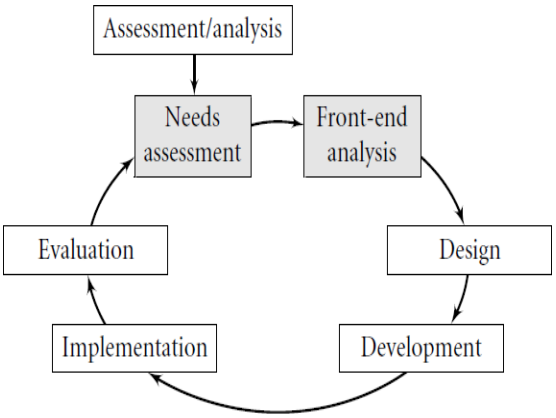

Figure 1. Lee & Owens development model (2004)

The development model by Lee & Owens consists of 5 stages called assessment/analysis consisting of 2 parts, namely need analysis and front end analysis, followed by design, development, implementation, and finally evaluation. However, this development is only carried out up to the development stage. At the analysis stage before the development of learning media, the first step is to make observations. this is important to do to understand the constraints and needs that exist in the field so that the development of learning media that has been carried out is in accordance with the needs. According to (Lee & Owens, 2004) the assessment stage is divided into 2 stages, namely, needs analysis and front-end analysis.

The front-end analysis stage is followed by further analysis activities. In this section, the types of analysis are described, including (1) audience analysis, (2) technology analysis, (3) task analysis, (4) critical incident analysis, (5) situational analysis, (6) objective analysis, (7) issue analysis, (8) media analysis, (9) extant-data analysis, and (10) cost-benefit analysis. Design stages. (Lee & Owens, 2004) There are several points that need to be done in the design stage, namely the schedule of activities, the team in the project, and media specifications. At this stage the developer begins to determine product planning both media specifications, content information and configuration control.

In the development stage, space building materials begin to be collected and compiled into applications and modules. There are 2 kinds of markers with different functions. At this stage the Unity 3D 2019 application is used to build applications with an Android base, along with 2 other supporting devices. With the help of smartphones, students can learn independently, save time, and be active when learning (Rahardjo et al., 2019) Content adjustments are arranged according to the context of the material, the design is made attractive so that an attractive product is obtained and as needed in the form of an Augmented Reality-assisted module with a puzzle. In this stage, the development of instruments to test the feasibility level of the product prepared for media reviewers and material reviewers is arranged. While the implementation of product utilization trials was carried out on small groups, namely kindergarten teachers. According to (Lee & Owens, 2004), the data analysis technique used in this method is Rating scale with the assessment obtained based on the total response data from each statement point presented in the questionnaire. The following is a rating scale reference used in the questionnaire assessment aspects (1) strongly disagree, (2) agree, (3) disagree, (4) strongly agree.

In the study, the use of a rating scale was used with the aim of measuring respondents' perceptions of this development module product. While the data collection technique applied in this development uses an instrument in the form of a questionnaire. The use of 4 points of the questionnaire assessment level is needed to eliminate doubts, and usually there are a total of 5 levels of reference points that represent the meaning of doubt/neutral. Therefore, the results of the feasibility test with a rating scale if the data obtained from the questionnaire get the majority points at a value of (3) agree, and (4) strongly agree, then a media gets a positive response and is said to be feasible to use. Meanwhile, if the majority of data in the questionnaire that has been collected gets a value of (1) strongly disagree, and (2) disagree, then the resulting media is said to be unfit.

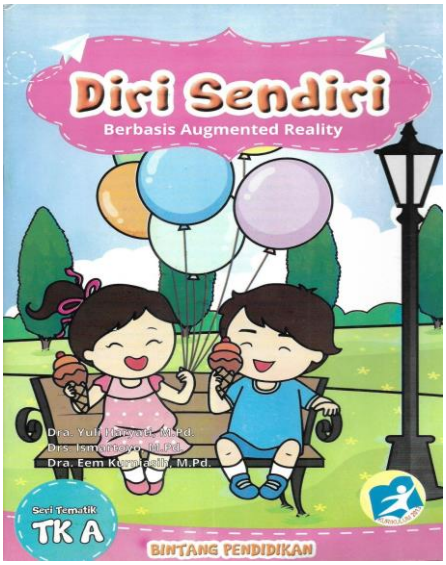

Figure 2. M-BAT page view

RESULTS AND DISCUSSION

The result of the development is a 2-dimensional pictorial space module book. The module contains material, examples and practice questions. Two-dimensional objects are modified into markers that project 3-dimensional objects when scanned with the application. The following figure 3 shows the part of the module that has a picture of the building space and functions as a marker.

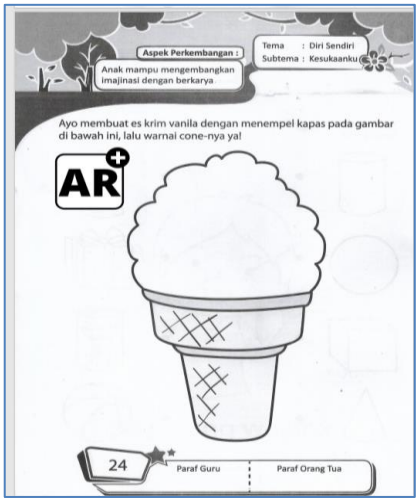

Figure 3. Projected Thematic AR display

If the marker as shown in Figure 3 above is scanned by the Augmented Reality application, the projection of 3-dimensional objects is automatically raised. Augmented Reality application projects 3D objects from 2D images printed in the book is a development product. Each 3D object that appears will correspond to the type of building space that is being scanned. The following in Figure 3 is a display of 3D objects when the marker is scanned with the application.

Figure 4. M-BAT display juxtaposed with marker

The animation of the spatial web is generated when the action card is juxtaposed with the marker. This is also a different development from the existing development. So that students can better understand the characteristics of each building space and add to the attractiveness of the product developed. The difference is shown in Figure 4 when the marker is scanned together with the action card.

The product results of the development were carried out feasibility tests on media experts and material experts. as for the results of responses from media experts and material experts on Augmented Reality-assisted modules with M-BAT are presented in graph 1.

Figure 5. Media & Material Expert Validation

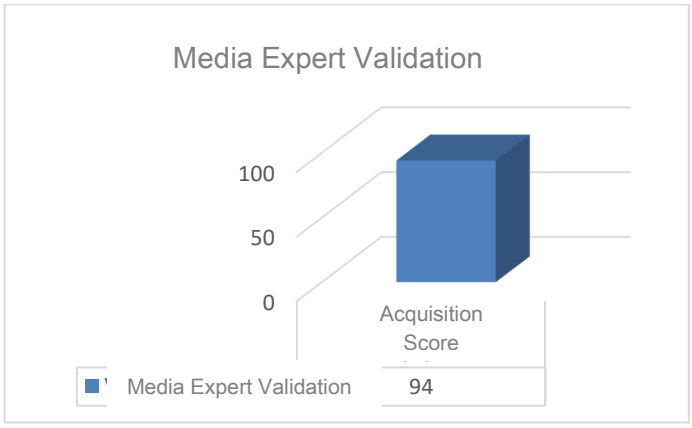

Figure 6 . Diagram of Media Expert Responses

In Figure 6 of the media expert's response, based on the results of the media expert validation, the average value of the validation sheet is 94. Therefore, based on the results of the responses obtained, the Augmented Reality module with puzzles obtained a positive response and is feasible to use. In addition, there are suggestions and input from media experts on the Augmented Reality module media with this puzzle in the form of additional optimization in the aspect of utilization instructions. For the rest of the media experts gave a positive response both from the module design and the user interface of the Augmented Reality module media with puzzles.

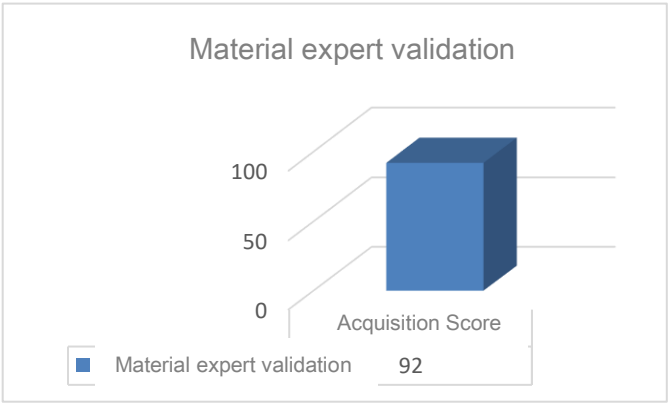

Figure 7. Diagram of Material Expert responses

Based on Figure 7 diagram of the results of the Material Expert's response, based on the results of the material expert validation obtained an average value of the validation sheet of 92. Based on the results of the responses obtained, the Augmented Reality module with M-BAT received a positive response and was feasible to use. For the rest of the media experts gave a positive response to the product both from the density of the material and the questions in the module as well as the content of the material in the application of the Augmented Reality module media product with puzzles.

Figure 8. Limited Product Test of Tunas Kencana Mukti Kindergarten Pedurungan & at NASIMA Semarang Islamic Kindergarten

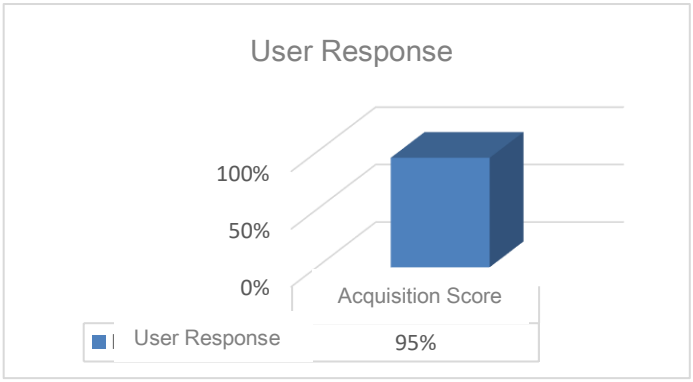

Figure 9. Teacher's Response

From the example of figure 9, the results of the trial in the aspect of product usefulness, based on the results of the user response questionnaire obtained a score of 95%. From the responses obtained, the teacher likes the Augmented Reality module with puzzles because the product is able to display an interesting and amazing 3D augmented reality, so the Augmented Reality module with M-BAT gets a positive response and is feasible to use.

In the development of Augmented Reality assisted module products, several stages are carried out, namely, the analysis stage. This stage is carried out observations to understand the constraints and needs that exist in the field so that development as needed. According to (Lee & Owens, 2004), the assessment stage is divided into 2 stages, namely (1) needs assessment and front-end analysis. The needs analysis stage is carried out by direct observation and interviews with teachers at school, namely kindergarten teachers. the next step is to analyze needs by collecting data on student characteristics, namely observations made of kindergarten students. determine the material, determine the competency standards achieved and decide on the media used and identify student learning needs.

Stage (front-end analysis) based on the results of interviews and observations. obtained the conclusion that there are difficulties for students to understand the concept of abstract spatial shapes. Because students have varying intelligence potential. some facts that learning activities that are guided by printed books and lecture methods are still considered less than

optimal in meeting the diversity of student characteristics. resulting in students not achieving optimal learning outcomes. Therefore, as a support for the learning process in kindergarten students of building space material, Augmented Reality technology was chosen as a solution to solving the obstacles that occur.

Design stage. At this stage began to determine the 3D shape model that will be displayed in the module book, the design of the attractive module book both cover design and layout design and presentation of separate action card pieces with books, User Interface design in Augmented Reality applications, media specifications, content information and configuration controls. Stages of development, space building material is collected and organized into applications and modules. Making Augmented Reality applications is made from the main software, namely utilizing the Unity 3D 2019 application to produce applications with an Android base, Vuforia as a target manager marker database and Adobe Photoshop to design UI and Module Layout. There are 2 kinds of markers with different functions used in this media, the first kind of 2D printed space in the book and markers in the form of action cards in the form of QR-Codes separated from the module. If the action card is placed side by side with the Thematic 2D marker, it can bring up the web animation form of the 3D object that is being projected. Furthermore, the marker design is uploaded on the target manager marker database provider page.

Instrument development is carried out to test how the feasibility level of Augmented Reality module products with puzzles to media expert reviewers and material experts. As well as trials of product utilization assessment carried out on small groups, namely with kindergarten teacher respondents. Augmented Reality is one of the technologies combining the real world with the virtual world, as if there is no boundary between the two. As a medium that mediates between humans and computers and computers with humans and humans with humans, Augmented Reality technology can be developed into interesting applications that are utilized for various purposes and not only exist as a mere new technology update. AR technology can also bring a new environment by utilizing the addition of virtual environments (Wang, 2009).

Augmented Reality technology-assisted module with M-BAT as a learning resource for kindergarten students' space building material was developed as a support for the main book. Learning support books have a function as material for enrichment for students (Kurniasari et al., 2014). It can be concluded that supporting books or complementary books are an addition to the main book for students. According to (Jamhari et al., 2018) in learning supporting devices such as learning resources are needed to help teachers convey information or messages to students. Given that conventional learning resource materials in the form of physical or printed materials are the easiest media for educators to operate in delivering material.

The use of modules is a form of learning that leads to assistance, attention and special treatment aimed at students with different interests, abilities, understanding and speed. Research conducted by (Cusack & O'Donoghue, 2012) shows that students strongly agree and are satisfied learning using modules. So that the module is a learning resource that can individually help students to achieve learning goals. Degeng in (Prasetiyo et al., 2018) The use of media in combination is possible. This is in line with previous research which states that the intended combination is a combination of conventional media with technology. The result of the combination is a combination of real objects with virtual objects (Abdillah et al., 2020).

The combination intended here is the result of combining media with technological sophistication that is always developing, sophisticated and modern. As well as artificial objects that are presented in virtual form. The use of AR technology in learning is still in its infancy so

it is necessary to observe how much potential it has to be utilized in creating an effective learning atmosphere (FitzGerald et al., 2013). Augmented Reality is a unique change in learning with mobile devices (Joan, 2015). Utilization of Augmented Reality for learning is proven to be able to attract students' interest, providing comfort for students learning material through the use of AR (Wu et al., 2013). Therefore, due to the continuous development of AR technology, it can be utilized in various fields including education, one of which is learning mathematics.

The module developed is media by utilizing Augmented Reality technology with the addition of Android-based puzzle features. Media utilizing smartphones is very practical, can be done anywhere and anytime (Puspitasari et al., 2020). Complete material is presented in the module regarding sample images, explanations, practice questions and examples in real life. The application is included in the android smartphone so that the media can be studied independently anywhere. From the results of research by (Soepriyanto et al., 2017). In line with previous research, the use of Augmented Reality learners can directly interact with digital content so as to support increased abstraction of creativity, imagination and learning (Persefoni & Tsinakos, 2015). The results of research using Augmented Reality in science learning show a higher cognitive increase when scaffolding is used (Yoon et al., 2012). In accordance with the exposure of previous research that produced AR mobile learning media classified as very effective, efficient and fun (Hidayat et al., 2018). Similarly, explained in previous research in the form of Augmented Reality applications as a supplement to the sign language module getting a valid assessment as media (Hapsari et al., 2019).

Based on the development objectives and has gone through a series of stages and responses obtained from experts, Augmented Reality assisted modules with puzzles are said to be good overall both the completeness of the material in it. The results of the media expert's response from 15 statements got 4 points and 1 statement scored 3. From these results, it shows that the Augmented Reality-assisted module with puzzles is said to be feasible to use. With additional suggestions in the form of additional optimization in the aspect of utilization instructions. The results of the material expert's response from 22 statements get points 4 positive responses to the product both the density of the module material and the application and questions in the module. Therefore, the Augmented Reality module media with M-BAT is said to be feasible to use.

Meanwhile, in the results of the trial of the usefulness of Augmented Reality module products with puzzles applied to 4 students obtained from respondent one 13 statements obtained points 4. Respondent two 13 statements obtained points 4. Respondent three 13 statements obtained points 4. Respondent four 13 statements obtained points 4. Therefore based on the responses obtained, the Augmented Reality module with M-BAT obtained a positive response and is feasible to use.

CONCLUSION

This development research produces products in the form of Augmented Reality-assisted modules with M-BAT containing space building materials and Android-based Augmented Reality applications. This product is an alternative to complement the deficiencies in space building math learning at Tunas Mukti Pedurungan Semarang Kindergarten and Nasima Semarang Islamic Kindergarten. The results of responses from media experts obtained feasible criteria, the results of the material expert review obtained feasible criteria and the results of small group trials clarified feasible use.

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