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Implementation of Augmented Reality-based thematic elementary school textbooks to improve students' literacy skills

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Abstract

In the current post-pandemic period, breakthroughs are needed in conducting learning, one of which is packaging printed versions of conventional teaching materials into digital teaching materials, there are already many digital textbooks or e-books on the internet, but there is no elementary thematic material packaged digitally based on augmented reality and able to display augmented reality that is interesting for students, this augmented reality-based elementary school thematic textbook can make it easier for students to understand elementary thematic material whose products can be installed on all students' computers and smartphones, so that learning becomes more fun and enjoyable, then It is hoped that students will have the literacy skills of students in using the AR-based textbook product. the research method used is using the ADDIE R & D model (Analysis, Design, Develop,

Keywords: Development; textbook, elementary school thematic, based on Augmented Reality.

Introduction

In the world of education, there are currently many textbooks on the market, but they are not in accordance with the demands of the times, for example, textbooks in elementary thematic learning. This reality makes teachers have to be able to package and make textbooks that are interesting for students and able to improve students' literacy skills, elementary schools in the city of Semarang and its surroundings, both public and private, have not been able to provide augmented reality-based elementary thematic textbooks that are capable of displaying 3D objects in every area. textbook pages, therefore it is necessary to make augmented reality-based thematic elementary school textbooks that can improve students' ability to understand mathematical material in a measurable way.

3) Teachers who teach material about numbers and letters only use media to make sketches or pictures and there are still few teachers who use software-based media that facilitate abstraction of subjects for students, 4) Students are still weak in solving problems related to numbers and letters that comes from everyday life. 5) students have difficulty recognizing letters and numbers so they need renewable media that displays augmented reality accompanied by interesting music and games.

In accordance with the results of observations made by researchers at SDN Pedurungan Tengah 01 Semarang and SDN Pandean Lamper 01 Semarang, the thematic learning process for SD is less active and less interesting. The interaction of teaching and learning in the classroom is inseparable from the influence of the media used by teachers in conveying teaching material that is currently developing rapidly, namely smartphones. The existence of technology, especially smartphones which are now growing, must be addressed wisely. The phenomenon of the high number of smartphone users is certainly a challenge and opportunity in the world of education. The challenge is abuse for negative things. Besides being a challenge, the existence of smartphones also brings great opportunities to develop useful technology in the field of education. One of the benefits that can be drawn from the existence of this technology is to use it as an effective, creative and educative learning medium. So that educational application media can continue to be developed, one of which is Augmented Reality (AR) technology.

Literature Review

Augmented Reality

Understanding the Definition of Augmented Reality In general, Ronald T. Azuma (1997) defines Augmented Reality as a

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combination of real and virtual objects in a real environment, running interactively in a literature review of no more than 1000 words by presenting state of the art and road maps (road map) in the field studied. Charts and road maps are created in JPG/PNG format which are then inserted in this field. Relevant primary sources/references and prioritizing research results in scientific journals and/or the latest patents. It is recommended to use library sources from the last 10 years. real time, and there is integration between objects in three dimensions, namely virtual objects are integrated in the real world. The merging of real and virtual objects is possible with appropriate display technologies, interactivity is possible through certain input devices, and good integration requires effective tracking. [6] Virtual objects display information that the user cannot perceive with his own senses. This makes Augmented Reality suitable as a tool to help users' perception and interaction with the real world. Information displayed by virtual objects helps users carry out activities in the real world. An example is when a television presenter delivers the news, there are animations or virtual objects that accompany him, so it is as if he is in the virtual world, when in fact it is a technique of combining the virtual world with the real world which is called Augmented Reality. In addition to adding virtual objects in a real environment, Augmented Reality also has the potential to eliminate existing objects. Adding a virtual image layer is possible to remove or hide the real environment from the user's view. For example, to hide a table in a real environment, it is necessary to draw a layer representation of empty walls and floors placed over an image of the real table, thereby covering the real table from the user's view.

Augmented Reality Thematic Book

Augmented Reality Thematic Book is a combination of ordinary books with AR technology. In general, BUBAR has two main components, namely books equipped with Quick Response Code (QRC) type markers on almost every page, and the second is equipment to capture markers and display the results. Augmented Reality Book is included in the category of specially designed learning resources, because it was developed as a component in terms of making it easier for users to understand the contents of the book by displaying 3-dimensional objects on 2-dimensional images printed on the book. Augmented Reality Books can also be said to be media because they are in the form of printed materials that can display the necessary information. D. Vuforia Vuforia Vuforia is a software library for Augmented Reality, which uses consistent sources regarding computer vision that focus on image recognition. Vuforia has many features and capabilities, which can help developers realize their thoughts without any technical limitations. With support for iOS, Android and Unity3D, the Vuforia platform supports developers to create applications that can be used on almost all types of smartphones and tablets. E. Unity 3D Unity 3D is an integrated tool for creating 3-dimensional objects in video games or for other interactive contexts such as Architectural Visualization or realtime 3D animation. The Unity 3D development environment runs on Microsoft Windows and Mac OS X, and applications created by Unity 3D can run on Windows, Mac, Xbox 360, Playstation 3, Wii, iPad, iPhone and do not lag behind on the Android platform. Unity can also create browser-based games using the Unity web player plugin, which works on Mac and Windows, but not Linux. The resulting web player is also used for development on Mac widgets. F. Blender Blender is software for creating three-dimensional animations on a free-of-charge basis. In addition, this software can also be used to create three-dimensional games. As in other three-dimensional software, in Blender the formation of objects is made from primitive objects. Primitive objects include cubes, planes, cones, circles and tubes. By manipulating these primitive objects we can create the three-dimensional object we want.

Elementary Thematic Learning

Elementary Thematic Learning Thematic learning is integrated learning that uses themes to link several subjects together in a book so that the material is related to one another. Implementation of the 2013 curriculum requires the existence of thematic textbooks. Implementation of this curriculum as the basis for compiling thematic books is expected to provide many advantages including: 1) Students easily decide to pay attention to a particular theme, 2) Students are able to learn knowledge and develop various basic competencies between subjects in the same theme, 3) understanding of the subject matter is more in-depth and memorable, 4) basic competencies can be developed better by linking other subjects to students' personal experiences, 5) Students are able to feel more about the benefits and meaning of learning because the material is presented in the context of a clear theme, 6) Students are more passionate about learning because they can communicate in real situations, to develop an ability in one subject while studying other subjects, 7) teachers can saves time because subjects presented thematically can be prepared at once and given in two or three meetings, the remaining time can be used for remedial, strengthening, or enrichment. Problems in thematic learning for elementary school students are given several themes so it can be said that every day each class will get one learning activity. However, the implementation of the 2013 curriculum with thematic learning is felt to be inappropriate for some people.

Student Literacy Ability

Today, the problem of literacy is a problem that must receive special attention from the Indonesian people. This is because in the last few decades, the competitiveness of the Indonesian nation among other nations has lacked competition, which is reflected in the comparison of the Human Development Index (IPM). Tjalla (2011) suggests several international studies that describe this condition, namely the Program for International Students Assessment (PISA) research on literacy skills (mathematics, science and language) of students from various worlds in 2003, 2006, 2009 and 2012. Specifically for language literacy, In 2003 the literacy achievement of Indonesian students was ranked 39th out of 40 countries, in 2006 it was ranked 48th out of 56 countries, in 2009 it was ranked 57th out of 65 countries, and in 2012 it was ranked 64th out of 65 countries. Then, research Progress in International Reading Literacy Study (PIRLS) in 2006, which conducted a study of 45 developed and developing countries in the field of reading

in fourth graders of elementary school around the world under the coordination of The International Association for the Evaluation of Educational Achievement (IEA) and obtained results that placed Indonesia in 41st place. The results of this international study showed that the literacy skills of Indonesian students who represented Indonesian society were relatively low, especially in terms of language literacy. Society has not made reading and writing activities a daily habit. For western society, reading activities on buses, trains or airplanes has become a common sight and is rarely found in Indonesia. Purwanto (Nurdiyanti, 2010) argues that this is because Indonesian society is an alliterate society, meaning people who can read, but do not wish to make the habit of reading a daily activity. Thus, the cause of low literacy skills is the oral tradition that is rooted in society. In addition, the school system still does not provide opportunities for literacy traditions for students. The teaching model in the classroom is delivered using a teacher center approach that positions students as listeners. Reading activities as a framework for learning are rarely applied by teachers. Therefore, students do not find or are not facilitated in their literacy development, so that a literacy culture that yearns for literate generations is difficult to achieve. Apart from reading ability, Indonesian people's writing skills are also relatively low. The Ministry of National Education (Gipayana, 2004: 60) revealed a number of survey data from (IEA) regarding the literacy skills of Indonesian children that around 50% of grade VI elementary school students in the six provinces assisted by the Primary Education Quality Improvement Project (PEQIP) cannot compose. One of the reasons for the low reading ability of elementary school students in Indonesia is that students receive more rote lessons than practice, including composing.

METHOD

method

This research utilizes research and development (R&D). Development research is a study strategy used to create specific goods and assess their efficacy (Sugiyono, 2017). This development study employs the ADDIE approach, which has five stages: Analysis, Design, Development, Implementation, and Evaluation.

Research Design

The ADDIE model was utilized in this research as the research design, which is divided into five phases: analysis, design, development, implementation, and evaluation. These five processes are carried out on a consistent and systematic basis.

Population and Sample/Study Group/Participants

Qthe population in this study were students of theElementary School at Semarang especially SDN Pedurungan Kidul 01 Semarang and SD Hj Isriati Baiturrahman 1 Semarang, took two experimental classes and a control class.

Data Collection Tools

The research data was gathered through a questionnaire response validation from material experts, learning media experts, and user responses, which was then followed by tests in the form of pretest and posttest to measure students' literacy abilities.

Data Collections

The data was gathered using a Google form referring to the validation of material experts and learning media experts, followed by the student response questionnaire, which was also completed using a Google form, while the pretest and posttest were completed in writing and scanned results were sent via email to be evaluated in detail.

Data Analysis

For the evaluation of the results of the acquisition of research data conducted using a Likert scale connected to user replies and expert validation, the average score and N Gain test were used to measure the development of process skills and the cognitive learning consequences of students.

RESULT AND DISCUSSION

Results

In this study using the ADDIE development model with five stages, in order to obtain the following research results:

1. Analysis

The analysis step consists of two stages, namely performance analysis and needs analysis. The first stage, namely performance analysis is carried out to find out and clarify whether the performance problems encountered require solutions in the form of program implementation or management improvements. In the performance analysis, an in-depth study was carried out on the performance of the teachers of SDN Pedurungan Tengah 01 and SDN Pandean Lamper 01 Semarang who taught thematic material for grade 1 elementary school which showed that so far no teacher had used AR-based thematic elementary school textbooks during the Covid-19 pandemic. this, so it is very necessary to have this textbook media in helping students practice in AR to understand thematic material and its types.

In the second stage, namely needs analysis is a necessary step to determine the abilities or competencies that students need to learn to improve learning achievement (Pribadi, 2010: 128). What is clear is that learning media are needed that are able to produce thematic material for grade 1 elementary school packaged in augmented reality and enable students to practice getting to know other thematic elementary schools in an interesting and systematic way.

2. Design

This step requires clarification of the learning program designed so that the program can achieve the learning objectives as expected (Pribadi, 2010: 130).

In product design, what is done is the next stage of the ADDIE model, namely design. At this step it is necessary to clarify the learning program designed so that the program can achieve the learning objectives as expected (Pribadi, 2010: 130).

In the manufacture of augmented reality-based thematic

elementary school textbooks, class 1 material was made in a team by the UT research team and assisted by IT experts outside UT so that there was good collaboration with the UT research team to create a material and design framework that was expected in making SD-based thematic materials. AR, then executed by IT experts who are competent in their fields, after the design of AR-based elementary thematic textbooks has been finished for approximately 3 months according to the suggestions from the first year's research results, the product is continued at the third stage, namely development.

Figure 4. Elementary Thematic Textbook Design after revision

3. Development

This development step includes making, buying, and modifying learning media to achieve predetermined learning goals. The development step, in other words, includes activities to select and determine the appropriate learning methods, media and strategies used in delivering personal material (2010: 132). In this development stage the framework that has been designed will be realized so as to produce a product that can be implemented. In this development stage the AR-based thematic SD textbook products are validated in advance to the experts, namely material experts and media experts, so that the augmented reality-based SD thematic products are truly suitable for use before being tested limitedly at SDN Pandean Lamper 01 Semarang

At the development stage, AR-based thematic elementary textbooks will be made according to the material, after print-based media and AR are completed, media experts and material experts will be validated by the validator to get input and evaluate according to the input provided by the validator. Furthermore, the Android-based media is revised according to the input provided by the validator to improve the product.

Figure 5. Product validation of AR-based elementary thematic textbooks by experts

Based on 2 validators who are experts in the field of elementary school children's education, namely Dr. Fida Fironika, M.Pd. (Head of Study Program PGSD Unissula Semarang) and learning media expert namely Dr. Achmad Buchori, M.Pd. as a learning technology expert at the University of PGRI Semarang, the following data is obtained:

Table 2. Validation of learning media experts

Media Expert	Application Aspect	Creative Aspect	Innovative Aspect	Aspects of Visual Communication
Validation Value	90%	85%	95%	90%

From the table above, an average score of 90% is obtained, meaning that the augmented reality-based thematic SD textbooks are very suitable for use in SD thematic learning in SD Semarang.

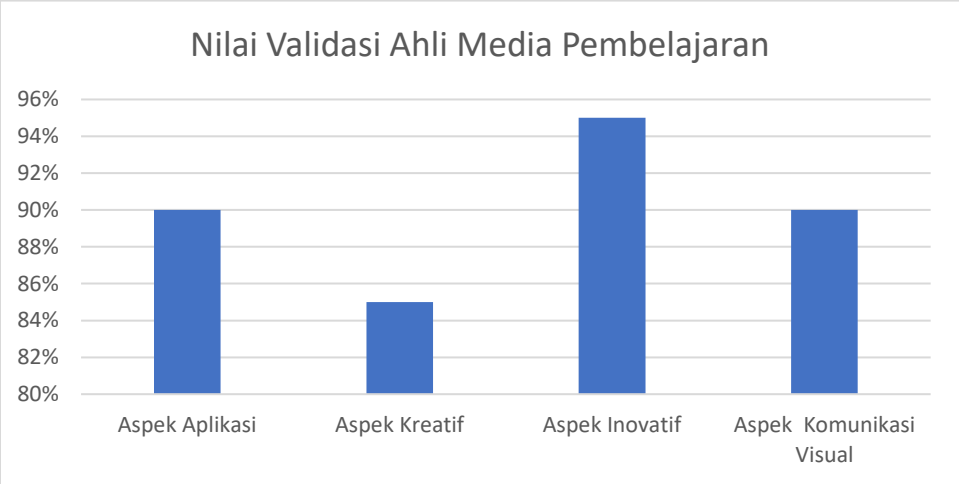

Table 3. Validation of learning media experts

Then continued with the validation of learning media experts, it was obtained data that the AR-based thematic SD textbook media was feasible to use, so that AR-based thematic SD textbook media products could be used optimally.

Table 4. Validation of learning material experts

Material Expert	Aspects of Material Substance	Language Aspect
Validation Value	90%	94%

From the table above, an average score of 92% is obtained, meaning that the material in the AR-based thematic elementary school textbooks is very suitable for use in thematic learning in elementary schools.

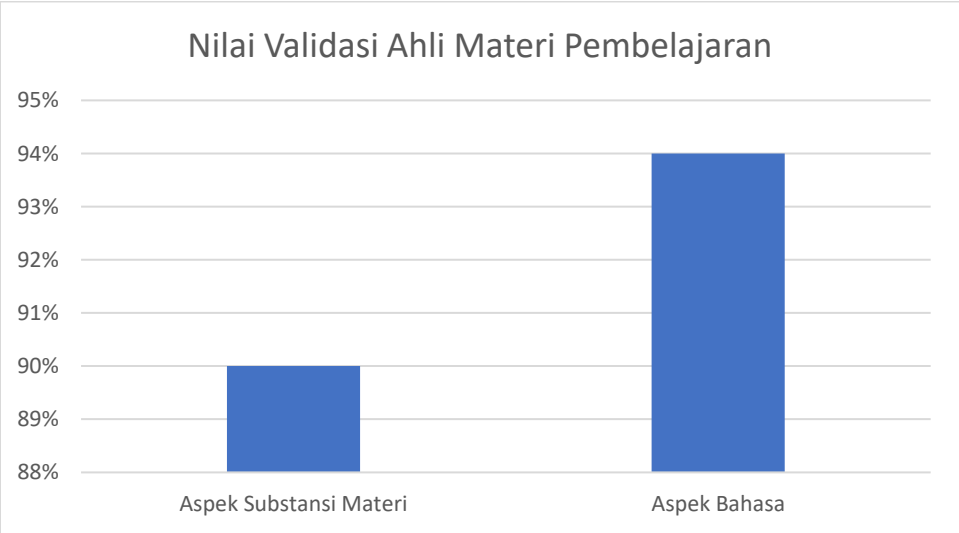

Table 5. Validation of learning material experts

Then continued with the validation of material experts so that the suitability of the content of the material can be accounted for, so that the media products of AR-based thematic SD textbooks can be used materially.

4. Implementation

Carry out learning programs by implementing learning program designs or specifications. The main objective of the implementation phase, which is the step of realizing design and development, is to guide students to achieve learning objectives, guarantee solutions to address gaps in learning outcomes faced by students, and ensure that at the end of the learning program students need to have the knowledge, skills, and competency competencies necessary attitude (Personal, 2010: 134). In the implementation stage, the researcher plans to apply AR-based thematic SD textbook learning media which will be carried out in a limited test at SDN Pandean Lamper 01 Semarang to find out the response of teachers and students offline at school,

Figure 5. Extensive test at SDN Pedurungan Kidul 01 Semarang by the research team

Figure 6. Expanded test at SDN Pedurungan Kidul 01 Semarang by teachers and students

Figure 7. Expanded test at SD Hj Isriati Baiturrahman 1 Semarang by the research team

Figure 8. Expanded test at SD Hj Isriati Baiturrahman 1 Semarang by the research team and teachers at SD Hj Isriati Baiturrahman 1 Semarang

5. Evaluation (Evaluation)

The final step of the ADDIE model is to evaluate learning programs and evaluate learning outcomes. As in the analysis step, the evaluation process is carried out by clarifying the competency knowledge, skills and attitudes. This evaluation is known as a formative evaluation according to the theme that has been made. In addition, it can also be done by comparing the learning outcomes that have been achieved by students with the learning objectives that have been formulated previously (Pribadi, 2010: 135). After practicing the use of AR-based thematic elementary school textbooks by teachers and students, the teachers were then asked to fill out an online questionnaire using the Google form and students took formative tests.

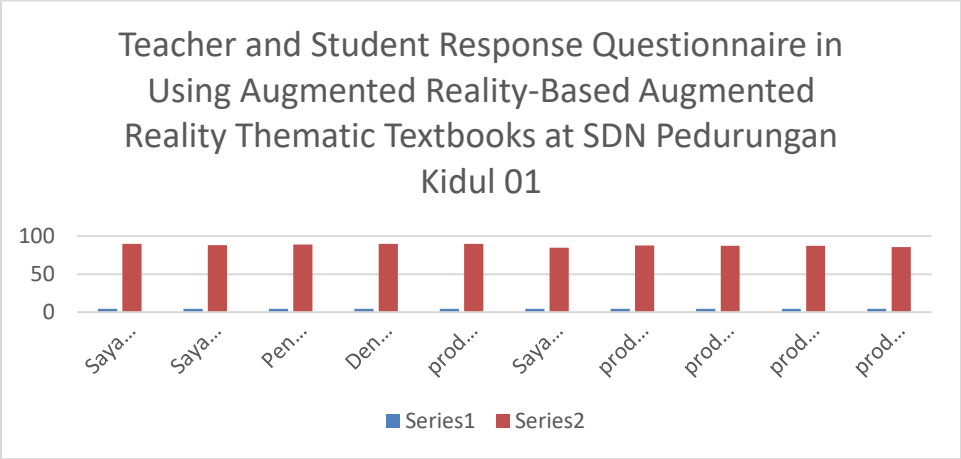

Figure 9. Student and teacher response questionnaire at SDN Pedurungan Kidul 01 Semarang

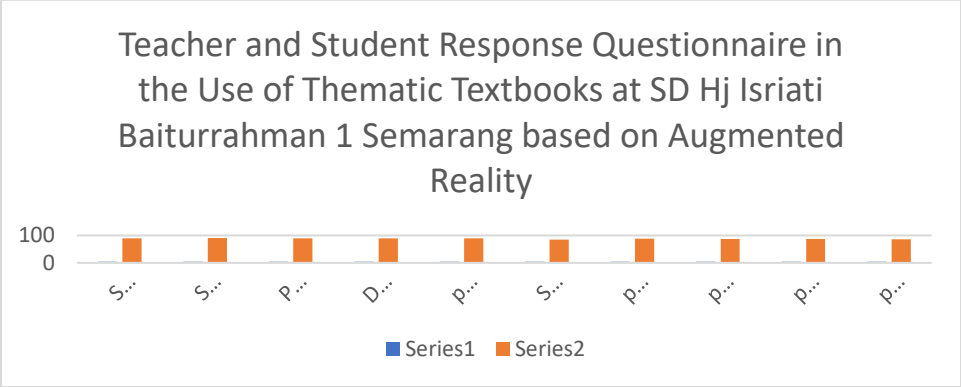

Figure 10. Questionnaire of student and teacher responses at SD Hj Isriati Baiturrahman 01 Semarang

From the results of the expanded test of augmented reality-based thematic elementary school textbooks at SDN Pedurungan Kidul 01 Semarang and SD Hj Isriati Baiturrahman 1 Semarang, they obtained a percentage score of 87.82% and 88.06% which indicated that teachers and students were very interested in using textbook products. thematic SD based on Augmented Reality. Based on the results of the posttest test, it showed an average increase of 77 to 87, meaning that the literacy skills of grade 1 elementary school students increased by 10 percent.

Discussion

The following items were notably developed during the research development stage of the ADDIE model:

Based on student response data at the State Islamic University of Semarang, it was shown that 87.34 percent of students were greatly helped by the BUBAR media for differential equations courses to increase students' spatial abilities in learning ordinary differential equations material. This is reinforced bySin, AK, & Zaman, HB (2010, June) who explained that students understand more about solar system material with augmented reality that displays 3D objects which are very easy for students to understand. Then Taketa, N., Hayashi, K., Kato, H., & Noshida, S. (2007, July). Strengthening the success of packaging pop up books based on augmented reality which makes students easy to access lecture material in three dimensions with attractive and easy-to-understand material displays, then Chao, WH, & Chang, RC (2018) explains that with augmented reality in learning mathematics makes students change their mindset regarding learning mathematics into something that is easy and fun, then Dhiyatmika, IDGW, Putra, IKGD, & Mandenni, NMIM(2015) explained that kindergarten children in Bali really enjoy learning about animals in an interesting way using augmented reality

Based on the calculation above, because Ho is rejected, it can be concluded that mathematical cognitive abilities using Android-based learning media using BUBAR are better than conventional learning models. This proves that there are differences in cognitive abilities because the lecturer uses two different treatments between the control class and the experimental class with the average value of the experimental class, namely x1 = 83.13 and the average of the control class, namely x2 = 72.29. From the results of cognitive abilities it shows that students are enthusiastic in using android-based learning media using BUBAR because this is a new thing for students. They feel that there is a media that makes it easier for them to understand ordinary differential equations. This is reinforced byTomi, AB, & Rambli, DRA (2013) who explained that using mobile augmented reality made science learning easier for students to understand with the help of magical playbooks, then reinforced by Estapa, A., & Nadolny, L. (2015) explained that by using learning media based on augmented reality makes students' motivation and interest in learning better, then Tomaschko, M., & Hohenwarter, M. (2019) explains that by learning mathematics based on geogebra AR makes students' spatial abilities improve better.

Conclusion

From the results of the extended test in the mathematics education study program UIN Walisongo Semarang, pretest and posttest with the t test obtained tcount > ttable, namely 4.29 > 1.78, then Ho is rejected, it can be concluded that the learning outcomes of augmented reality-based differential equations Ordinary Differential Equations the smartpedagogy approach is better than the conventional learning model with the average value of the experimental class being strengthened, namely x1 = 83.13 and the average control class, namely x2 = 72.29.

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