

AUGMENTED REALITY MAPS AS AN ALTERNATIVE HISTORY LEARNING MEDIA FOR VOCATIONAL STUDENTS

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Abstract: *This research focuses on the significance of responding to massive changes in historical learning. However, various learning issues arise, resulting in a lack of understanding of the content by students, particularly those who have not previously understood Indonesian History material well. This is due to dense learning materials and the use of ineffective learning media. As a result, students struggle to understand the material in the text-book. Based on this, learning innovations that facilitate learning Indonesian history are required. One of them is the study of prehistoric people's lives, which includes historical values, using augmented reality visual media. This media has the ability to clarify ideas, increase students' imagination and interest, and thus increase understanding of the material. Augmented reality packaged digitally can directly create interaction between students and 3D objects, facilitating information delivery. The goal of this study is to create learning media ARMAPS (Augmented Reality Maps) and evaluate their effectiveness. A 4D model was used in this study, which included: (1) definition, (2) design, (3) development, and (4) dissemination. "ARMAPS" learning media contains material pack-aged in the form of an Android application. Based on the percentage value, it is possible to conclude that the learning media "ARMAPS" is very valid and very effective for learning Indonesian history.*

Keywords: *history learning media; ARMAPS; Mesolithic rock shelter.*

Abstrak: Penelitian ini berfokus pada pentingnya merespon perubahan besar dalam pembelajaran sejarah. Namun, berbagai permasalahan pembelajaran muncul sehingga mengakibatkan kurangnya pemahaman terhadap isi materi oleh siswa, terutama yang sebelumnya belum memahami materi Sejarah Indonesia dengan baik. Hal ini disebabkan karena padatnya materi pembelajaran dan penggunaan media pembelajaran yang tidak efektif. Akibatnya, siswa kesulitan untuk memahami materi dalam buku teks. Berdasarkan hal tersebut, diperlukan inovasi pembelajaran yang memudahkan pembelajaran sejarah Indonesia. Salah satunya adalah kajian kehidupan masyarakat prasejarah yang memuat nilai-nilai sejarah melalui pemanfaatan media visual augmented reality. Media ini memiliki kemampuan untuk memperjelas gagasan, meningkatkan imajinasi dan minat siswa, sehingga meningkatkan pemahaman materi. Augmented reality yang dikemas secara digital dapat secara langsung menciptakan interaksi antara siswa dengan objek 3D, sehingga memudahkan penyampaian informasi. Penelitian ini bertujuan untuk membuat media pembelajaran ARMAPS (Augmented Reality Maps) dan mengevaluasi keefektifannya. Model 4D yang digunakan dalam penelitian ini meliputi: (1) definisi, (2) desain, (3) pengembangan, dan (4) diseminasi. Media pembelajaran "ARMAPS" berisi materi yang dikemas dalam bentuk aplikasi

Android. Berdasarkan nilai persentase tersebut dapat disimpulkan bahwa media pembelajaran “ARMAPS” sangat valid dan sangat efektif untuk pembelajaran sejarah Indonesia.

Kata kunci: media pembelajaran sejarah; ARMAPS; gua batu mesolitikum.

PENDAHULUAN

The world face technological disruption, accelerating and causing changes in all aspects of life (Bashori, 2018; Saputra & Meilasari, 2020). Technological disruption goes hand in hand with the Industrial Revolution 4.0. This creates a close relationship between humans and technology and gives humans complete control over the world they make (Harari, 2018; Mahmood & Mubarik, 2020). The Industrial Revolution 4.0 creates a complex interaction between humans and technology, education, gender, work, and mentality (Muhali, 2018; Thomas & Nicholas, 2018). Education is considered the primary basis for welcoming the industrial revolution; it aims to make the younger generation creative, innovative, and competitive (Harahap, 2019). In this era, history learning is required to take advantage of IT developments in learning activities to become a tool that can improve students' learning experience and way of thinking (Yusuf et al., 2020).

History can be said to be one of the social science clusters that aim to provide students with an understanding of past events and is the door to finding wisdom from events that have occurred (Sayono, 2013). Learning media can be a tool to reconstruct and concretize past events to make learning easier for students (Suryani, 2016). Therefore, in the preparation of historical learning media, it is expected to reconstruct historical events to be more authentic, transparent, vital, and engaging (Kochhar, 2008).

Data in the field (SMK Negeri 4 Malang) indicated that the technological advance in the form of learning media has not been optimally utilized in the learning process of Indonesian history. Moreover, the identification of student's textbooks, show that the textbooks tended to provide historical facts with rigidly written language and cause students to experience boredom when reading material (Darmawan & Mulyana, 2016). In addition, another challenge arises when all materials in the Indonesian History subject must be completed within one year. This impact the low-interest of students in the matter of Indonesian History. In connection with this phenomenon, we need a learning media that is packaged concisely, clearly, and attractively that can stimulate the curiosity and interest of students.

As a positive response to the problem of learning history, learning media is needed to increase students' curiosity and interest. One alternative that can be used is visual media which plays an important role in the learning process because it can strengthen memory and facilitate the process of understanding historical material (Atmaja, 2019; Suryani, 2016). Visual media can also provide a relationship between the content of the material and the real world; this of course, can help make the learning process more optimal (Atmaja, 2019; Nurannisaa, 2017). One form of visual media is 3D objects in the form of augmented reality.

Augmented reality integrate real and virtual objects in a real environment that forms the interaction between the user and the surrounding environment (Azuma, 1997; Carrera & Asensio, 2017; Idrus & Yudherta, 2016; Mühlhäuser & Gurevych, 2008). As stated by Schrier (2006), it is explained that the use of historical learning media with augmented reality can increase the imagination and interest of students

because it is more effective and efficient. Furthermore, Lee (2012) explained that this technology has the potential to attract, inspire, and motivate students to explore information from various perspectives. In addition, adding map elements to the media can provide a clearer picture related to the part of the earth's surface to be studied (Subagio, 2003). So, by including 3D objects (augmented reality) and maps in the learning media, it is expected to increase interest in the material being taught, especially in material related to an area's landscape.

Studies on augmented reality and maps in history learning are still rarely found. The use of augmented reality and maps is widely used in the field of tourism and landscape analysis, for example in the research of Guntur et al. (2019) which uses a combination of AR and maps for information on buildings and roads in Pontianak, Carrera & Asensio (2017) which uses a combination of AR and maps. Dimas et al. (2018) used a combination of AR and maps to visualize protected forest areas to improve spatial intelligence. These three studies present an element of novelty in augmented reality development, but have not been applied to the realm of historical education. This research suggests historical material based on augmented reality in classroom learning.

One of the subjects that must be studied by students is related to the lifestyle of the Pre-historic Age in Indonesia. However, in practice the material is not reviewed clearly and in detail so that it has an impact on the lack of understanding of students. In addition, the results of the latest research findings have not been presented. Whereas the results of the latest research can increase the repertoire of knowledge of students and can improve self-competence. One of the research results that can be used is related to the findings of residential caves in South Kalimantan which are rich in prehistoric relics (Suprpta, 2019).

To face the massive development of technology and knowledge, we need media that can arouse students' interest in learning related to Indonesian History material. The alternative solution offered is to utilize augmented reality in learning. The research aims to develop ARMAPS (Augmented Reality Maps) history learning media which can increase students' interest in learning history, so that students' understanding will increase. In this case, the material presented is related to the cultural remains of the Mesolithic community in the karst caves of Mantewe, South Kalimantan related to cultural and environmental aspects.

METODE

This research is guided by a media development model that can clearly and systematically describe development research procedures to get the best product according to the needs analysis. The research and development of ARMAPS learning media are structured using a 4D model with a systematic procedure for each stage. There are four stages, among others (Thiagarajan, 1974): (1) define, (2) design, (3) development, and (4) dissemination. Figure 1 is a chart of the research and development procedure of the 4D Model.

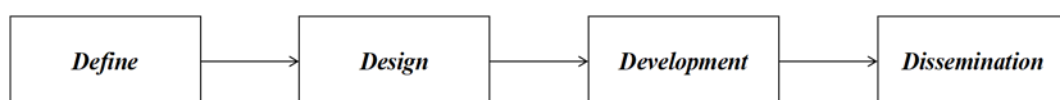


Figure 1. 4D Development Research Procedure

Data Collection Instruments

Before carrying out the product testing process, the ARMAPS media that has been developed needs to be validated by Indonesian prehistoric materials experts and learning media experts. Then after that, the media is tested on students. Therefore, a research instrument is needed. Research instruments are tools or facilities used by researchers to collect data to facilitate the data processing process (Arikunto, 2017; Hakim et al., 2017). In this study, an instrument in the form of a questionnaire was used to collect data regarding responses and assessments of a media experts, responses and assessments of material experts, and responses to trials of use on students. The material expert in this research is Deny Yudo Wahyudi, S.Pd, M. Hum who has competence related to prehistoric material and the media expert in this study is Lutfiah Ayundasari S.Pd., M.Pd who has competence in the field of technology in education. The subject of the field trial was carried out on students of class X ANIMASI A at SMK Negeri 4 Malang with details of seven students for limited trials and 28 students for large group trials. The questionnaire used in developing of this learning media is a questionnaire type with a Likert scale with four answer choices (Budiaji, 2013; Likert, 1932).

The data obtained from the Likert scale measurement results are in the form of numbers. The figure is then interpreted in a quantitative sense (Sugiyono, 2015). Answers start from a score of 4, 3, 2, to 1. The choice of a Likert scale with four answer choices is based on the convenience and advantages that can capture research data more accurately because the neutral category has multiple meanings, or it can be interpreted that the respondent has not been able to decide or give an answer, was not used in this study (Budiaji, 2013). Furthermore, non-structured interviews on student were conducted to obtain more in-depth data in the form of student responses in using ARMAPS media in the learning process.

Data Analysis

The data obtained through various kinds of expert tests and prospective users need to be analyzed to get a conclusion about a treatment. The analysis was carried out using the mean method. According to Akbar (2017), a formula can be used to process assessment data and responses from media and material experts (See Table 2). The analysis aims to determine the suitability of the ARMAPS learning media to be applied to history learning.

$$Percentage = \frac{\text{Score earned}}{\text{Max Score}} \times 100\%$$

Table 1. Criteria Level of Validity According to Expert

Level	Criteria	Information
86%- 100%	Very Valid	Very good to use
71%- 85%	Valid	Can be used with minor revisions
56%- 70%	Sufficiently Valid	May be used after major revisions
41%- 55%	Less Valid	Should not be used
25%- 40%	Invalid	Should not be used

Source: Akbar (2017)

Furthermore, the data obtained from student trials, both small group trials and large group trials were analyzed to determine the level of effectiveness of the ARMAPS learning media in Learning

Activities. The following formula can calculate the percentage level of product effectiveness (Akbar, 2017) that later could be converted into qualitative criteria (see Table 2).

$$\text{Percentage} = \frac{\text{Score earned}}{\text{Max Score}} \times 100\%$$

Table 2. Product Effectiveness Criteria by Students

Level	Criteria
81.00% - 100.00%	Very Effective
61.00% - 80.00%	Fairly Effective
41.00% - 60.00%	Less Effective
21.00% - 40.00%	Not Effective
00.00% - 20.00%	Very Ineffective

Source: Akbar (2017)

RESULTS AND DISCUSSION

The Development of ARMAPS

This learning media called ARMAPS was developed according to the needs of students to achieve basic competence 3.2, namely "Analyzing human life and cultural outcomes of the Indonesian pre-literate community". The material content developed in the ARMAPS learning media includes several things such as prehistory in Indonesia, the Mesolithic era, residential caves in South Kalimantan, to the archaeological remains found. The media developed is in the form file type named ARMAPS so, users can install the application on an Android smartphone. The application contains an arrangement of materials and 3D objects of residential caves, each containing supporting text and images to facilitate information delivery.

The learning media "ARMAPS" generally contains material for the Mesolithic people live's in Indonesia, especially related to the selection of karst dwelling caves in South Kalimantan. So, the preparation of the material on this media is adjusted to the general flow of thinking and then narrowed to specific things. Several features are found in the first ARMAPS media, namely material features packaged in the form of infographics, camera features to scan markers, and evaluation features to measure students' understanding. The main feature of the ARMAPS learning media is a 3D object that visualizes karst dwelling caves in South Kalimantan. Figure 2 is an ARMAPS media flowchart.

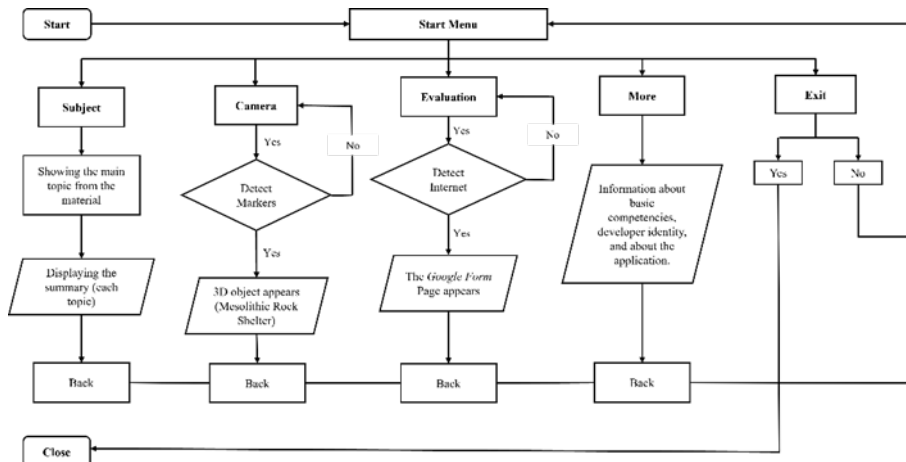


Figure 2. ARMAPS Design



Figure 3. Display of ARMAPS learning media (a) Main menu display (b) Display of one of the materials (c) Display of marker scan results

The use of learning media with augmented reality is more efficient to use (Rizki, 2012). This will increase the knowledge and understanding of students (Yuen et al., 2011). This learning media is also equipped with an evaluation feature integrated with the Google Form. This, aims to measure students' understanding of the information exploration process through the ARMAPS learning media.

The Evaluation Of ARMAPS

Products that have been developed must go through a testing phase which aims to determine the level of validity and effectiveness of the media when applied in the process of learning history (Thiagarajan, 1974). Several stages of testing must be carried out: product validity test stage (material and media), small group initial trials, and large group trials. At the validity test aims to determine whether the product developed as per the criteria and is feasible to be applied in learning. The Indonesian prehistoric material expert in this study is Deny Yudo Wahyudi, S.Pd, M.Hum and an expert on history learning

media is Lutfiah Ayundasari, S.Pd., M.Pd. See Table 3 for the result of calculation of the average percentage of material validation and media

Table 3. Calculation of the average percentage of material validation and media

Material Expert Validation	Media Expert Validation
$P = \frac{\Sigma x}{\Sigma x1} \times 100\%$	$P = \frac{\Sigma x}{\Sigma x1} \times 100\%$
$P = \frac{45}{48} \times 100\%$	$P = \frac{101}{104} \times 100\%$
$P = 0,9375 \times 100\%$	$P = 0,9711 \times 100\%$
P = 93,75%	P = 97,11%

Source. Calculation of the average percentage of expert validation results, 2021

After the two stages of expert testing have been carried out, the following process is product testing which includes testing, starting in small and large groups. Small group trials were conducted on seven students with heterogeneity who could represent the sample class, namely X ANIMATION A at SMK Negeri 4 Malang. After that, a large group trial consisted of 28 students of class X ANIMATION A who did not participate in the initial small group trial. The results of the test stated that the ARMAPS media was very valid and effective for learning.

The Main Finding

This product trial aims to determine the effectiveness of the learning media "ARMAPS" in the history learning process so it can arouse students' interest in learning. Student trials were conducted in class X ANIMASI A at SMK Negeri 4 Malang. In this stage, two steps must be carried out: initial, trials in small groups and trials of use in large groups (Thiagarajan, 1974). The scheme for collecting data on the results of product effectiveness, namely by carrying out the teaching and learning process by providing "ARMAPS" media products for learning.

The test process is carried out online using Google Meet. Seven students were randomly chosen from class X ANIMATION A in selecting students as respondents for the small group trial. The results of the effectiveness test on research subjects in the small group initial trial resulted in a percentage of 92.2%, with a sufficient number of scores. Evenly on each assessment criteria. Based on this percentage, the effectiveness of the ARMAPS learning media product on the small group trial subject shows very effective criteria to be used and utilized in learning Indonesian history. Meanwhile, the test of the effectiveness of the use of the large group followed by 28 students resulted in a percentage of 93.3%. This percentage also shows that the ARMAPS learning media product is classified as very effective for use in the Indonesian History learning process.

Based on qualitative data obtained from student comments when filling out a questionnaire on the google form. The comments obtained not only contain words of support and praise regarding the product's advantages, but also suggestions about the shortcomings of the products that researchers have developed. The student responses were grouped based on responses in the form of criticism, suggestions, and praise (Table 4).

Table 4. Criticism, Suggestion, and Praise of Students towards Learning Media ARMAPS

No.	Criticism	Suggestions	Praise
1.	It is difficult to change the position of the image on 3D objects.	The rotation feature on 3D objects be improved, so that it is easier to operate	The ARMAPS application view is very interesting, especially on 3D objects that display various residential caves in South Kalimantan that have never been encountered before.
2.	Unfortunately, not all types of smartphones can open the application	Additional aspects in the application need to be improved and improved, such as for example adding other chapter materials. You can also add a storyline to the application so that it can be more easily understood.	The application is very easy to use and helps the learning process. It looks attractive coupled with informative and easy-to-understand material.
3.	There are still many writings in the material section that are broken and unclear.	Maybe you can add a feature to zoom to make it clearer or improve image quality in the material section.	The visualization of this application is interesting and simple with buttons that are not complicated so that it is easy to use for learning.

Source: Analysis of the Effectiveness Test Questionnaire Instrument of the Use Trial on Students (2021)

Various criticisms, suggestions, and praise given by students are used as material for product improvement and refinement through the final product revision stage. The product that has been revised will be distributed through the dissemination or dissemination stage. The previous criticisms, suggestions, and praise became the basis for researchers to describe the advantages and disadvantages of the products that have been developed. The advantages and disadvantages of these products will be described in Table 5.

Table 5. Advantages and Disadvantages of Learning Media Products ARMAPS

No.	Advantages	Weakness
1.	The design and visualization of this application are very attractive and simple to arouse and increase students' interest in learning Indonesian history.	Need more storage space on the smartphone.
2.	Learning to use the ARMAPS application allows participants to find out the description or visualization of historic sites, especially in South Kalimantan anytime anywhere, because it uses augmented reality and is widely explained related to prehistoric sites in the region.	Some 3D objects are still a bit difficult to control the direction and position, especially the rotation feature.
3.	The material provided in the ARMAPS application is easy to understand because it has been simplified in infographics so, that the message can be appropriately conveyed.	The evaluation menu requires internet access, because it is connected to the google form.

4. The model and interface in the application are very good and cooperative; the colour selection makes students comfortable to learn

Sumber: Analysis of the Effectiveness Test Questionnaire Instrument of the Use Trial on Students (2021)

Discussion

ARMAPS is a learning media developed to achieve the goal of basic competence 3.2 "Analyzing human life and cultural outcomes of pre-literate Indonesian society". The preparation of learning media "ARMAPS" is carried out thematically / topically, systematically, and in detail. Researchers also compile the material in-depth, clearly and simply, making it easier for students to understand the material presented. This is in line with the opinion of Widja (2018), who states that learning material selection should be reduced to one thematic/topical content. Each topic developed contains a variety of information that can stimulate students to understand the material according to the context.

The learning media "ARMAPS" is arranged systematically based on the elements of the learning media, including: (1) learning objectives that have been written in the lesson plans and applications; (2) the characteristics of students in detail that have been mapped at the define (defining); (3) learning materials arranged thematically, clearly, and simply to improve students' understanding; (4) the method or method that has been designed in the lesson plan; (5) evaluation that contains questions that are integrated with the google form; and (6) feedback in the form of straightening and clarifying answers during the learning process (Miftah, 2013). The learning media "ARMAPS" can be said to be a learning medium, because it has been systematically designed based on the elements of existing learning media, so that learning objectives can be achieved.

The development of "ARMAPS" has met the criteria of learning media in stimulating students to learn by presenting historical objects in learning (3D objects of karst dwelling caves in South Kalimantan) adapted to their original forms to make a duplication of the actual object. This is because learning media is a messenger that makes abstract concepts more concrete. With several other features presented in the "ARMAPS" learning media, such as interface and application design, this has the potential to provide a fun learning atmosphere (Sanaky, 2013).

Learning media, especially visual media, have several functions, one of which, according to Levie & Lentz (1982), is: (1) attention function, (2) effective function, (3) cognitive function, and (4) compensatory function. The development of ARMAPS media can be said to have shown its function as a learning medium. Starting from the attention function, "ARMAPS" media can attract and direct students' attention to the learning material displayed. Its Effective function, with the learning media "ARMAPS", can increase the interest and comfort of students in studying and exploring the material. Cognitive function, the learning media of ARMAPS in its development process has been adjusted to the basic competencies and learning objectives as well as the needs of students. As well as a compensatory function, the "ARMAPS" learning media can accommodate students who tend to have difficulty understanding the material because the "ARMAPS" learning media not only presents the material in text form but is also adapted to visual learning methods, namely by completing the material with several charts, visual illustrations, and attractive design.

Learning media "ARMAPS" does not only contain material, but is also equipped with pictures, 3D objects, marker cards and evaluations that are integrated directly with the google form. The subject matter

of the Mesolithic Age lifestyle is packaged in a 3D object equipped with explanatory sentences and illustrated infographics so that students can interact directly with visual objects so that it will be easier to understand the material, easy to remember or not quickly forget, and more flexible to learn. They are used in learning (Arsyad, 2015). This condition is in line with the opinion of Sanaky (2013), who states that to stimulating in learning can be done by presenting historical objects in learning.

The packaging of ARMAPS learning media is made in the form of an application on an android smartphone. The ARMAPS application can be operated after the user installs the application on the smartphone. ARMAPS media packaging is tailored to the needs and ease of access to tools close to users, in this case, students. The ARMAPS application can also attract the attention of class X ANIMATION A students due to the first experience of students using history learning applications equipped with augmented reality to visualize historical objects for real. This affects students' interest in learning Indonesian history and students understanding. It can be concluded that some of the things mentioned earlier were done to facilitate students and make it easier for students to learn.

SIMPULAN

Based on the analysis of the data obtained at the validity and effectiveness test stage, it is stated that the ARMAPS learning media is very valid and very effective to be used and utilized in learning Indonesian history. This is supported by calculating of the validity and effectiveness formula, which shows that this product is valid and effective. Even the results of the analysis of students in the discussion process in learning and the results of quizzes on the evaluation menu show that this learning media provides understanding to students. At the testing stage, several improvements and revision processes were also carried out on learning media products derived from input and suggestions from media experts and students.

The testing process carried out by material experts and media experts, and the product effectiveness tests on students that have been carried out; shows that in the process of developing a learning product, it is necessary to carry out a systematic approach, including testing the product design before the primary target uses it. This aims to ensure that the products developed are appropriate and suitable for use in the learning process, both on the material and the type of media used. This is also the background of the revision process carried out per input and suggestions given by material experts, media experts, and students during the research process.

Further product development can take into account some of the shortcomings of the ARMAPS media that have been developed. Another thing that needs to be considered is related to students' learning needs, by conducting a potential analysis that is carried out from various points of view. Not only that, but careful consideration also needs to be made in the selecting information technology to be used, tailored to the needs of students.

Further product development can be done by enriching new materials, illustrations, photo galleries, and easier operation of 3D objects. Thus, it allows the delivery of material to be more easily attracted to students and easier to operate by students. Not only that, in material development, character values can also be inserted to protect the environment as a form of maintaining and preserving historical sites that are around. Also, one thing to keep in mind is that the changing times are getting faster, which can increase the demand for the need for innovative and interactive history learning media. Therefore,

exploration of ideas, creativity, and innovation in learning must always be done. Based on the analysis of the data obtained at the validity and effectiveness test stage, it is stated that the ARMAPS learning media is very valid and very effective to be used and utilized in learning Indonesian history. This is supported by calculating of the validity and effectiveness formula, which shows that this product is valid and effective. Even the results of the analysis of students in the discussion process in learning and the results of quizzes on the evaluation menu show that this learning media provides understanding to students. At the testing stage, several improvements and revision processes were also carried out on learning media products derived from input and suggestions from media experts and students.

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