Analysis of physics learning media needs based on mobile augmented reality (AR) on global warming for high school students

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Abstract. The rapid progress of the times requires an educational approach to be innovative and adaptive to changes in technology and information. Mobile Augmented Reality (MAR) is a system that incorporates technology in education. This method facilitates learning to be interesting, effective, and easily accessible to everyone. This survey research was an initial step in developing Augmented Reality based Modules for high school students on global warming. The importance of this research is that educational media using Augmented Reality is relatively new in the field of educational media. Analysis of learning problems and analysis of students are the two indicators used in the analysis of this need. Based on this research survey, it was found that augmented reality based educational media is viewed as important and necessary as learning materials in schools especially for students of high ability. The next phase is the development of MAR-based learning media that meets these requirements.

1. Introduction

The development is so rapid in this world, so fast that Indonesia has achieved the Fourth Industrial Revolution. The advancement and ease of technology today have a significant impact on the lives of every Indonesian citizen including the education sector, are affected by [1]. In the world of education, there are important things that affect the learning process, which lies in the learning activities carried out by educators. Teachers should actively involve students in every learning activity during the learning process. In line with the current educational paradigm, namely the student centered method, which expects students to be more active participants in learning activities, this is appropriate [2].

Students have difficulty understanding physics learning, according to research conducted by [3], because the information is provided only through textbooks and only applies to problems involving formulas. Lubrecht [4], a teaching and learning process requires communication between two parties to create a fun and challenging environment where students can express themselves creatively, allowing their talents and interests to develop and maturity and independence to develop. Born to students. As a result, physics learning must be accompanied by appropriate learning tools to be effective [5]. In today's world, one of the most popular sources of learning is the utilization of learning media. Conversely, the current learning media is less able to visualize abstract processes, and has inadequate or excessive dimensions, resulting in difficulties in practice and direct observation, especially in terms of physical matter [6].

Print media, both textbooks, and modules are one of the learning media available. Arsyad [7] Teaching book media has the advantage that students can repeat the material without quickly tiring the
eyes, follow the order of the mind rationally, and progress according to the speed of each student. While print media has the disadvantage that is difficult to convey movement on the page, it also has shortcomings that if not designed properly can cause students to become bored. In addition, the use of textbooks severely limits the learning opportunities available to students.

Supatros et al [8] learning media is always evolving along with technical advances, including print technology, audiovisual technology, computer technology, and a combination of print and computer technology. By technological advances, a book media format can be created that incorporates augmented reality (AR). This has the potential to reduce the shortcomings of the teaching book medium or module.

Based on the background information above, researchers are interested in analyzing the needs of mobile augmented reality (MAR) based physics learning media for high school students, with the title "analysis of the needs of mobile augmented reality (MAR) a global warming material based physics learning medium for high school students". Students need for offline and online teaching and learning processes is considered to be identified and mapped through the use of this research based analysis.

2. Method
Researchers surveyed at Senior High School SMAN 6 Pekanbaru. And SMAN 2 Tambang, Riau with 60 students survey respondents. The research was conducted in April 2021. The type of research conducted is survey research using online questionnaires (Google form). The flow of the research process is depicted in the diagram in Figure 1.

![Flowchart of the development of MAR based E-Module learning tools](image)

**Figure 1.** Flowchart of the development of MAR based E-Module learning tools

The questionnaire used in this study was prepared in response to the needs analysis indicators used in this study. The validity and reliability of this research tool have been determined. The questionnaire consists of question items derived from two indicators, as shown in Table 1.

| Table 1. Research Instrument Statement Indicator |  |
|-----------------------------------------------|---|
| **Analysis Indicators**                       | **Number of Question Items** |
| Student Analysis                              | 6 |
| Learning Problem Analysis                     | 4 |
The results of this study are used to assess the level of need, as shown in the following Table 2.

| Category            | Rank     | Percentage    | Decision         |
|---------------------|----------|---------------|-----------------|
| Strongly Disagree   | 1 – ≤ 1.75 | <16% - 37%   | Very No Need    |
| Disagree            | >1.75 – ≤ 2.5 | <37% - 58%  | No Need         |
| Agree               | >2.5 – ≤ 3.25 | <58% - 79%  | Need            |
| Strongly Agree      | >3.25 - 4  | <79% - 100%  | Very Need       |

The answer choices for the question items are as follows: strongly agree with a value of 4, agree with a value of 3, disagree with a value of 2, and strongly disagree with a value of 1. To determine whether the questionnaire is appropriate or not, feasible, it will be validated by a professional validator before it is available to participants.

3. Results and Discussion

Dudley-Evans et al [9] in the analysis of needs that are the subject of research, there are three concepts of needs analysis, namely to know the condition of students, to know how learning can be maximized in a particular goal, conditions and groups, as well as to know the target situation and environment so that data can be interpreted appropriately. It is also supported by [10], who argue that this analytical model should consist of three subcategories of target needs analysis, among other needs, deficits, and wants. This is because, according to [11], learning needs are defined as tasks that students must complete before they are deemed to have acquired the necessary information and abilities. To that end, when defining or analyzing those needs, everything related to students should be considered, including their interests, talents, and background.

Kuo [12] needs analysis is a strategy to collect data and evaluate important information connected with research design to map the problem to be studied. Learning e-module for high school students, this project conducts a needs analysis. In addition, this research is expected to be a starting point for the development of learning innovations that incorporate technology into education. As a result, using MAR based media, e-Module learning, which was previously unattractive, becomes much more successful. Teachers will find it easier to teach with this MAR based e-module learning, which will be assisted by the role of technology in the process. Similarly, students will be more interested in videos using 3D scanning modules and mobile phones because they will see virtual media as real. Learning takes place in an environment that relies heavily on technology integration. MAR agrees with this media learning. The results of this study will develop MAR based e-module learning for high school students, and two indicators will be measured and studied as a reference to determine the requirements for building MAR based e-module learning. There are four question items in the problem analysis indicators, including what learning methods have students experienced so far? what learning methods do students want? and what learning methods have students experienced so far? what learning approach suits the needs of students, and whether or not the method is effective in meeting those needs. For question item 1, which asks about what learning strategies have been used in e-module learning, Respondents provide answers as depicted in Figure 2. The following questions are intended to determine the effectiveness of the most frequently used approaches and the preferred learning methods of students in the learning environment. virtual. numbers 2 and 3 whose results are depicted in Figure 2.
Figure 2. Learning methods that have been used so far

However, there are still some drawbacks and drawbacks to the discussion approach, which is the most widely used of the available methods. According to the statement, three learning strategies based on the discussion method have been identified as very helpful for learning physics. However, because learning can take place offline or online, the conversation must be packaged as a virtual or virtual world dialogue through the use of technology. To achieve this, learning must be accompanied by interesting and appropriate media resources. However, much has happened so far, the media used are less attractive and less effective. Based on the distribution of the survey in SMA 6 Pekanbaru in Riau Province, the results show that high school students need technology to understand physics courses on global warming which are included in the "agree" group. This can be seen in the following statement 4 in Figure 3:

Figure 3. Questionnaire results about the problem less interesting e-module learning media and the use of technology in understanding physics learning

After analyzing the learning problems of the four questions posed in the questionnaire, it was determined that the most significant problem for students in e-module learning was the ineffectiveness and attractiveness of the media that had been used so far. For example, the media used is not interactive, does not have many characteristics of learning content, and does not allow students to complete the material in learning easily and effectively. Without improvised media, this makes the learning methods used ineffective, especially in terms of letting students learn through modules without the media. This also causes students to become less interested in actively participating in the learning that takes place and is taught by the teacher as a result of this. The right answer must be found for this problem; This solution is communication through media that is effective and interesting for students. In this example case, MAR. A research project directed by [13] investigated the effect of augmented reality-based experiments in increasing students' knowledge and cognitive load when compared to 3D and traditional trials.

There are a total of six question items in the student analysis. To understand the physics lesson on global warming information in question number 1, students must have access to technology. Question 2 resulted in the results that all students (60 percent) did not know Augmented Reality technology, and (40 percent) who filled out active questionnaires and often used smartphones in learning but did not
use modules with MAR technology themselves; The survey results for the percentage can be seen in Figure 4.

![Figure 4. Students are already familiar with Augmented Reality technology](image)

Based on the picture above, there are still most people who are new to Augmented Reality technology, but there are also those who are not familiar with MAR technology in understanding physical learning to improve the quality of learning and educational procedures. This student analysis also examines students' requirements in offline and online learning environments, to ensure that teaching and learning activities remain communicative, successful, and enjoyable even if done digitally. Some questions were asked regarding the needs of students, including the use of smartphones with module connections to make learning more exciting and fun, as well as about students' requirements for effective and efficient media and learning materials in physical learning. In the following steps, the findings of the student need analysis survey are obtained, as illustrated in Figure 5:

![Figure 5. Questionnaire results of student needs in E-learning](image)

Students agree with the choice stating that physics learning will be more exciting and enjoyable if transferred and integrated with a mobile-based physics learning system of global warming materials designed to help students understand abstract learning concepts, and developed modules can be used to help students understand abstract learning concepts in the survey results shown in the image above. In addition, it can also be an alternative media that teachers can use to teach more interestingly and interestingly. Students motivation to learn about global warming can be enhanced by the use of integrated, communicative, effective, engaging, and simple media to apply, as this medium shows. As a result, it generates greater interest and participation from students in learning and teaching activities while still ensuring that learning takes place successfully, both offline and online. It is intended to be used in this example medium which is based on the MAR technology system. Hendriyani [14] augmented reality technology can create any 3D model that may be difficult to visualize in the classroom, on a computer, or in a student's brain. Students gain a deeper understanding of the subject matter learned when abstract content is included in a visual model.

The needs analysis carried out in this study can be used as a reference and standard for current educational needs and needs. Students have a strong interest in the needs of MAR based media and...
learning tools as they are communicative, integrative, and effective media with a wide range of interesting features and materials. This is seen from the description of the results of the analysis of survey research data above. This advantage has the potential to be a significant source of capital to maintain the quality of education and increase the attractiveness of learning. In general, this MAR system is a very unique software that contributes to the learning environment by providing various advantages, among others [15]. Given the survey findings of each question item about problem analysis and student needs analysis described above, it can be determined that high school students, particularly those studying physics, have an urgent need for MAR based e-modules. Study in those subjects. For the survey results to answer the demands identified during the study, the survey must be completed.

4. Conclusion
The basic Mobile Augmented Reality (MAR) e-module needs analysis for high school students consists of two indicators, namely problem analysis, and student needs. With the findings of the study, there should be an e-module in MAR learning for high school students with a very agreeable and much-needed category level. As a result, the next stage is designing MAR media and the development of learning devices that fit current needs.

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