What do students need during Covid-19? A need analysis of augmented reality with STEAM worksheet (AR-STEAM) in electromagnetic induction

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Abstract. This study aims to collect initial information in designing Augmented Reality-based Physics worksheet with a Science, Technology, Engineering, Art, and Mathematical (AR-STEAM) approach. The research method used descriptive qualitative by collecting some field research information was carried out by sharing the viewpoints of 26 students (male N=3 and female N=23) who had studied the material of Electromagnetic Induction. Based on field studies using questionnaires, it is known that 69.2% of respondents enjoy learning by using visual media, 66.3% consider the concept of type induction to be very abstract and difficult to apply in real life, 80.8% of respondents say they are happy if physics learning is explained in the form of three-dimensional animation. Therefore, it can be said that the STEAM-AR worksheet is needed in learning physics on the topic of Electromagnetic Induction.

1. introduction

The current pandemic condition makes face-to-face learning unable to be carried out in schools as a result learning is carried out virtually. Although the results of a study conducted by Chriyah et al [1] stated that the facilities owned by Indonesia were ready for online learning. However, the results of the study also show that Indonesian students are not ready to do online learning because students are not used to learning independently [1,2]. In addition, problems are also experienced by educators as measured by their low literacy skills [1].

1.1. Augmented Reality

According to Abdusselam and Karal [3] AR is a combination of virtual and reality that presents virtual and real images in 2D or 3D simultaneously. visualization of Augmented Reality (AR) based on the depiction of objects in the real world and then enhanced through virtual data plots so as to make object visualization more realistic [4,5] because of these advantages, AR technology can assist in constructing abstract concepts that are difficult to understand into 2D visual form or 3D so that it can attract someone's interest in using it [6]. AR technology has penetrated a lot in various fields including physics learning [7] because this technology has several advantages, namely making learning more fun, interesting, enthusiastic and can create fun learning situations [7].
Several studies have shown that learning using AR can have a positive impact, which can be seen from improving learning outcomes, attitudes, motivation, attention and memory in the learning process [7]. Basically, technology is used as a tool to facilitate teaching. According to Cai et al [4] (1) AR can be applied in learning when the phenomenon cannot be simulated directly in the classroom, (2) the concept cannot be experimented with because it is dangerous.

1.2. STEAM

In the 21st century learning using science, technology, engineering, art, and mathematics (STEAM) is increasingly being used, especially in developed and developing countries [8]. As a result of the development of technology and science, it demands the preparation of superior human resources and is able to innovate so that the characteristics of the two-first century learning are to use the (STEAM). The characteristics of this approach are how the components of STEAM do not stand alone but can synergize with each other in the steam disciplines, namely mathematics, technology, informatics, biology, chemistry, physics, and geography which are blended into a teaching oriented towards science and technology education [9,10]. So that this approach will train students to be skilled in integrating each STEAM discipline in solving practical problems [11].

STEAM learning has many benefits if applied in classroom learning, namely: STEAM learning can improve students' creative thinking skills [8,12], students' conceptual understanding [9,13], logical and systematic thinking skills [12]. Which is the demand for skills in the industrial era 4.0. so that the application of this approach will produce superior people who are ready to be competent in the world of work by offering a variety of innovations [14] that they can present.

1.3. Augmented Reality with STEAM approach

According to Jesionkowska et al. [15] AR is a supporting medium in STEAM learning because AR media can improve student learning experiences more than conventional methods so that it will provide interesting and comprehensive teaching. By innovating in learning through the use of STEAM and AR approaches, it will produce interesting learning synergies.

The use of AR in creating a virtual environment in the form of Student Worksheets is also very possible, this is supported by the results of research conducted by Sonntag et al [16] and Barma et al [17] who wrote that augmented development Reality can be done with data-based so that it can create a real learning environment even though the objects, data and actions are carried out virtual. So that by combining AR technology with the steam approach, it is hoped that it will create attractive worksheet products that can be used to improve learning outcomes in this pandemic situation as figure 1.

![Figure 1. Framework](image)

Based on the description above, this research was compiled which aims to collect initial information in designing Augmented Reality-based Physics worksheets with the Science, Technology, Engineering, Art, and Mathematical (AR-STEAM) approach. Therefore, it is hoped that the continuation of this research
can develop a worksheet product that can be used in maximizing the learning of physics on electromagnetic induction materials, especially during this pandemic covid-19.

2. Method

2.1. Design

This study uses a descriptive qualitative research type with the main data of the questionnaire with the aiming to explore the weaknesses of learning physics in electromagnetic induction during a pandemic and collecting input on the ideal electromagnetic induction learning conditions for students in a pandemic situation like today.

2.2. Respondent

Initially, the number of respondents was 29 people (aged between 17-19 years) with an estimated 8 men (43%) and 21 women (57%). Students who become respondents are students who are applying to enter college with the assumption that they have studied magnetic field material and have not studied again in college. However, after further study, there were data on respondents (3 men) who did not meet the characteristics so that further data were processed as many as 26 respondent data (men N=5, women N=21). Based on the distribution, most of the respondents came from the city of Makassar and only two respondents came from the city of Palu but in terms of geography the two areas did not have a significant difference. Data from google form also shows that the respondents came from 5 different schools, some of which came from superior schools in Makassar and Palu.

2.3. Instrument

This instrument was developed based on the analysis of student needs by referring to the obstacles faced by students during the online learning process on electromagnetic induction material. The indicators that are the center of the study of the questionnaire shown as figure 2. Based on these indicators then developed into 18 items. In this analysis used a sticky instrument consisting of 4 choices; strongly agree, agree, disagree, strongly disagree.

![Figure 2. Questionnaire development indicators](image)

2.4. Data Analysis

Data analysis using interactive analysis by Miles and Huberman, with the following steps in figure 3.
3. Result and discussion
In this discussion, the data from the questionnaire distribution in the form of a google form will be discussed and assessed based on each indicator.

3.1. Student motivation in learning physics
The first question that was written in the questionnaire to analyze student needs for AR-based physics worksheets using STEAM analysis was their interest in learning physics. Most of the respondents answered that they were interested in learning physics even only 8% of the respondents stated that they were not interested in the subject. The factor of interest in learning physics must also be the object of study because students having an interest in a subject will try to understand it [18,19]. Therefore, it is possible that students do not understand the material being taught to them not because the material is not interesting but because students do not have the desire to learn.

3.2. Students' views on magnetic material
Most of the respondents think that electromagnetic induction material is a difficult discussion which is characterized by the difficulties faced by students while studying the material. In addition, the electromagnetic induction material is still considered abstract by most students because they think that the material is very difficult to apply in everyday life. this is in line with research conducted by Jelicic et al. [20] by interviewing several students and it was found that students had difficulty in understanding the basic concepts of electromagnetic induction and especially those related to the concept of the phenomenon of electromagnetic induction. In line with these problems, AR technology can be used as a tool to visualize phenomena in 3D. This technology can provide a visual representation of situations or phenomena that are considered abstract so that people who study will directly relate existing phenomena to physical concepts [3,17].

3.3. Student' learning style
Based on table 1, it can be seen that physics learning is not sufficiently explained in verbal or written form but there must also be image representation assistance in making it easier to visualize the physics concept being studied. Moreover, most of the concepts are natural phenomena that occur in everyday life, so that to make it easier to explain, these phenomena should be presented in the form of visual images and then explained in verbal form or in written form. In addition, visual representations can have a positive impact on understanding physics because good visuals can directly explain physics concepts to students [21].

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**Figure 3. Interactive analysis steps**

- Data collection, at this stage the link of the needs analysis questionnaire in the google form is distributed to students in the Makassar and Palu. respondents having studied electromagnetic induction during the pandemic.
- Data reduction, at this stage the researcher collects and calculates the data has been distributed. Then sort out the data according to the characteristics that have been mentioned and discard the power that does not match the characteristics, such as respondents have studied electromagnetic induction material before the pandemic.
- Data presentation. At this stage the researcher presents the data that has been analyzed in the form of table representations, graphs and verbal representations.
- Conclusion. The data that has been presented and analyzed are then drawn conclusions.
Table 1. Student’ learning style (%)

| Indicator                  | Statements                                                                 | SA  | A   | DA  | SDA |
|----------------------------|-----------------------------------------------------------------------------|-----|-----|-----|-----|
| Student’ learning style     | I like to learn physics by just listening to the teacher's explanation in class | 11.54 | 30.77 | 53.85 | 3.85 |
|                            | It is easy to understand the shape of the magnetic induction line when it is explained through pictures | 26.92 | 46.15 | 26.82 | 0.00 |
|                            | I find it difficult to understand the shape of the magnetic induction line if it is only explained through pictures | 7.69  | 50.00 | 42.31 | 0.00 |
|                            | I easily understand right-handed rules when explained with two-dimensional drawings | 23.08 | 61.54 | 15.38 | 0.00 |
|                            | I can easily understand right-handed rules when explained with animated three-dimensional images | 23.08 | 73.08 | 3.85  | 0.00 |
|                            | I can understand physics material just by reading                            | 0.00 | 19.23 | 61.54 | 12.23 |

3.4. How to teach physics teacher electromagnetic induction material in school

To find out the basic description of the learning that has taken place during this pandemic, two questions are presented to respondents related to the use of learning media commonly used by teachers when teaching. It is known that most of the students said that when learning physics their teachers were accustomed to using three-dimensional media. However, in the statement, there can still be a misunderstanding if students are referred to as three-dimensional media, it could be a real object or a virtual object.

Furthermore, during this pandemic most teachers did virtual practicums due to the fact that during the pandemic face-to-face learning activities could not take place. Based on the results of the questionnaire, it was found that 50% stated that their teachers used to use virtual practicums with applications that presented three-dimensional images while the others did not. Therefore, from this data it is known that there are still many teachers who do not use virtual practicum in the form of applications that present two-dimensional images so that it can be a challenge for researchers in developing applications that can be used in conducting virtual practicums that not only present 2D data but can also present data. 3D.

3.5. How to learn physics that students want

Based on the results of the questionnaire in figure 4, it is known that most of the participants stated that learning physics would be easier if it was explained in the form of pictures not only in two-dimensional form but also in three-dimensional form. In accordance with previous research showing that AR is very effective in learning in this situation [22]. Besides AR can be used to present 3D images, this technology is also able to improve students’ knowledge, attention and practical skills.

Figure 4. How to learn physics of electromagnetic induction material expected by students during a pandemic
Therefore, the last question regarding student responses if AR is STEAM-based, 38.5% strongly agree and 50% agree if the technology and approach is applied in physics learning. Therefore, it can be concluded that students are very enthusiastic and accepting if AR technology is applied in physics learning, especially in a pandemic situation like today.

4. Conclusion

Based on the above discussion, it is known that physics learning will be better if the teaching involves visual media, both two-dimensional and three-dimensional. This aims to facilitate student learning styles in learning physics, especially in pandemic situations where face-to-face learning cannot take place maximally. Therefore, it can be concluded that the development of AR-based physics worksheets with the STEAM approach is needed during this pandemic.

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