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Facilitating student involvement in physics learning through worksheets assisted by augmented reality during the covid-19 pandemic: Analysis of teacher perceptions

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Abstract. One of the obstacles faced in physics learning during the COVID-19 pandemic is the low students' involvement in the learning activities. This research was aimed to describe the views of Islamic school physics teachers on the importance of Augmented Reality-assisted worksheet teaching materials in facilitating students' involvement in the learning process. This research involved 31 Islamic high school physics teachers in Lampung Province, Indonesia. The explanatory design mixed methods were used in this research. The results showed that the Augmented Reality-assisted worksheet could increase potentially student involvement in physics learning during the pandemic by implementing a learning management system suited to students' learning needs and facilities. The results of this research also illustrated the importance of designing worksheets that support the effectiveness of online learning during the COVID-19 pandemic.

Keywords: augmented reality, student involvement, worksheets, COVID-19 pandemic

1. Introduction

The development of 21st-century learning has triggered the advancement of education in various countries, including Indonesia. The era of the industrial revolution 4.0 has changed the order of education [1]. Thus, teachers must adapt by not only focusing on the deliverance of knowledge, but also fostering character, moral, and exemplary education [2]. Therefore, the Indonesian national curriculum seeks to reform the educational curriculum through three educational concepts, namely century skills, scientific approach, and authentic assessment [3].

These educational goals will be achieved if the teacher can encourage students to be actively involved in science (physics) learning process [4]. Active student involvement in the science learning process will determine the extent to which students can increase their knowledge and skills in scientific inquiry [5]. However, during the COVID-19 pandemic, science learning is currently dominated by online learning [6]. Online science learning causes students to be passive in the process of acquiring knowledge. In other words, student performance in learning science during the COVID-19 pandemic has been low [7]. This is because the presentation of learning content in the Learning Management System (LMS)[8] has not been optimal in involving students in the learning process [9]. It is dominated by the static display, such as text and still images [10].

In the current development of educational technology, 3D visualization such as AR (Augmented Reality) technology has been developed to visualize scientific phenomena [11]. In contrast, many



multimedia-based learning media [12-15] are limited to the use of pointers, such as a mouse or keyboard. Augmented reality (AR) is a 3D technology that enhances the real world environment generated by computers through devices using layer images [16] AR has also become popular in educational research topics in the last decade, namely the availability of devices, low-cost with innovative features, and efficient learning and better outcomes. AR is very useful in the fields of science, technology, engineering, and mathematics (STEM), including spatial abilities, practical skills, conceptual understanding, and scientific inquiry learning [17].

In physics learning, the most important thing is that students are active and able to master the material. The physics learning activity is not only listening, taking notes, and remembering but also observing, experimenting, discussing, paying attention, answering questions, applying concepts, and communicating [18].

Physics is one of the subjects that are closely related to everyday life [19]. To help students understand physics learning in delivering abstract material, a practicum is needed which is supported by student worksheets [20]. Teaching material that can help students understand physics material and encourage them to be active is a student worksheet.

This research was aimed to describe the students' involvement in physics learning through Augmented Reality-assisted worksheet during the COVID-19 pandemic based on Teacher Perception Analysis.

2. Research Method

This research is mixed-methods research with the quantitative-qualitative explanatory design. It consists of two sequential distinct phases, namely quantitative followed by qualitative [23]. In the first phase, the researchers collected and analyzed quantitative (numerical) data while the qualitative data (text) was collected and analyzed from interviews to explain or describe the quantitative results obtained in the first stage.

In the second phase, qualitative data was built based on the first phase. Then, both phases were linked to the intermediate stage in the study. The rationale for this approach is that quantitative data and subsequent analysis provide a general understanding of the research problem. Qualitative data analysis refines and explains the statistical calculation results by exploring the views of participants intensively [24]. The schematic research design can be seen in the following figure:

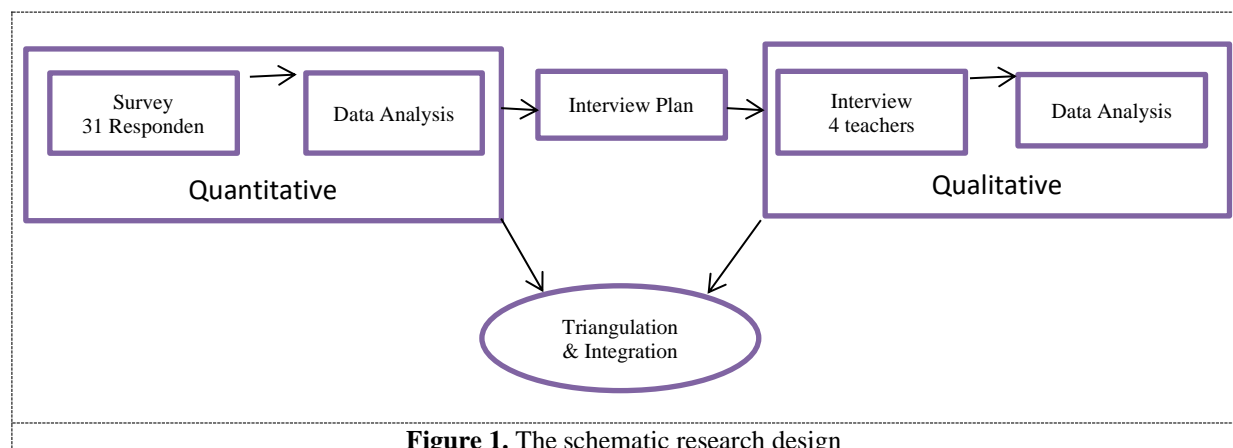


Figure 1. The schematic research design

3. Results and Discussion

The following is the profile of online learning in science (Physics) subjects carried out by teachers in Islamic high schools in Lampung province.

Table 1. Profile of Online Learning during Pandemic

No	Statements	Percentage (%)
1	Focus more on material/content (reading, videos, exercises, etc.) than direct interaction (discussion, presentation, etc.)	61,3 %
2	Student-centered approach	25,8%
3	Teacher-centered approach	12,9%
4	Synchronous (teachers and students present online at the same time)	16,1%
5	Asynchronous (indirect learning)	22,6%
6	Technology is an important part	48,4%
7	Unsuitable to be applied because it might cause students' anxiety	12,9%
8	Does not have to direct students to collaborate, because independent performance is needed	6,5%
9	Should be focused more on the learning contents rather than activities	19,4%

Based on Table 1, the learning has been focused more on content and technology and technology should be an important and main part of learning.

Furthermore, the teacher considered that it was important to provide information on students' involvement in the online learning process during the pandemic so that students can be directed to carry out the online learning process as shown in Figure 2.

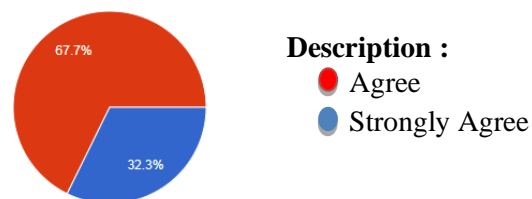


Figure 2. The Teacher's Perception of the Importance of Directing Student Activities in Learning

Based on Figure 2, it can be seen that providing information regarding students' involvement in online science (physics) learning process during the pandemic is important.

Also, for the online learning process to run effectively, the teachers argued that it was necessary to prepare several prerequisites so that students can be actively involved in the physics learning process. The followings are online learning preparation:

Table 2. Online Learning Preparation by Physics Teachers

No	Statements	Percentage (%)
1	Prepare the material learning independently	74,2%
2	Taking material from the internet or other sources then adjusting it to the learning objectives	67,7%
3	Designing learning media independently	51,6%
4	Designing assignments to be given to students	58,1%
5	Setting a routine schedule for each activity	64,5%

Based on Table 2, it can be seen that there was a need to prepare learning materials independently, taking material from the internet or other sources and then adjusting it, choosing a learning management system (LMS) platform that is suitable and easy to use (Google Classroom, Teachers

Room, Edmodo, Schoology, Smart School, Moodle, etc.). Furthermore, for students to be involved in the learning process, the teachers argued that various media are needed as shown in Table 3.

Table 3. Variations of Media Used by Teachers

No.	Statements	Percentage (%)
1	Video	90,3%
2	Image	87,1%
3	Audio	48,4%
4	Text	87,1%

Based on Table 3, the media in the form of videos, texts, and images are required so that students can be involved effectively. The learning management system (LMS) for online physics learning utilized by the physics teachers can be seen in Table 4.

Table 4. LMS Utilized in Online Learning

No	Statement	Percentage
1	WhatsApp	90,3%
2	Youtube	48,4%
3	Google Classroom	58,1%
4	Zoom	45,2%

Based on Table 4, the popular LMS platforms used by teachers during the pandemic are WhatsApp and Google Class Room. Physics learning equipped with animation in the form of virtual 3D that can move or commonly called Augmented Reality (AR) can help students understand physics material.

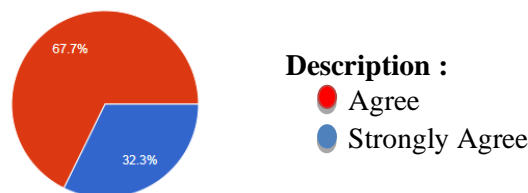


Figure 3. Physics Learning Assisted by Augmented Reality

Based on Figure 3, it can be seen that the physics learning process assisted by Augmented Reality can help students understand physics learning in the new normal era during the COVID-19 pandemic. If this is the case, Augmented Reality can be the main alternative for physics learning in the new normal era.

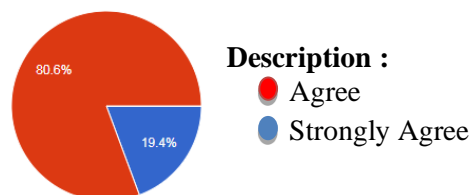


Figure 4. Augmented Reality as The Main Alternative in the New Normal Era

Based on Figure 4, Augmented Reality is the main alternative for physics learning media in the new normal era during the COVID-19 pandemic which can help students understand the material.

An interview had been conducted with 3 representative physics teachers in Lampung province to analyze the LMS Platforms used during the learning process. The results can be seen in Table 5.

Table 5. The Use of the LMS Platforms

No	Code	Origin Schools	Subject	Educational Background	Questions
1	KH	MA Mathlaul Anwar Pesawaran	Physics	S2	What Learning Management System (LMS) platforms used at the schools? Why?
2	SN	MAN 1 Pringsewu	Physics	S2	
3	IS	MA Wali Songo Lampung Utara	Physics	S1	

Different answers had been obtained based on the questions of the interview. At MA Mathlaul Anwar Pesawaran (KH), the LMS application used was in the form of WhatsApp and Google Class Room because they were considered effective, efficient, and minimum internet usage. This was influenced by the remote location of the school. It was hard to obtain good internet networks and the majority of students had difficulty providing internet package.

At MAN 1 Pringsewu (SN), the central education office facilitated the school with a website. However, the LMS application used at the school was WhatsApp as a medium of communication between students and teachers. Zoom Meeting was also used in the learning process.

At MA Wali Songo Lampung Utara (IS), the learning activities were carried out face-to-face (offline) while adhering to health protocols. This was because the school is a boarding school where students are not allowed to have or use cellphones in the school area.

Table 6. Analysis of Augmented Reality

No	Code	Origin Schools	Subject	Educational Background	Questions
1	KH	MA Mathlaul Anwar Pesawaran	Physics	S2	Have you ever heard the term 'Augmented Reality'?
2	SN	MAN 1 Pringsewu	Physics	S2	
3	IS	MA Wali Songo Lampung Utara	Physics	S1	

Based on Table 6, the majority of teachers did not know the term Augmented Reality (SN, IS, KH). Some of them have never heard of Augmented Reality and have never used it (SN, IS, KH).

Limited skills and knowledge were some of the reasons that teachers did not know about the application. The schools have only been assisted by YouTube (KH). Some of the teachers have only ever heard the term Virtual Reality in 2D format (SN).

Table 7. Analysis of Student Worksheets

No	Code	Origin Schools	Subject	Educational Background	Questions
1	KH	MA Mathlaul Anwar Pesawaran	Physics	S2	Do you need an electronic worksheet with Augmented Reality assistance?
2	SN	MAN 1 Pringsewu	Physics	S2	
3	IS	MA Wali Songo Lampung Utara	Physics	S1	

Table 7 shows that the majority of teachers agreed that the Electronic Worksheet can be used easily (KH) and teachers also needed electronic student worksheets assisted by Augmented Reality (KH, SN,

IS). With the current state of the COVID-19 pandemic, this worksheet can be very important because it can help students to understand abstract physics material (SN).

4. Conclusion

Based on the results of research and discussion, it can be concluded that the teacher has not fully integrated physics material. The student worksheet used has not been assisted by Augmented Reality. The media used have not fully used interactive media. Therefore, it is necessary to develop an electronic worksheet assisted by Augmented Reality that can help students understand abstract physics material and facilitate science (physics) learning activities.

The electronic worksheets expected by the teacher are: (1) in line with core competencies, basic competencies, indicators, and learning objectives; (2) contain components in the forms of videos, images, work steps, material summaries, and animation; (3) easy to use and helps understand the learning material, and (4) the language used is easy to understand and unambiguous.

For further research, it is suggested to develop worksheets that are in line with the skills contained in the industrial revolution era 4.0 so that students can compete globally and can keep up with the times.

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