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Needs Analysis for Practical Guide Based Augmented Reality (AR) in an Effort to Support Basic Physics Practicum Activities During the Covid-19 Pandemic

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Abstract

This study aims to conduct a field study on the need to develop Augmented Reality (AR) assisted practicum guidelines. Data collection instruments were in the form of questionnaires and interview guidelines. The subjects in this field study were students who became practicum assistants, physics laboratory staff, and lecturers of basic physics courses. Questionnaire data and interview results were analyzed qualitatively to see the real conditions of the practicum. Based on the results of data analysis, it is known that practicum manuals are still dominant in text, and practicum activities can be directed to practice problem-solving skills. The phenomenon of coastal areas can also be associated with physics practicum material. Based on the results of the practicum assistant's questionnaire, it is known that AR can facilitate physics practicum, so it is necessary to develop an AR-assisted practicum guide that presents audio-visual presentations. Based on the results of the interviews, it is also known that the constraints on practicum activities during this pandemic were that not all practicum courses were available at PheT to carry out virtual practicums, counter-dependence with assistant explanations in carrying out practicum procedures, so strict procedures could not be carried out, so it could be interpreted that a solution was needed an alternative practicum guide that is equipped with a video tutorial about practicum procedures. AR technology can be used to visualize tutorial videos that can be accessed offline.

Keywords: Augmented Reality; Coastal Phenomena; Practical Guide; Problem Solving

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INTRODUCTION

According to the preliminary study analysis, students had difficulty adhering to practicum procedures through a survey of seven Indonesian higher education institutions. The manual provides narrative explanations of practicum procedures. Due to the many students, lecturers and practicum assistants struggle to manage practicum classes. During a pandemic or new normal, this adds to the constraints that must be met in practice. There are no supplements that could aid in gaining practical experience. During this COVID pandemic, it is challenging for students to complete practicums because of this issue.

Technology played a significant role in many spheres of life during the Industrial Era 4.0, including education (Hartini et al., 2017; Matsun et al., 2018; Lestari et al., 2018). The beginning of the digitalization of education marked the beginning of the Industrial Revolution 4.0. In order to adapt to the rate of technological change, technology directs every aspect of the education sector (Dewantara et al., 2021; Dinata et al., 2021; Misbah et al., 2021; Surani et al., 2019; Widiasih et al., 2021). The use of augmented reality (AR) technology is one method that can be utilized to make it easier for students to gain real-world experience during practicum activities. This is consistent with the viewpoint (Arkan et al., 2023; Radu et al., 2023) that Augmented Reality is one of the media that can be utilized in an engaging learning process and boost students' willingness and motivation.

Augmented reality technology is thought to simplify practicum procedures (Widiasih et al., 2021). The positive effects of learning with augmented reality systems in various learning contexts have been the focus of recent research (Thees et al., 2020). The technology known as augmented reality, or AR, projects computer-generated information into the eye to visually enhance the real-world environment (Mahpudin & Puadi, 2018). An application known as augmented reality combines the real and virtual worlds in two- and three-dimensional forms that are simultaneously projected onto a real environment (Khunaeni et al., 2020). According to Mahpudin & Puadi (2018), augmented reality can be interpreted as adding real objects to virtual objects that appear when tools or devices are used on these real objects in real-time. According to Wang et al. (2017) and Al-Ansi et al. (2023), augmented reality is a technology that projects computer-generated information into the eye to enhance the real-world environment visually. Augmented reality technology is quite effective as an introduction medium, particularly for learning media (Alamsyah et al., 2023).

The following are the advantages of augmented reality, according to Afifah et al. (2019): 1) More interactive; 2) Useful; 3) Widely applicable to a variety of media; 4) Simple object modeling because it only displays a few objects; 5) Expensive, unstable production; 6) Simple to use. While the disadvantages of Augmented Reality are: 1) Sensitive to changes in viewing angles; 2) Not too many makers; 3) Requires a lot of memory on the equipment (Afifah et al., 2019).

Presenting examples of contextual physics concepts in coastal areas is expected to make it easier for students to understand the meaning of physics concepts. Students can explain the phenomenon of coastal areas using physics concepts, and then they can test the concept in practical activities. Various phenomena in coastal areas can be explained using physics concepts. Phenomena in coastal areas can also be a source for identifying physics problems in practicum activities. One example of

the utilization of the phenomenon of the coastal area is the installation of a wave barrier, as shown in Figure 1.

Figure 1 Breakwater on the beach

Figure 1 shows that the breakwater is constructed with inclined planes instead of perpendicular planes. Students can identify problems in this context. Students can conduct inclined plane experiments to answer why the breakwater construction is on an inclined plane. Thus, students can understand the application of physics principles in the context of coastal areas.

One of the higher-order thinking abilities required for the industrial era of 4.0 is the ability to solve problems. It is known from observations that the practicum activities that have been completed still require verification. Practicum activities do not require high-level thinking skills like critical thinking and problem-solving. Through video tutorials in the guidebook, augmented reality technology can enable students to participate in all practicum activities.

The practicum manual includes augmented reality technology for the display of practical procedure tutorials. Students can better understand practicum procedures by using augmented reality technology to visualize practical tutorials. In addition, using narrative text to confirm practicum procedures is helpful. By allowing students to avoid relying on lecturers or assistants, augmented reality technology reduces interactions that have the potential to spread the COVID-19 virus. Practicum activities can run smoothly during a pandemic. Mobile phones that are not connected to the internet can access augmented reality.

The COVID-19 pandemic condition requires physical distance. On a laboratory scale, practicum activities are significantly impacted by this. Limit the amount of interaction between instructors and practicum participants. The practical work manual used before the pandemic must be updated to address this condition. During a pandemic, the technology known as augmented reality can be utilized as a solution for practicum activities. Procedures for practicum activities, which typically only take the form of narrative text, can be visualized with this technology. Practitioner and instructor interactions decrease as a result. According to this viewpoint, Karagöz & Saka (2015), laboratory applications that are supported by technology and carried out on computer software and the surrounding environment are required to help overcome these limitations in a mass pandemic. Using various kinds of natural phenomena in coastal areas can make it easier to meet the demand for people with strong analytical skills in the industrial era of 4.0. An explanation of the concept of physics can be used to solve the case of the phenomenon of the coastal area. As a result, to carry out practicum activities during the COVID-19 pandemic, it is necessary to develop a practical guide based on problem-solving using contextual cases of coastal natural phenomena and augmented reality technology. As a result, this study aimed to carry out field studies regarding the requirement to create AR-aided practicum guides.

METHOD

This research was conducted at Universitas Bengkulu. Universitas

Bengkulu is one of the universities located in the coastal area of Bengkulu. This study employed the R&D method with a 4D design. This article focuses on the preliminary analysis stage. The preliminary analysis used a qualitative descriptive method with data collection tools like questionnaires and interview guidelines.

This research involved students who become practicum assistants, physics laboratory staff, and lecturers in basic physics courses. Data collection instruments are listed in Table 1.

Table 1 Data collection instruments

Data	Data source	Data collection technique
There is a need for a practicum guide with the help of augmented reality and utilizing the context of the phenomenon of the coastal area as a problem case so that practicum activities are more interesting and train higher thinking.	15 students at the Universitas Bengkulu fill the physics education study program's Practicum assistants.	Questionnaire
There needs to be innovation in developing interactive, interesting, and easy for students to understand practicum guides.	Lecturer and Laboratory Assistant	Interview

The technical analysis of the data in this study used a qualitative approach. Questionnaire data and interview results were analyzed qualitatively to see the real conditions of the practicum. This data was also used to determine the condition of the available practicum guidebooks. In addition, the analysis was carried out to determine the need for basic physics practicum books during the COVID-19 pandemic. This is from the point of view of students who are practicum assistants, lecturers in basic physics courses, and laboratory staff.

RESULTS AND DISCUSSION

It is known from the findings of a practical assistant needs analysis questionnaire that was filled out by 15 students enrolled in the physics education program at the University of Bengkulu that independent practicums with activity procedures and simple experiments were carried out during the pandemic. 54.5% of respondents said that the practicum guide was just narrative text. 99% of respondents stated that case studies and audio-visual materials related to coastal area phenomena should be added to the guidebook. According to 90.9% of respondents, augmented reality technology can assist in providing practical procedures. During a pandemic, this demonstrates the need for novel practicum activities. This innovation extends to the manual utilized as well.

The results of the practicum assistant response questionnaire can be seen in Figure 2.

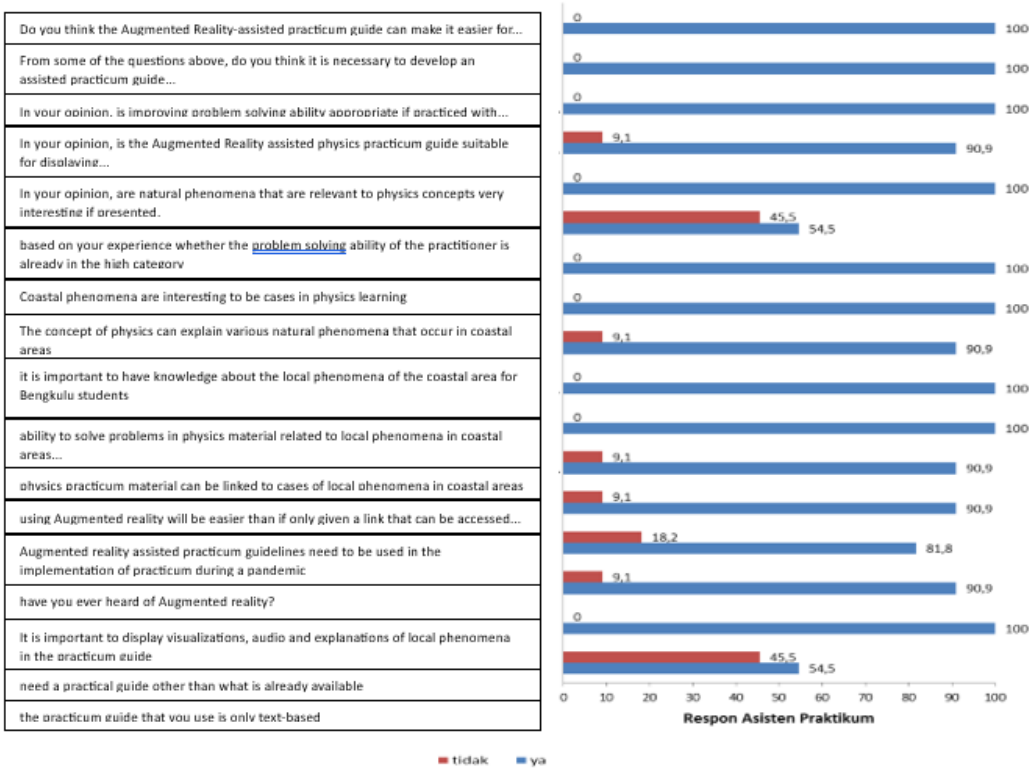

Figure 2 The results of the practicum assistant response questionnaire

Based on the questionnaire results in Figure 2, it is known that 100% of respondents agree that the concept of physics is related to various phenomena in coastal areas. 100% of respondents also stated that physics practicum activities could explain various phenomena in coastal areas. Phenomena in coastal areas is an interesting context to be used as a case in physics learning, including in basic physics practicum activities. Utilization of the environment in learning can be used as a learning resource so that students are accustomed to using systems of thinking and adaptive behavior (Irwandi & Fajeriadi, 2020; Apriliani et al., 2019). In line with the opinion (Arifin et al., 2022), the potential for the coastal environment should be raised as a strength in learning so that students can analyze the material presented.

This can be seen from the 100% of respondents who agree on this matter. Difficulties in understanding manuals only in the form of narrative text can be bridged with innovative visualization-assisted practicum guides in the form of practicum procedure videos packaged in Augmented Reality technology, which can be accessed without being connected to the internet. This can be seen from the 100% of respondents who agree that there is a need for practicum guides assisted by augmented reality and utilizing the context of coastal area phenomena as problem cases to make practicum activities more interesting and train higher thinking. Skills. 45.5 respondents stated that practitioners' problem-solving abilities were still in the low category. Stimulation of problem-solving abilities can be facilitated through practicum activities. Cases of coastal area phenomena will be very interesting and challenging to present as problem identification in a series of problem-solving processes.

Presenting cases contextually in learning or practicum activities can stimulate higher thinking skills, such as problem-solving and critical thinking (Erlistiani et al., 2020; Johan et al., 2018). One of the problem-solving procedures that can be used is the SSCS problem-solving model (search, solve, create, and share). SSCS has several advantages, including inviting students to focus on problems by presenting cases at the beginning of learning activities. Presenting this case can stimulate problem-identification skills and attract students' interest in learning (Erlistiani et al., 2020). Presentation of authentic data in the field of hydrology relating to coastal areas can also help stimulate higher thinking skills (Johan et al., 2018).

The results of interviews with lecturers and laboratory assistants can be seen as follows:

a. Guidebook development and innovation are not carried out routinely every year;
b. Available guidebooks facilitate face-to-face activities during non-pandemic periods;
c. The phet-based virtual practicum dual mode manual only facilitates 25% of the total basic physics practicum courses;
d. An innovative practicum guidebook is urgently needed that can facilitate all practicum courses during a pandemic or new normal;
e. A practicum handbook that is oriented towards problem-solving skills has never been developed and needs to be developed to support the attainment of higher-order thinking skills;
f. The contextual coastal area presented in the guidebook is very relevant to the character of students living in coastal areas such as the Universitas Bengkulu;
g. the need to optimize the application of relevant technology for practical activities during a pandemic, one of which is by using video tutorials based on augmented reality.

Wahyuni (2015) states that practicum guidelines are guidelines written with the aim that students can study independently or without the help of lecturers and teaching assistants. Arifah (2014) states that practicum guidelines are books compiled to help carry out practicums that contain experimental titles, objectives, theoretical foundations, tools, and materials, as well as questions that lead to goals by following the rules. From scientific writing (Rz et al., 2022).

The practicum guidebook is intended to facilitate and provide information, assistance, or learning materials to guide students in carrying out practicum activities. Providing tutorial video shows can facilitate independence in carrying out practicum procedures. This can be assisted by augmented reality technology. Augmented reality (AR) is a technology that visually augments real-world environments by projecting computer-generated information into the eye.

Augmented reality (AR) in education has become an innovative and promising field of research and practice due to its emphasis on superimposing virtual information on real environments, creating different contexts from traditional learning, and providing completely new imaginations about learning (Chang et al., 2022). They also state that AR is a rapidly growing research field that aims to integrate the virtual with the real environment fully (Johan et al., 2018; Pai et al., 2016, Suenaga et al., 2013; Widiasih, et al., 2021). In addition, AR programming can increase student motivation and balance between deep learning. This AR technology allows students to experience learning directly rather than just reading, hearing, or watching videos. This experience is considered very important when learning about AR.

In implementing AR, a marker is needed to detect the placement of virtual objects that can bring up virtual objects on a visual computer device, after which the marker is directed with a camera that has identified the marker, whether the marker pattern matches the template memory. Then, the position of the marker to a 3D object that is rendered above the marker is changed so that a 3D view will appear in the real world, and the use of augmented reality is successfully used in learning (Ardhianto et al., 2012).

CONCLUSION

The findings' analysis can be used to conclude that the practicum activity guidebook requires new ideas. This innovation primarily aims to satisfy practitioners' requirements during a pandemic. This is because practical manuals are not updated frequently. Practicum activities are not made easier by the available basic physics practicum books during a pandemic. Students can use augmented reality technology to complete practicum procedures independently. Physical contact is limited as a result of this. According to the responses, the idea of physics is connected to a variety of natural phenomena. These natural phenomena include coastal phenomena. A case study in a series of methods for solving problems can be the context of the coastal phenomenon.

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