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IMPROVING STUDENTS' UNDERSTANDING ON STATIC FLUIDS USING *VIRTUAL* LABORATORY DURING COVID - 19 PANDEMIC

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ABSTRACT

Abstract: The purpose of this study is to find out the influence of virtual laboratories on static fluid material to improve the understanding of students of class XI MAN 1 Jembrana during the Covid 19 pandemic. The research design used is a mixed method with embedded experimental design and samples used in the study of 29 learners. Based on the acquisition of this study, it can be concluded that the use of virtual laboratories equipped with LKS in the field for learning proved to be quite effective because from the acquisition of analytical results explained there is a positive influence on the use of virtual laboratory learning media with a scientific approach to static fluid material to learning outcomes. With this research, it is expected that the use of virtual laboratory learning media can be applied by teachers to physical learning so that learners can easily understand concepts and there are no misconceptions about concepts that exist in physical learning.

INTRODUCTION

In November of 2019, the Covid 19 virus, which causes symptoms similar to those of severe acute respiratory syndrome (SARS), was identified in Wuhan, China. The epidemic was instantly proclaimed a pandemic, infecting millions of people and forcing lockdowns in over 180 nations (Azlan et al., 2020). The Covid-19 epidemic has halted operations in a number of industries. Indonesia has been impacted by the COVID-19 epidemic, particularly in the educational sector. To prevent the spread of the virus, the government adopted a social distance legislation mandating online schooling (Setiawan et al., 2020). Maintaining social distance is anticipated to assist in flattening the infection curve and lowering the virus-related mortality rate (Santhalia & Sampebatu, 2020). E-learning typically refers to learning activities that employ information and communication technologies in the teaching and learning process or online learning activities (Setiaji & Dinata, 2020). When the government mandates that educational institutions educate online, many teachers and other educators strive to find successful learning tools such as Whatsapp, Zoom, Youtube, Edmodo, Classroom, Google Meet, and Moodle. Obviously, the chosen program is based on its utility, and the chosen application is anticipated to stimulate student interest in online instruction (Alfarizi K et al., 2020).

The online learning method is implemented not just for academic courses but also for practical subjects (Endah Yuliani & Romadhiyana Kisno Saputri, 2021). Therefore, innovation in education is required to support the learning process of students (Fadhillah & Andromeda, 2020). Physics is one of the subjects that need both theoretical and practical knowledge. A widespread misunderstanding or misinterpretation of physics curriculum is one of the greatest obstacles that students confront when learning. This issue is caused by the fact that the instructor teaches abstract physics subject in classrooms that are not equipped with practical instruments, such as laboratories. Several issues contribute to the low efficacy and quality of physics education, including the lack of laboratory facilities, tools, and supporting materials for conducting physics experiments. To conduct an experiment or practical procedure in the laboratory, instructors must consider the availability of space, materials, and equipment (Swandi et al., 2015). The development of a virtual laboratory for physics practicum. Virtual laboratory is a type of traditional laboratory simulation (Oidov et al., 2012). Experiential exercises are essential so that students not only comprehend the studied material, but also its application in the real world. Experimentation can boost students' enthusiasm in autonomous learning and discovering concepts (Andromeda et al., 2018). Experiments can facilitate students' real-world comprehension of abstract concepts (Astuti, 2016; Astuti & Bhakti, 2018; Astuti & Handayani, 2018). Additionally, experimental or practical activities boost students' cognitive learning outcomes (Andromeda et al., 2016).

Previous research reported the efficacy of worksheets using virtual laboratory applications on dynamic fluid materials and heat temperatures in SMAN 15 class XI Padang. The collected results demonstrate that the application of student worksheet with the implementation of a virtual laboratory application on dynamic fluid materials and heat temperatures is highly effective (Sahfitri et al., 2019). While previous research by Auliyani et al. (2018) concerning the use of worksheets with the assistance of a virtual laboratory application in guided inquiry teaching in achieving the level of student competence found that the average value of learning outcomes for physics attitudinal competence has steadily increased, the results of the current study indicate that this trend has continued. Previous

research by Aji and Widodo (2017) to determine the feasibility and effectiveness of student worksheets using virtual laboratory media and problem-based learning models in terms of students' learning motivation demonstrates that worksheets are both highly feasible and effective in terms of motivating students to learn.

Numerous research conducted in the past have addressed virtual laboratories. However, research on the integration of a virtual laboratory with worksheets in the application of static fluid materials during the Covid-19 epidemic has yet to uncover a comparable study. Consequently, a new study was conducted using a virtual laboratory complete with worksheets on static fluid material during the Covid-19 epidemic, which was hypothesized to enhance the students' knowledge in grade XI MAN 1 Jembrana. To demonstrate this, a study will be done to evaluate how much impact the adoption of a virtual laboratory equipped with worksheets directly embedded in the virtual laboratory application on static fluid materials has on conceptual understanding during the Covid-19 epidemic. This study intends to examine the impact of the virtual laboratory application on static fluid material on the students' comprehension of Covid-19 during class XI IPA MAN.

METHOD

This research employed mixed methods. The qualitative data collected for this study was intended to complement the quantitative data. This enables for a more comprehensive and synergistic analysis of data, as well as the use of qualitative data to investigate quantitative discoveries (Talley & Martinez Ortiz, 2017). The design employed in this study is a single-group pre- and posttest. Students from class XI IPA 4 MAN 1 Jembrana in the province of Bali served as respondents for the sample. This study's design was accomplished in three parts. The first stage consisted of administering a pretest to the sample class, followed by treatment in learning, and concluding with the administration of a posttest (Creswall, 2008; Jannah, 2020). The following is the research methodology employed in Table 1.

Table 1. Research Design

Pretest	Treatment	Posttest
T_1	X	T_2

Note:

T_1 = Pretest
T_2 = Posttest
X = Application of *virtual laboratory* equipped with worksheets

The study began by administering a pretest to individuals to assess their starting abilities before to receiving learning treatment. The pretest questions consisted of six multiple-choice questions typed into a Google form. Before being distributed to students, the pretest question instrument must pass the validation stage, which is conducted by the supervisor and colleagues with an explanation that the questions meet the legitimate requirements. In addition to administering a pre-test, the researcher conducted interviews with students to inquire about their perspectives on the learning process and instructional materials.

After the pretest, the implementation of learning using a virtual laboratory equipped with worksheets containing static fluid content was maintained for three meetings beginning on March 29, 2021 and ending on March 10, 2021. The study employed a 97.12 percent media-validated virtual laboratory for static fluids. The characteristics of the virtual laboratory media that have been developed consist of two main parts, namely problems in each concept being taught and virtual practicum as a tool to find solutions to problems, problems in the application are given to users by adopting apperception techniques in learning, namely by providing the application of a concept in everyday life and then by filling out the LKPD that has been listed in the virtual laboratory, this virtual practicum as a tool to find solutions to problems. Due to the lack of face-to-face education provided by the provincial government and schools, this research was conducted online utilizing Google Meet. Observations on the learning process and students were made during the research procedure by documenting the complete learning process. A posttest was administered at the conclusion of the study to assess the students' abilities. The supervisor has validated six multiple-choice questions for the post-test. After the posttest, the researcher conducted interviews with the students to determine how the learning process had changed as a result of the research.

After completing the study procedure, the researcher evaluates the collected data. The results of the data analysis are then qualitative and quantitative data. Interviews, observations, and learning recordings constitute qualitative data, whilst students' pre- and post-test scores constitute quantitative data. From the qualitative data, inferences are generated and the supplied data is verified to get additional information. Before and after the study, changes in students' conceptual knowledge were determined by quantitative data analysis. Using inferential statistics, quantitative data analysis revealed disparities in students' conceptual comprehension before and after the study.

Table 2 . Indicator Achievement of Competence

No	Indicator Achievement Competence	Number Question
1	Participant can understand the concept of hydrostatic pressure	1.2

2	Participant can understand the concept connected vessel system	3.4
3	Participant understand the concept of the pressure of a liquid on each part of an object	5.6

RESULTS

In this study, there are three markers of competency success whose concept comprehension will be assessed using the static fluid pretest and posttest questions listed in Table 2. Before being examined, Table 3 displays the percentage of student responses to the pre- and post-test questions on the three competency accomplishment indicators.

Table 3 . Percentage Answer of Pretest & Posttest On Each Indicator

No	Indicator Achievement Competence	Pretest		Posttest	
		Right	Wrong	Right	Wrong
1	Participant can understand the concept of hydrostatic pressure	53.3%	46.7%	26.9%	73.1%
2	Participant can understand the concept connected vessel system	35%	65%	23.05%	79.95%
3	Participant understand the concept of the pressure of a liquid on each part of an object	20%	80%	61.55%	38.45%

According to Table 3, the third indication of competency achievement explains an increase in the proportion of right answers. Before analyzing the data gathered from the pre- and post-tests in this study, two conditions must be met: the data must be regularly distributed and homogenous. This study collects non-normal data that is nonetheless homogenous. Consequently, the Wilcoxon test analysis is utilized, which is a non-parametric study that may be used to determine how much influence the virtual laboratory has on static fluid material in boosting class XI students' grasp of learning outcomes in the widespread Covid-19 outbreak. Utilizing SPSS 16.00 for Windows for statistical analysis.

The results of the SPSS normality test revealed Sig values of 0.003 for the pre-test and 0.000 for the post-test, indicating that the data was not normal since Sig 0.05. During the homogeneity test, the data earned a Sig value of 0.074 based on the mean, indicating that the data are homogeneous. Due to the failure to meet the requirements for the parametric test, the Wilcoxon test was utilized instead. Table 4 displays the results of the Wilcoxon test conducted with the aid of SPSS.

Table 4. Wilcoxon Results

		N	Mean Rank	Sum of Rank
Posttest-Pretest	Negative Rank	0a	.00	.00
	Positive Rank	29b	15.00	435.00
	Ties	0c		
	Total	29		

The explanation of thye results from Wilcoxon test is explained as follows:

1. Negative rank: the learning outcomes between pretest and posttest is 0, either in N values , Mean Rank, or Sum Rank. The score of 0 indicates that there is no decrease of score from pretest to posttest.
2. Positive rank: there are 29 positive data (N) which means that 29 students have increased learning. The mean rank obtained is 15.00 and the number of positive ranks is 435.00.
3. Ties: there is a similarity between pretest and posttest. Ties value in table is 0, thus no similarity between pretest and posttest.

Based on the results of the Wilcoxon test conducted with SPSS, it was determined that Asymp.Sig (2-tiled) had a value of 0.000. Due to the fact that 0.000 0.05, Ho is refused while Ha is accepted. This indicates that there is an average difference between pre- and post-test learning outcomes, so it can be said to have a positive effect on the use of virtual laboratory learning media for static fluid materials equipped with a scientific approach model to improve students' understanding in class 11 MAN.

Based on the results of the questionnaire (qualitative data), students felt it was difficult to ask questions freely during online learning due to the limited period of video conferencing. When asking questions via chat, it can be difficult to comprehend what the teacher is saying. In addition, physics courses, such as static fluid material, have several formulas that relate to everyday occurrences. When the instructor explains, it can be difficult for pupils to visualize the physical condition of the physics formula being presented. Rarely do teachers provide pupils practical exercises, especially amid the current Covid-19 pandemic. Students expect that face-to-face learning will be used immediately to enhance learning.

DISCUSSION

The findings of the proportion of responses to the pre- and post-test questions on each competency achievement indicator, as shown in Table 3, demonstrate that there are disparities between each competency achievement indicator. In the first indicator, which explains the fall of 26.4 percent in the proportion of accurate responses, the proportion of incorrect responses increases by 26.4 percent. The percentage of accurate responses declined by 11.95 percent in the second indicator, while the percentage of incorrect responses grew by 14.95 percent. The third indication explains that the percentage of accurate responses has increased by up to 41.55 percent while the percentage of incorrect answers has decreased by up to 41.55 percent. Students' misunderstandings lead to the selection of incorrect responses, resulting in a varied percentage for each indicator.

One of the disadvantages of static fluid learning is that online learning makes it difficult for pupils to absorb the lesson. Students find it challenging to ask questions freely during online learning owing to the limited time available for video conferencing and the high internet constraint. When students ask questions about lessons through chat, often the teacher's responses are difficult to notice and comprehend. In addition to physics, which includes static fluid material, there are numerous formulas pertaining to commonplace occurrences. When the instructor explains, it can be difficult for pupils to visualize the physical condition of the physics formula being presented. Rarely do teachers provide pupils practical exercises, especially amid the current Covid-19 pandemic. Students hope that face-to-face learning will be applied promptly so that learning becomes more effective.

The ineffectiveness of online learning is the primary cause of students' misunderstandings in grasping concepts in static fluid materials or the occurrence of misconceptions, so that students still struggle to connect formula concepts with real-world physical ideas (Chu et al., 2012). The use of a virtual laboratory to administer treatment after learning has a positive effect on students' comprehension of static fluid subject. Based on the results of the Wilcoxon test conducted with SPSS in Table 4, it can be observed that Asymp.Sig (2-tiled) has a gain of 0.000. As a result of acquiring 0.000 0.05, Ho is rejected, and Ha is admitted. It can therefore be concluded that the use of virtual laboratory learning media with a scientific approach to static fluid material has a good influence on enhancing the comprehension of students in class XI MAN 1 Jembrana.

According to what students mentioned when interviewed, learning to utilize a virtual laboratory helps students comprehend the notion of static fluids and realize that static fluids are quite similar to real-world fluids.

Researcher: What are the advantages of utilizing Virtual Laboratory in remote education?

Student: I am now more conscious that physics has a significant impact on life, particularly on static fluid. Even in my immediate environment, the rules of static fluid mentioned in distant learning are in use.

The student's opinion states that he is now aware of the significance of comprehending static fluid principles due to their proximity to his life. Due to their conceptual and procedural understanding of static fluid, this practicum will make it easier for them to handle difficulties involving static fluid material. With this research, researchers hope that the use of virtual laboratory learning media can be implemented by teachers in physics education so that it is easier for students to master concepts and there are no misconceptions about the concepts in physics, particularly those related to the application of physics in daily life. In this study, there are limits that restrict the learning process to a scientific method. As a result, the researcher advises, in future research, the application of other novel learning techniques that can be employed in the process of distant teaching, thereby enabling students to better comprehend learning.

CONCLUSION

The research utilizing the Wilcoxon test revealed that the use of virtual laboratory learning media with a scientific approach to static fluid content had a beneficial effect on the learning outcomes of students. This is based on a rise in the percentage of right responses given by students on the pretest and posttest, particularly for the third indication, which received a score of 41.55 percent. To have a beneficial impact on the use of virtual laboratory learning media With a scientific approach to static fluid material and its impact on student learning outcomes, a virtual laboratory containing worksheets can be considered extremely useful. With this research, the researcher hopes that the use of virtual laboratory learning media can be implemented by physics teachers so that students have an easier time mastering concepts and do not have misconceptions about physics concepts, particularly those related to the application of physics in daily life. In this study, there are limits that restrict the learning process to a scientific method. As a result, the researcher advises, in future studies, the application of various novel learning techniques that can be employed in the process of remote teaching in order to improve students' ability to comprehend concepts.

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