

Effects of Online Labs (OLABs) as Physics Learning Medium on High School Students' Motivation

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Abstract

The Learning media, particularly laboratory use, can have an impact on learning quality. However, not all schools provide suitable laboratory facilities. One potential option is the utilization of technology-based learning resources, such as Online Laboratory (OLabs). The goal of this study was to examine the effectiveness of OLabs as a physics learning medium in enhancing student motivation in high school when compared to contextual practicums. This study utilized a one-group pretest-posttest design. The students were in grade X at Pelita Rantepao Senior High School. The sample size consisted of grade 10A students from Pelita Rantepao Senior High School. The data were gathered using a validated questionnaire. The study's findings show that using OLabs as a high school physics learning tool can boost students' motivation to learn, as seen by the extremely high category of 11.11% of students who are very interested in using OLabs as a physics learning tool. 88.89% of students in the high category want to use OLabs as a teaching tool. In comparison to contextual practicum, it can be concluded that OLabs are helpful in boosting high school students' motivation to learn.

Keywords: Learning Media, Online Labs (OLabs), Motivation, and hands-on work

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1. INTRODUCTION

Learning media is a crucial component that significantly influences the quality of students' learning experiences. In physics education, learning activities generally involve two main approaches: theoretical instruction and practical experimentation. Through laboratory experiments, students are able to apply abstract physics concepts to real-world situations, thereby strengthening their conceptual understanding and developing essential scientific skills. Practical laboratory activities not only reinforce the theories taught in the classroom but also promote critical thinking, problem-solving skills, and scientific inquiry, which are fundamental competencies in physics learning (Arsetya, 2019). Traditionally, these practical activities are conducted in physical laboratories, where students can directly observe phenomena, manipulate equipment, and collect experimental data.

At the high school level, the availability and effective use of laboratories play a vital role in enhancing both students' academic understanding and their practical competencies. However, many high schools face significant limitations in providing adequate laboratory facilities. These limitations include the high cost of laboratory equipment and materials, insufficient space to establish and maintain laboratory rooms, and restricted access due to scheduling constraints or equipment maintenance. Such challenges often result in reduced opportunities for hands-on experimentation, which can negatively impact students' engagement and motivation in learning physics.

In response to these constraints, virtual laboratories have emerged as an innovative and practical solution. Technology-based learning resources, particularly Online Laboratories (OLABs), offer an

alternative experimental environment that enables students to conduct physics experiments virtually. OLABs provide interactive simulations that replicate real laboratory activities, allowing students to manipulate variables, observe outcomes, and analyze results without the limitations of physical resources. By overcoming restricted access to real laboratories, OLABs not only support the continuity of practical learning but also have the potential to increase students' motivation, as learning becomes more flexible, engaging, and accessible. Consequently, the integration of OLABs as a physics learning medium is highly relevant for high school education, especially in improving students' motivation and learning experiences in physics.



Figure 1. First look at OLabs

OLABs offer several advantages compared to other online laboratory programs, particularly in their ability to provide learning experiences that closely resemble those of physical laboratories. The design of OLABs emphasizes interactivity and authenticity, enabling students to conduct experiments through structured procedures that mirror real laboratory practices. With clear guidance and step-by-step instructions, students are encouraged to learn independently while actively engaging in experimental activities. Moreover, OLABs allow students to repeat experiments multiple times without the risk of damaging equipment or consuming laboratory materials, which is often a limitation in conventional laboratories.

Another significant advantage of OLABs is their high level of accessibility and flexibility. Students can access the experiments at any time and from any location, allowing them to learn at their own pace and revisit concepts that they find challenging. This flexibility supports deeper conceptual understanding and reduces anxiety commonly associated with time-limited or resource-constrained laboratory sessions. As learning becomes more student-centered and less restricted by physical limitations, students are more likely to develop a positive attitude toward physics learning.

Based on these advantages, OLABs were selected in this study to examine their effectiveness as a physics learning medium in enhancing students' learning motivation compared to contextual or conventional laboratory activities. Previous studies have indicated that technology-based laboratories, such as OLABs, can foster increased engagement, autonomy, and interest in learning physics, which are key factors influencing students' motivation (Halimatul Mu., 2022). Therefore, investigating the impact of OLABs on students' motivation is essential to understanding their potential role in improving the quality of physics education at the high school level.

2. METHODS

The researchers conducted an experimental investigation using a one-group pretest-posttest technique, which involves administering questionnaires to a single group of subjects before and after

therapy. In this study, researchers were able to demonstrate the benefits of using OLABs in the methodology used when comparing samples that had not been treated to samples that had. The research design to be implemented is described below.

Table 1. One group pretest- posttest design

O ₁	X	O ₂
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Description:

O₁ = Pre-test score (score before treatment)

O₂ = Post-test score (score after treatment)

X = Simulation and Practical Work using OLABs

This study included students from SMA Pelita Rantepao's class X. In this study, the researcher did not employ the full population; instead, class X.A Science at SMA Pelita Rantepao served as the sample. This study used a questionnaire instrument, which is a type of data collection approach that involves delivering a set of questions or written statements to assess students' motivation to follow the learning offered to them.

The questionnaire was used to measure students' motivation for studying physics. The questionnaire scores were then evaluated descriptively using the equation below (Arikunto, 2010):

$$x = \frac{a}{b} \times 100 \% \quad \dots \dots (1)$$

Description:

x = Individual score

a = Actual score

b = Maximum score

Each question and statement will be scored individually. The following table displays an assessment of student learning motivation:

Table 2. Questionnaire Scoring

Answer Options	Score	
	Positive Statement (+)	Negative Statement (-)
Strongly Agree	5	1
Agree	4	2
Netral	3	3
Disagree	2	4
Strongly Disagree	1	5

The results of the skor extraction from the angket were then analyzed in detail using the formula (1), yielding the following table:

Table 3. Standard

Value	Category f
86% ≤ x 100%	Very High
71% ≤ x 85%	High
56% ≤ x 70%	Currently
41% ≤ x 55%	Slow
0% ≤ x 40 %	Very Slow

According to the table, student learning motivation is regarded favorable when the score is $\geq 71\%$, indicating a high or very high level. SMA Pelita Rantepao will determine completion with a score of at least 71%. If the student's motivation exceeds 71%, using OLabs is regarded beneficial.

3. RESULT AND DISCUSSION

A. Understanding Motivational Data

The researcher gave each student a questionnaire with a total of 15 items. The table below shows the motivation data for students in class XA at Pelita Rantepao High School.

Table 4. Distribution of student motivation criteria

Value	Category	F	
$86\% \leq x < 100\%$	Very High	2	11.11
$71\% \leq x < 85\%$	High	16	88.89
$56\% \leq x < 70\%$	Currently	-	-
$41\% \leq x < 55\%$	Slow	-	-
$0\% \leq x < 40\%$	Very Slow	-	-
Summary		18	100

Based on the findings of the study conducted in Class X at SMA Pelita Rantepao, the implementation of OLABs as a physics learning medium demonstrated positive outcomes, particularly through the integration of contextual learning and online practical activities. In this study, OLABs were utilized to support physics experiments involving measurement instruments such as vernier calipers and micrometer screw gauges. The integration of online practical learning with contextual explanations allowed students to better understand abstract measurement concepts by connecting theoretical knowledge with simulated experimental activities. This was reflected in the students' responses to the questionnaire distributed to Class X.A, which captured their perceptions and motivation toward the use of OLABs in physics learning.

Further analysis of the questionnaire data is presented in Table 4, which illustrates the level of students' learning motivation related to the use of OLABs as a physics learning medium. The results indicate a generally positive student response, showing a strong interest in the use of OLABs for learning physics. Specifically, two students were classified in the *very high* motivation category, indicating a very strong interest in using OLABs as a physics learning tool. Meanwhile, the majority of students, totaling 16 individuals, fell into the *high* motivation category, reflecting a positive attitude and willingness to engage with physics learning through OLABs.

These findings suggest that the use of OLABs as a learning medium can effectively enhance students' motivation in physics learning. The interactive nature of OLABs, combined with the flexibility to conduct experiments virtually, appears to encourage active participation and sustained interest among students. Consequently, OLABs have the potential to serve as an effective alternative or complementary medium to conventional laboratories, particularly in improving students' motivation and engagement in physics learning at the high school level.

B. Types of motivation resulting from the use of OLabs

Speed of student comprehension of material.

Table 5. Speed of understanding the material

Question	Frequency	%
Strongly Agree	2	11.11
Agree	13	72.22
Netral	3	16.67
Disagree	-	-
Strongly Disagree	-	-
Summary	18	100

In relation to the speed of students' understanding in the vernier caliper and micrometer screw gauge practicum, the findings of this study indicate that the use of OLABs contributes positively to students' comprehension of physics concepts. Questionnaire results show that 11.11% of students strongly agreed that they were able to understand physics material more quickly when the practicum was conducted using OLABs compared to contextual or conventional practicums. Furthermore, a substantial proportion of students, amounting to 72.22%, agreed that the use of OLABs enabled them to grasp the physics concepts faster than when learning through contextual practicum activities.

Meanwhile, 16.67% of the students expressed a neutral or hesitant response regarding the speed of their understanding when comparing OLABs-based practicums with contextual practicums. This neutral response may indicate differences in students' learning preferences, levels of familiarity with technology, or varying degrees of adaptation to virtual laboratory environments. Nevertheless, the overall findings suggest that the majority of students perceived OLABs as a more efficient medium for understanding physics concepts, particularly in practical topics involving measurement instruments.

These results imply that OLABs can enhance the efficiency of physics learning by facilitating quicker conceptual understanding through interactive simulations and repeated practice opportunities. As a result, the use of OLABs has the potential to positively influence students' learning motivation and engagement, especially when compared to traditional contextual practicums that are often limited by time, equipment availability, and laboratory access.

Student Activity

Table 6. Student Activity

Question	Frequency	%
Strongly Agree	2	11.11
Agree	11	61.11
Netral	5	27.78
Disagree	-	-
Strongly Disagree	-	-
Summary	18	100

With regard to students' learning activities when using OLABs compared to contextual practicums on the topic of vernier calipers and micrometer screw gauges, the findings indicate that OLABs promote higher levels of student engagement. The questionnaire results reveal that 11.11% of students strongly agreed that they were more active in learning when using OLABs, while 61.11% agreed that OLABs encouraged active participation during the learning process. These results suggest that the majority of students perceived an increase in their learning activity when physics practicum was conducted through OLABs rather than through conventional contextual practicum.

Meanwhile, 27.78% of students expressed neutral or hesitant responses regarding their level of activity when using OLABs compared to contextual practicum. This hesitation may be influenced by individual differences in learning styles, prior experience with technology-based learning, or students' adaptation to virtual laboratory environments. Nevertheless, the overall trend of the data indicates that OLABs have a positive impact on students' learning activity.

In addition to learning activity, students' interest in using OLABs compared to contextual practicum also showed favorable results. The interactive features, visual simulations, and flexibility offered by OLABs appear to increase students' interest and involvement in physics learning. Increased activity and interest are important indicators of learning motivation, suggesting that the integration of OLABs as a physics learning medium can effectively enhance students' motivation and engagement, particularly in practical topics involving measurement instruments.

Table 7. Student Activity

Question	Frequency	%
Strongly Agree	1	5.56
Agree	13	72.22

Question	Frequency	%
Netral	3	16.67
Disagree	-	-
Strongly Disagree	1	5.56
Jumlah	18	100

In terms of students' interest in learning physics using OLABs compared to contextual practicum on the topics of vernier calipers and micrometer screw gauges, the findings indicate a predominantly positive response toward the use of OLABs. The questionnaire results show that 5.56% of students strongly agreed that they were more interested in learning physics through OLABs than through contextual practicum. Furthermore, a large proportion of students, amounting to 72.22%, agreed that they preferred the use of OLABs in physics learning over conventional contextual practicum.

Meanwhile, 16.66% of students expressed neutral or cautious attitudes toward the adoption of OLABs compared to contextual practicum, suggesting that some students may require more time to adapt to technology-based learning environments or may still value direct hands-on experiences in physical laboratories. In contrast, only 5.56% of students strongly disagreed, indicating a lack of interest in using OLABs as a medium for physics learning. This relatively small percentage suggests that resistance to OLABs was minimal among the students.

Based on the findings above, following the implementation of both contextual practicums and online practicums using OLABs on vernier calipers and micrometer screw gauges, it can be concluded that OLABs are effective in enhancing students' learning motivation at the high school level. The increased levels of interest, engagement, and preference for OLABs demonstrate that online laboratory-based learning can serve as an effective alternative or complement to conventional laboratory activities in physics education.

4. CONCLUSION

The use of Online Laboratories (OLABs) as a physics learning medium at the high school level has been shown to enhance students' learning motivation. This improvement is reflected in the distribution of motivation levels, where 11.11% of students were categorized in the *very high* motivation level, indicating a strong interest in using OLABs as a physics learning tool. Furthermore, 88.89% of students fell into the *high* motivation category, demonstrating a generally positive response toward the implementation of OLABs in physics learning.

These findings indicate that OLABs provide a more motivating learning environment compared to conventional contextual laboratory activities, particularly in practicum topics involving measurement instruments such as vernier calipers and micrometer screw gauges. The interactive features, flexibility, and opportunities for repeated practice offered by OLABs encourage greater student engagement and interest. Therefore, the implementation of OLABs as a physics learning medium is more effective than contextual laboratory work in improving students' motivation in learning physics at the high school level.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to Universitas Kristen Indonesia Toraja for the institutional support provided throughout the research process. Appreciation is also extended to all parties who contributed to the successful completion of this study, from the data collection stage to the preparation and publication of this research article. Their support and cooperation were invaluable in ensuring the smooth progress of this research.




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