

INCREASING THE LEARNING INTEREST OF BIOLOGY EDUCATION STUDENTS AT ABULYATAMA UNIVERSITY USING SMARTPHONE MICROSCOPES-STEM

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Abstract: The limitation of specialized laboratories for biology education poses a problem for students' interest in learning. Students have to use the university's integrated laboratory, resulting in suboptimal practical work, and not all biology practical needs are available. Smartphone microscopes are used as an alternative to this constraint. The objective of this research is to determine the enhancement of STEM-based smartphone microscopes on the interest in learning of Biology Education students at Abulyatama University. This type of research employs a quasi-experimental design with a one-group pretest-posttest approach. The sample in this research consisted of 31 participants determined by purposive sampling technique. The data collection technique in this study utilized a questionnaire which was analyzed using percentage test and N-Gain test. The results obtained show that 1) The interest in learning among students using smartphone microscopes is 59.65% (sufficiently interested); 2) There is an increase in learning interest with an N-Gain value of 0.75 (high). Thus, it can be concluded that learning using smartphone microscopes based on STEM can enhance the learning interest of Biology Education students at Abulyatama University.

Keywords: Learning Interest, Smartphone-STEM Microscope, Students

1. Introduction

Current technological advancements have brought significant changes across various aspects of life, including education. These developments in the educational field require students to be capable of keeping up with the competitive demands of the 21st-century technological era. According to Nasution and Rapono (2018) learning interest is one of the key factors influencing students' ability to face challenges in today's educational landscape. Suriati et al. (2021) further emphasize that students who fail to improve their learning interest tend to exhibit lower levels of critical thinking skills.

Biology is a subject closely tied to the use of microscopes. Limited access to microscope facilities poses a challenge in the learning process, including students' interest in learning. The lack of microscope usage has become an obstacle to improving students' knowledge quality (Pakaya et al. 2023). Murni et al. (2023) stated that smartphones can offer innovative approaches to learning and have the potential to enhance students' skills. One such innovation in the use of smartphones in biology is the integration of smartphone microscopes.

Smartphone microscopes can be applied using a STEM approach. STEM, an educational framework that integrates science, technology, engineering, and mathematics, has been shown to enhance students' interest in learning (Sukmana, 2017). This approach can be applied in biology, particularly through the development of smartphone microscopes, which serve as tools for fostering skills and problem-solving abilities (Samsuar et al. 2023).

Abulyatama University is a higher education institution committed to advancing biology education. One of its approaches is laboratory-based learning, using microscopes for various practical exercises. However, biology education students at Abulyatama University are still limited in their lab work due to the absence of a dedicated biology education lab. Consequently, they have to use the university's integrated labs, which lack the specific design needed for

biology education. Furthermore, the limited number of microscopes hinders the effectiveness of these practical sessions.

Based on initial observations of Biology Education students at Abulyatama University, it was found that students have a relatively low interest in learning biology. This subject is often perceived as difficult and monotonous due to the abundance of unfamiliar terminology and the heavy emphasis on memorization, which typically involves taking notes and passively listening to the instructor's explanations (Jayawardana and Gita, 2020).

Previous studies have shown that the use of smartphone microscopes can enhance learning outcomes, scientific process skills, psychomotor abilities, and creativity (Priyani and Nawawi, 2020; Samsuar et al. 2023). Based on these issues, the present study aims to determine whether the use of STEM-based smartphone microscopes can increase the learning interest of Biology Education students at Abulyatama University.

2. Literature Review

2.1 Interest in Learning

Learning interest is a tool that can stimulate an inner tendency or desire to improve academic achievement (Ratnasari, 2017). According to Inggriyani *et al* (2019) learning interest refers to a sense of enthusiasm for studying more diligently and taking continuous initiative in learning. (Friantini and Winata, 2019) define learning interest as an internal desire to be actively engaged in learning with joy and focused attention, characterized by indicators such as enjoyment, attention, willingness, activeness, and the realization of the desire to learn.

According to Ananda and Hayati (2020) the indicators of learning interest consist of four aspects: awareness, attention, desire, and enjoyment. According to Harap et al. (2022) the indicators for determining a person's interest in learning are based on five aspects: being diligent in the learning process, being persistent in the learning process, being diligent in completing assignments during learning, having a study schedule, and being disciplined in the learning process. Inggriyani et al. (2019) state that learning interest comprises four indicators: enjoyment, attention, interest in learning, and engagement in the learning process.

Drawing from previous definitions by scholars, learning interest can be understood as an individual's internal state when engaging in activities with a sense of happiness, free from external coercion, actively participating in the learning process, and feeling positively impacted by the experience. The indicators include:

1. Experiencing enjoyment during the learning process
2. Demonstrating focused attention and concentration in learning
3. Showing curiosity toward the subject matter
4. Actively engaging in learning activities
5. Perceiving the benefits of the learning experience

2.2 STEM- Based Smartphone Microscope

A smartphone microscope is a learning tool that utilizes a smartphone camera combined with easily accessible materials, which are modified to function as a digital microscope (Samsuar et al. 2023).



Figure 1. Smartphone Microscope

STEM is an approach that integrates four disciplinary components—science, technology, engineering, and mathematics—through project-based implementation, with an emphasis on the processes or stages involved in designing an object (Riyanto et al. 2021; Dewati et al. 2019). The application of STEM in the smartphone microscope project is as follows (Dewati et al.).

1. Science, In this study, science refers to the process of observing specimens of plant cells and tissues.
2. Technology, The technology referred to in this study is the smartphone. Students learn to operate it, collaborate through it, and utilize its digital features, such as image and video capture for observational purposes.
3. Engineering, Engineering in this context involves the process of designing microscopes. Students participate in the process of designing and modifying components, such as creating simple mounts or adjusting optical lighting to achieve optimal observation results.
4. Mathematics, The mathematical aspect is involved in determining appropriate measurement scales for microscope dimensions. This includes measuring and cutting acrylic glass, measuring the object glass, and calculating the height between the main glass and the object glass.

3 Method

(1) Research Type and Design

The type of this research is a quasi-experiment with a quantitative approach. The design used one group pre-test post-test as in Figure 2.

O_1	X	O_2
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Figure 2. Design *one group pretest posttest*
(Jack R. Fraenkel et al. 2015)

Where $O_1 = \text{Pretest}$
 $X = \text{Treatment}$
 $O_2 = \text{Posttest}$

This research was done in May 2025 at Abulyatama University, located in Aceh Besar, Kuta Baro District, Lampoh Keude, Blang Bintang Lama Street.

(2) Population dan Sample of Research

The population in this study consists of all students enrolled in the Biology Education program at Universitas Abulyatama, totaling 103 individuals. The research sample comprises 35 students from the 2023 cohort of the Biology Education program at Universitas Abulyatama, selected using a purposive sampling technique.

(3) Data Collection Techbique and Instrument

The data collection technique used in this study was a questionnaire. The instrument employed was a Likert scale questionnaire ranging from 1 to 5 points, consisting of five indicators and 20 positively worded statement items. The indicators used to measure learning interest included: (1) Enjoyment, (2) Attention focus, (3) Curiosity, (4) Activeness, and (5) Perceived usefulness.

(4) Data Analysis Technique

The data analysis techniques of this research included several steps as follow.

a. Interest Anakysis

The analysis of learning interest was conducted using a percentage test of learning interest with the following formula.

$$\text{Percentage} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

(Friantini and Winata, 2019)

b. Increasing Interest Analysis

The improvement in learning interest was tested using the following N-Gain formula.

$$\text{N-Gain} = \frac{\text{Score Posttest} - \text{Score Pretest}}{\text{Score Ideal} - \text{Score Pretest}} \times 100\%$$

(Meltzer, 2002)

The gain value obtained was then used to decide the level of interest as formulated in Table 1.

Table 1 N-Gain Assessment Criteria

N-Gain Score	Category
$G < 0,3$	Low
$0,3 \leq G \leq 0,7$	Medium
$G > 0,7$	High

(Meltzer, 2002)

4 Finding and Discussion

4.1 Interest Description

The results of the analysis on the use of STEM-based smartphone microscopes in relation to the learning interest of Biology Education students at Abulyatama University are presented in Table 2 below.

Table 2 Description of Learning Interest

Keterangan	<i>Pretest</i>	<i>Posttest</i>
N	31	31
Minimum	46	82
Maksimum	73	99
Mean	59,65	90,1
Median	61	90
Standard Deviation	6,199	4,96
Variance	38,437	24,642

The data from Table 2 with the sample (N) 31 students showed that the pretest obtained minimum score was 29, a maximum score of 73, a mean score of 58.65, a median score of 61, a standard deviation of 6,199, and variance of 38,437. In contrast, the posttest results revealed a minimum score of 82, a maximum score of 99, a mean score of 90.1, a median score of 90, a standard deviation of 4,96, and variance of 24,642. Based on the data obtained, the percentage analysis of students' learning interest according to each indicator can be determined.

The comparison of percentage values for each learning interest indicator between the pretest and posttest shows consistently high percentages. The detailed comparison of pretest and posttest percentages for each learning interest indicator is presented in Figure 3 below.

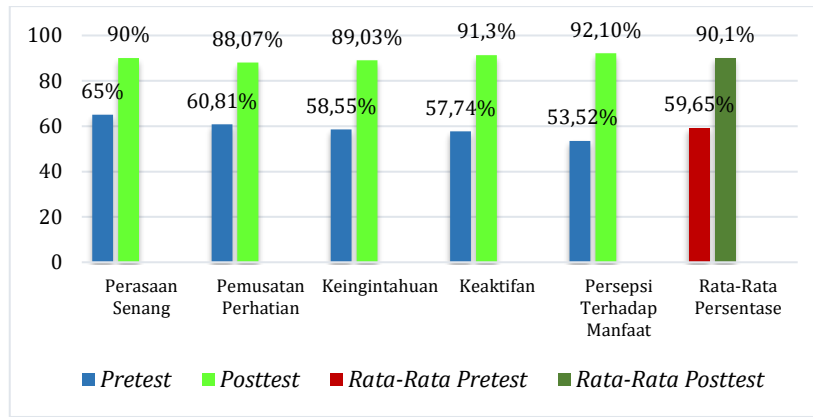


Figure 3. Comparison of pretest and posttest scores

Based on Figure 3, it can be observed that students' interest in learning to use a STEM-based smartphone microscope showed significant improvement across all indicators. The calculated results for each indicator are as follows: enjoyment at 65% (pretest) and 90% (posttest), attention focus at 60.81% (pretest) and 88.07% (posttest), curiosity at 58.55% (pretest) and 89.03% (posttest), activeness at 57.74% (pretest) and 91.3% (posttest), and perceived usefulness at 53.52% (pretest) and 92.10% (posttest).

The average percentage of learning interest in the pretest was 59.65%, while the posttest average reached 90.1%. Based on the graph, it can be concluded that there was a significant increase in students' learning interest across all indicators. These results indicated that the use of a STEM-based smartphone microscope has a positive impact on students' learning interest.

4.2 Increased Interest

The average N-Gain score can be seen in Table 3 below.

Table 3 N-Gain Scores *Pretest* dan *Posttest*

N	Pretest average score.	Posttest average score.	N Gain Score	N Gain Persen	Category
31	59,65	90,1	0,75	75	Tinggi

According to Table 3, the average pretest score was 59.65%, while the average posttest score rose significantly to 90.1%. The average N-Gain score was 0.75, which indicates a high level of improvement. These results demonstrate a notable increase in the learning interest of biology education students after using the smartphone microscope. This suggests that employing a STEM-based smartphone microscope effectively enhances students' interest in learning. This finding is consistent with the study by (Alamsyah et al. 2023), which states that technology can enhance students' learning interest.

The increase in the average percentage of learning interest, as measured by the N-Gain score, reached 0.75. This result indicates a high category of improvement in students' learning interest. This finding is consistent with the study by (Agustina, 2018), which demonstrated that the implementation of a STEM-based smartphone microscope as a practical tool can enhance skills by 0.7022. The high N-Gain value strongly supports the effectiveness of this approach in improving students' learning interest

5 Conclusion and Recommendation

Based on the results of the research and discussion, it can be concluded that students' learning interest increased, as indicated by an N-Gain score of 0.75%, which falls into the high category.

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