Analysis of the Learning Process in the Basic Concepts of Physics Course at Medan State University

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Abstract. This research is a descriptive study utilizing a qualitative approach. The aim of this study is to describe the learning process in the Basic Concepts of Physics course within the PGSD program at Medan State University. The research was conducted at Medan State University, located at Jl. William Iskandar Ps. V, Kenangan Baru, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra. The population comprised all students enrolled in the Basic Concepts of Physics course, which includes 14 classes. The sample selected for this study was Class A of the second semester PGSD cohort. The data analysis method employed involved data reduction, presentation, and analysis, followed by drawing conclusions based on the collected data. Observational results indicate that the learning process in the Basic Concepts of Physics course employs active learning models, such as Project-Based Learning (PjBL) and Problem-Based Learning (PBL). Assignments given include Critical Journal Reviews (CJR) and Critical Book Reviews (CBR). According to interviews with students, the learning process is fairly interactive and encourages direct student engagement. However, the instructional materials used are still primarily in the form of textbooks and lecture notes, which makes learning less accessible and practical for students. Furthermore, these materials do not facilitate or coordinate student learning activities outside the classroom. Documentation regarding semester evaluations reveals that assessment items still predominantly target C2 and C3 cognitive levels. The results of these evaluations show that many students achieve scores classified as "Sufficient," specifically within the range of 65.00–74.00.

Keywords: Analysis, Physics Learning, Learning, quality Study

1 Introduction

Indonesian education, as outlined in Law No. 12 of 2012, aims to develop individuals who are faithful and devoted to God Almighty, possess noble character, are healthy, knowledgeable, capable, creative, skilled, independent, and competent, and who become democratic, responsible, and cultured citizens committed to the nation's welfare. Based on these educational objectives, it is evident that Indonesia aspires for its next generation to possess not only strong academic abilities, but also the skills and creativity necessary to compete globally, all while embodying the values of Pancasila, the nation's foundational ideology.

The current state of education has progressed into the 21st century, characterized by a shift toward innovative, interactive, and effective learning approaches (Handayani & Wibowo, 2021). The learning process in the 21st century demands the development of complex

ICONSEIR 2024, November 28, Medan, Indonesia

DOI 10.4108/eai.28-11-2024.2355425

competencies, ongoing transformation, and the integration of technology-based instruction (Mutohhari et al., 2021). A key emphasis in 21st-century learning is the cultivation of students' abilities in critical thinking, creative thinking, collaboration, and communication (Mutohhari et al., 2021).

The demands of 21st-century education indicate that students must possess not only cognitive abilities but also a range of essential skills. In response to the challenges faced in Indonesia's educational landscape, the adoption of the Outcome-Based Education (OBE) curriculum is regarded as an appropriate, practical, and effective strategy for enhancing students' creativity and critical thinking (Mufanti et al., 2024). The OBE approach to learning emphasizes innovation, interactivity, and effectiveness in the educational process (Handayani & Wibowo, 2021).

The goals of education in Indonesia should be able to address all global challenges in the educational sector. However, the performance of Indonesian students, as reported by PISA, indicates that Indonesia is at Level 2 out of a maximum of 6 for science and reading skills. Level 2 signifies the ability to interpret and recognize information without direct instruction and to represent simple situations mathematically. According to PISA data, only 18% of Indonesian students achieve Level 2, meaning that the remaining 82% fall below this threshold and are not adequately detected in the assessment. The disparity between the educational objectives outlined for Indonesia and the current learning outcomes highlights a significant gap. Investigating the underlying causes of this discrepancy presents an important and relevant area for further research.

In the learning process, several factors can support the achievement of optimal learning objectives and mastery of the expected competencies. One such factor is the use of technology as an innovative tool for learning (Roemintoyo & Budiarto, 2021). In addition to technological innovation, the implementation of learning models that promote interactive instruction can help foster collaborative skills among students (Purnomo & Yunahar, 2019). Creating an interactive learning environment not only prepares students to engage more effectively in learning activities but also serves as a means to enhance their scientific literacy (Suryandari et al., 2018).

The various factors that influence learning outcomes become particularly evident when examining current educational conditions. Prior to this study, observations were conducted on the learning environment at Medan State University over the past three years, which will subsequently be analyzed in relation to existing conditions. Based on the mission of Medan State University (UNIMED), it can be concluded that the PGSD study program aims to produce outstanding educators who are capable of making significant contributions as competent and professional teachers, in accordance with government regulations.

Achieving the mission and goals of a university involves a multifaceted approach. One important aspect is the design of the learning system within the study program, which plays a critical role in fulfilling the institution's vision and mission. An examination of administrative preparations for science courses—such as course syllabi (RPS) and student grade lists—reveals that science instruction in the PGSD Study Program is designed to cultivate the expected competencies in all students, with a particular emphasis on the development of higher-order thinking skills.

Based on the results of observations conducted at Medan State University, this research will involve an analysis of the learning processes that have been ongoing over the past three years.

2 Research Method

This research is a descriptive study utilizing a qualitative approach. The qualitative aspect of this study aims to describe the learning process within the PGSD Study Program at the State University of Medan (UNIMED). Data collection involved a series of activities, including observations, interviews, orientation studies, and focused studies.

The research was conducted in the PGSD Study Program at Medan State University, located at Jl. William Iskandar Ps. V, Kenangan Baru, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra. Data collection took place in February 2024, specifically during the even semester of the 2023/2024 academic year. The primary data sources were PGSD lecturers responsible for the Basic Concepts of Physics course at Medan State University, as well as second-semester students.

Observations related to the teaching of basic physics concepts were conducted through interviews with the lecturers responsible for the course. The purpose of these interviews was to obtain specific information regarding the instructional process and the challenges encountered.

Data analysis in this study was carried out in several stages, including data collection, data reduction, data display, and the drawing or verification of conclusions.

3 Results and Discussion

3.1 Planning Implementation Learning

Lesson planning is a form of organizing learning activities (Maulida et al., n.d.). The process of planning instruction involves establishing both general and specific objectives, followed by developing patterns, sequences, and learning activities designed to achieve these goals (Ergawati et al., 2023). Instruction that does not begin with thorough planning can negatively affect students' learning activities (Iqbal et al., 2021).

Based on the results of interviews, it was found that lecturers prepare a Semester Learning Plan (RPS) as part of their instructional planning. The teaching materials prepared by lecturers primarily consist of textbooks with ISBNs. In addition to using these resources, lecturers also provide students with opportunities to access supplementary information online.

Several forms of evaluation are implemented in the learning process, including Critical Book Reviews (CBR), Critical Journal Reviews (CJR), midterm exams (UTS), final exams (UAS), and project-based assessments. The curriculum used aligns with the Outcome-Based Education (OBE) framework and adheres to government policy.

Interview results also indicated that the identification of students' backgrounds and needs by lecturers has not yet been systematically conducted. Generally, lecturers begin the first session by introducing themselves and taking attendance to get to know the students. In terms of providing learning resources, lecturers typically recommend standard textbooks as outlined in the RPS.

3.2 Activity Learning

The selection of appropriate learning approaches is a crucial factor in determining the quality of instruction (Qureshi & Ullah, n.d.). The use of effective teaching techniques and methods is an essential component in enhancing the quality of learning (Dunlosky et al., 2013).

The learning activities analyzed in this study are based on direct classroom observations conducted by the researchers. The initial phase of the lesson typically begins with the lecturer greeting the students present in the classroom and waiting for the atmosphere to stabilize before taking attendance. The lecturer then engages in a brief reflection on the material and assignments given during the previous session.

During the core activities, the lecturer presents instructional materials in accordance with the Semester Learning Plan (RPS). The learning methods applied include lectures, question-and-answer sessions, and discussions. In some instances, demonstrations are also utilized to facilitate ongoing learning. The closing activities generally involve providing a learning evaluation and conducting a question-and-answer session between the lecturer and students.

The learning model implemented in this course is Project-Based Learning (PjBL), where, at the end of the course, students are required to submit a project as an external assignment. The use of the PjBL model serves as a strategy for lecturers to encourage students to be interactive, creative, and critical thinkers (Almulla, 2020; Fitri et al., 2024).

3.3 Evaluation Learning

Learning evaluation activities serve as a form of feedback within the instructional process. Effective feedback should be specific, timely, routine, integrated, and constructive (Adarkwah, 2021). Routine and continuous evaluation provides opportunities for students to actively engage in learning, while evaluations conducted during examinations help assess the effectiveness of instruction, academic achievement, and student progress (Bulut et al., 2024).

In the Basic Concepts of Physics course, various forms of evaluation are employed, including assessments at the end of each learning cycle as well as midterm and final exams. Each type of evaluation offers distinct benefits. Evaluations conducted at the conclusion of instructional activities provide insight into the effectiveness of the learning process (Raković et al., 2022). The types of exam questions used in semester evaluations (UAS) over the past three years are summarized in Figure 1.

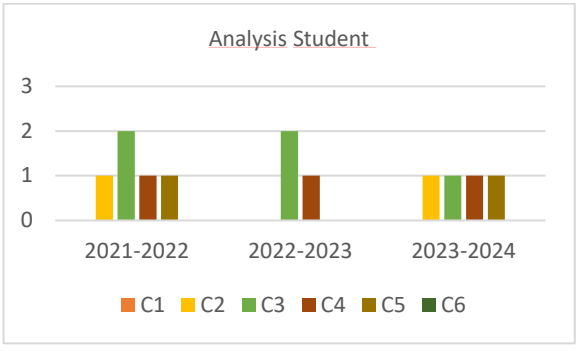

Fig. 1. Form of Final Exam Questions for the Basic Physics Concepts course for students in the academic year 2021-2024

Based on the results of initial observations of students' final semester exam (UAS) scores from the 2021–2022 to 2023–2024 academic years, the data obtained are presented in Figure 2.

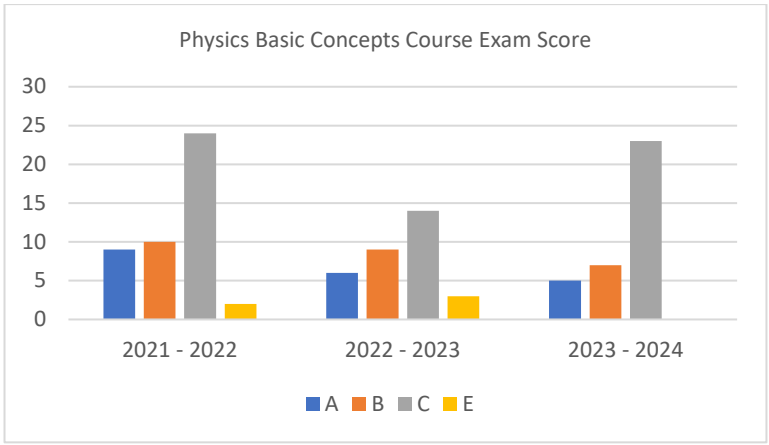

Fig. 2. Student Exam Scores for the Basic Physics Concepts Course

In addition to written examinations administered at the end of each semester, students are also assigned project tasks as part of the learning model employed, specifically Project-Based Learning (PjBL). These project assignments include activities such as Critical Book Reviews (CBR) and Critical Journal Reviews (CJR).

3.4 Obstacles in Learning

The learning process often encounters obstacles that deviate from ideal expectations. Based on interviews and observations with lecturers, it was found that students' understanding of physics concepts remains highly varied. As a result, lecturers frequently need to revisit fundamental physics concepts and techniques to establish a common understanding among students. Additionally, low student interest in the course presents a further challenge, as it leads to insufficient participation in learning activities. Consequently, lecturers must design more engaging and interactive learning experiences.

This can be achieved by carefully selecting appropriate learning models, teaching materials, syllabi (RPS), and evaluation methods. To ensure optimal learning outcomes, teachers should plan instruction by identifying student characteristics, establishing learning objectives, selecting relevant teaching materials, and determining the types of assessment to be used (Anugrah & Monoarfa, 2023).

3.5 Discussion

Based on the findings at the research site, detailed information was obtained regarding the entire learning process—from the lecturer's planning and preparation to the evaluation and its results. The data revealed that lecturers generally prepared for the learning process quite well,

such as by developing the Semester Learning Plan (RPS) and establishing the formats for assignments and assessments to be used. According to Ergawati et al. (2023), several elements must be addressed in preparing for instruction, including the development of the RPS, teaching materials, and other learning tools. Learning design plays a crucial role in fostering active student engagement in the learning process (Iqbal et al., 2021). Furthermore, a teacher's planning is vital as it directly influences their readiness to conduct the learning process (Psychology Department, Ghor University, Afghanistan et al., 2023).

However, these findings also indicate that certain aspects—such as providing more interactive teaching materials to attract students' interest—are yet to be fully addressed. One area for improvement is enhancing the lecturer's preparedness in designing engaging teaching resources and materials that can better stimulate student participation. This is particularly relevant given the observed lack of student interest and active involvement in the learning process.

UNESCO (2015) stated that future societies must possess skills in creative thinking, critical thinking, collaboration, and communication. Learning strategies that align with the needs of 21st-century education should stimulate the creation of active, responsible, distinctive, and rational learners (Özdoğru, 2022). The learning process in the Basic Concepts of Physics course can be considered effective in attempting to create an engaging educational environment. The use of Project-Based Learning (PjBL) in this course supports the requirements of 21st-century education (Undari et al., 2023) and has been shown to enhance students' thinking skills (Biazus & Mahtari, 2022).

Nevertheless, field observations reveal a gap between theoretical expectations and actual classroom practice, as some students remain passive and less enthusiastic in the learning process. Such obstacles present ongoing challenges and highlight the need for innovative solutions to improve student engagement.

The evaluation in the Basic Concepts of Physics course comprises various forms, including project assignments (CBR and CJR), as well as mid-term (UTS) and final semester (UAS) exams. Over the past three years, student exam scores have averaged between 70 and 74. Analysis of the UAS questions shows that they primarily assess application-level (C3) skills. Considering the demands of 21st-century education, one of the key expected competencies is critical thinking, which is associated with higher-order thinking skills (C4, C5, C6) (Miterianifa et al., 2021). The observed misalignment between these educational demands and the format of student assessment questions highlights the need for reform in the learning system, ensuring that students are better prepared to meet the challenges of globalization.

4 Conclusion

The primary objective of learning activities in the 21st century is to cultivate a society equipped with critical thinking, creativity, communication skills, and the ability to collaborate (UNESCO, 2015). An analysis of the learning process in the Basic Concepts of Physics course at Medan State University indicates that the instructional activities are well-structured and mutually supportive, playing a crucial role in achieving learning objectives effectively and efficiently. The teaching methods employed in this course generally align with the theoretical requirements of 21st-century learning.

However, field observations reveal several challenges that must be addressed, particularly by lecturers. One major obstacle is the low level of student interest, which often leads to passive participation in lectures and, consequently, less satisfactory learning outcomes. This situation presents a challenge for lecturers to design more interactive and engaging instruction, utilizing teaching materials and media that leverage technology to attract student interest.

Furthermore, student learning outcomes have not yet demonstrated higher-order thinking skills (HOTs), as the assessments are still largely focused on understanding and application levels (C2–C3), rather than on analysis, evaluation, or creation. Addressing these issues is essential for ensuring that students develop the competencies needed to succeed in the 21st century.

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