

Problem-Based Learning as a Learning Innovation Strategy To Improve the Motivation and Learning Outcomes of Distance Learning

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Abstract

Distance learning, which lasted long during the COVID-19 emergency, has led to student boredom in participating in the learning process. The impact is a decrease in learning outcomes, so innovative learning methods are needed to minimize this. This study will analyze the application of problem-based learning by considering learning outcomes and student motivation. The subjects of this study were 5th-semester Mechanical Engineering students. The design of this study used classroom action using the Kemmis and McTaggart models, which consisted of three steps: planning, acting and observing, reflecting, and carried out in two cycles. The research data was then analyzed quantitatively based on predetermined indicators. Based on this research study, it was found that learning outcomes data increased by 36% from cycle I to cycle II. The results of student learning motivation in Process I were 27.3% had high learning cycles, 63.7% had moderate learning cycles, and 9.9%. In cycle II, students' learning motivation increased from high, medium, and low, respectively, by 45%, 52%, and 3%. Based on the results of the analysis, this means that problem-based learning strategies improve learning outcomes and student learning motivation.

Keywords: Distance Learning, Problem Based, Learning Outcomes, Motivation.

1. Introduction

About 45 million students in Indonesia, or about 3% of the total student population, are affected in the field of education [1]. The COVID-19 pandemic has forced many educational institutions to switch to a distance learning model, namely online learning. Because face-to-face meetings to teach in schools are not possible, especially with quarantine policies to reduce the interaction of many people to minimize the spread of the virus [2]. The school closure policy became a historic first for the world [3][4]. In this case, the government must establish alternative continuity of education so that the learning process does not stop and learning losses can be avoided. However, there are some challenges in ensuring that online learning provides an optimal learning experience for learners. In this context, problem-based learning has been identified as an innovative learning strategy that can improve learners' motivation and learning outcomes in distance learning. However, the shift to distance learning has led to various problems, including student boredom, ineffective learning exchanges, and one-way learning. Such issues can lead to decreased learning outcomes, especially in a pandemic where students face various challenges. Thus, there is a need to find innovative and interactive learning techniques that can keep students engaged in the learning process.

The first step in resolving these issues is for technology to be more fully integrated into the learning process, particularly in online learning. However, not everyone understands technology and makes good use of it; perhaps some people are still left behind due to a lack of knowledge or infrastructure, and this is an issue with a high-level solution [5][6], how to encourage someone to be more familiar with technology. Currently, various Learning Management System platforms are available, such as Rumah Belajar, Google Classroom, Vinesa, Canvas Moodle, and others [7]. Research on the impact of problem-based learning on student motivation and learning outcomes in a pandemic still needs to be completed. This knowledge gap can hinder the improvement of the education system

during and after the pandemic. The Covid-19 pandemic has shown that remote learning is the answer to ensuring students' educational rights while keeping them safe. But the effectiveness of this learning method still needs to be determined, especially in terms of student motivation and learning outcomes.

Students in distance learning should be able to learn more. independently than students in face-to-face teaching. Students' critical thinking and inventiveness [8] are necessary for effective distance learning that does not depend solely on the teacher. Learning media, supporting tools, and internet stability support online learning [9]. Students are intended to be more involved in thinking, communicating, searching and processing facts, and drawing conclusions due to the problem-based learning paradigm, making the learning environment more exciting and exciting.

Several previous studies have shown that PBL effectively improves learners' motivation and learning outcomes in various learning contexts, including distance learning. According to O. Koh at.al, (2017) “problem-based learning allows learners to learn through practical experience in solving real-world problems, which can increase learner engagement and strengthen their understanding of the concepts learned” [10]. In conducting a gap analysis, this study will use empirical facts and theories related to online learning and PBL as a basis for recommending effective solutions that are following the needs of students. For example, according to Sajidan et.al, (2014) ” PBL strategies can be well integrated into online learning, provided that online learning platforms support features such as group discussions and collaboration between learners” [11].

Based on the environment described above, the purpose of this study is to investigate the impact of problem-based learning on student motivation and learning results during a pandemic by using problem-based learning as an implicit distant learning model.

2. Research Methodology

The research was conducted in the odd semester of 2020/2021 in the heat and mass transfer class of fifth-semester mechanical engineering students at the State University of Surabaya, with a total of 33 students. The purpose of this study was to measure the amount of student motivation and interest, as well as student learning outcomes over time, and this research using quantitative methods.

The application of the Problem-based Learning model, which is based on the principle of using problems as a starting point for acquiring and integrating new knowledge, is one of the efforts made by lecturers to overcome learning boredom and increase student activity in distance learning. Problem-solving is defined in Problem-based Learning as a process or effort to complete a task or circumstance that is truly real as a problem by applying existing rules. As a result, Problem-based Learning focuses more on real-life situations that students care about. Students are confronted with genuine problems as a context for learning, which is why Problem-based Learning is used—critical thinking skills.

Google Meet, Google Classroom, and WhatsApp Groups are some learning media utilized in distance learning. This study employs classroom action research, as depicted in the Figure 1, based on the Kemmis and McTaggart paradigm. The model of Kemmis and McTaggart is frequently used in various classroom action research methods.

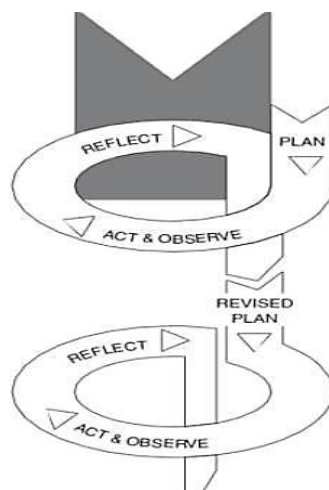


Figure 1. Kemmis and McTaggart's Classroom Action Research Model [14]

The steps of classroom action research in the spiral model of each cycle are depicted in the diagram:

- a. Planning (plan) change.
- b. Taking action and watching (observing) the process and outcomes of change.
- c. Reflecting on the process and results of change (mirror).

The procedure and the results Then move on to re-planning, action and observation, and reflection, among other things. Early action on the problem was taken before the first cycle [12]. The steps of action research are depicted in the diagram from Figure 1 [13].

According to the diagram above, this classroom action research was conducted in two learning cycles with three stages as show in Figure 2a and Figure 2b, namely:

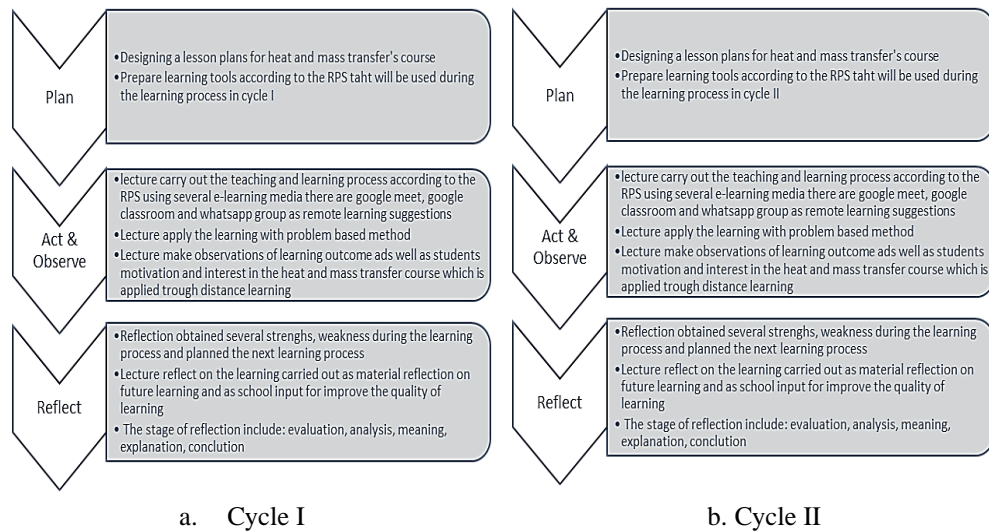


Figure 2. Classroom Action Research

The accomplishment of student learning outcomes was investigated in detail. The frequency distribution table descriptively describes learning outcomes data so students' achievement may be seen at a specific level. The cognitive, affective, and psychomotor learning outcomes in the Heat and Mass Transfer course were investigated in this study. Using observation sheets, a test examines student learning outcomes in cognitive, emotional, and psychomotor elements. The scale utilized in lectures at the State University of Surabaya's Mechanical Engineering Study Program was used to establish the category of student learning results in this study as show Table 1. The research is considered adequate if student learning results attain a learning completeness score of 70.

Table 1. Criteria for Learning Outcomes

Level of Mastery	Category
85-100	Very good
70-84	Good
56-69	Fair
45-55	Poor
0-44	Very bad

The motivation and interest of students in learning were also investigated. The questionnaire results given to students after the learning period concluded were used to compile the student response data. The study's findings were distributed in questionnaires on a scale of 1-5. Similarly, the affective and psychomotor aspects were obtained from the observation instrument's datasheet. The data is then

processed by looking at the results of the distributed questionnaires and the data. Data from an observation instrument sheet The procedure for finding intervals is as follows [15], and student responses are examined using the percentage formula as follows:

$$Interval = \frac{(maximum\ value - minimum\ value)}{many\ categories} \tag{1}$$

In addition, the score of learning outcomes and the value of each responder from the questionnaire data are transformed to percentage using the formula:

$$P = \frac{f}{N} \times 100\% \tag{2}$$

3. Result and Discussion

3.1 Research Result

Before beginning classroom action research, the researcher describes the learning scenario and the processes followed during the study. Google Classroom, a Learning Management System, is the learning media used in this Learning Management System (LMS) with extensive features such as discussions, uploading teaching materials, and using multiple choice quizzes and essays. Google Meet as a face-to-face medium during the learning process and WhatsApp groups as a medium for discussion or information sharing to ensure more effective communication.

Problem-Based Learning in this study is intended to improve critical thinking skills. Problem-based Learning presents students with problems from their daily lives, and students work in groups to find alternative solutions to the issues. Students' critical thinking skills were also observed individually and in small groups as they searched for answers and solutions to problems the teacher had answered. Students learn to think critically, analyze problems, and locate and use learning resources through problem-based Learning. In learning with the Problem-based learning approach, students must answer the issues presented by digging out as much information as possible and then to find solutions that have problems. This Classroom Action Research was carried out in two cycles to investigate using of a problem-based learning approach to improve students' motivation and learning outcomes. The results from the two cycles are depicted in the Figure 3 below.

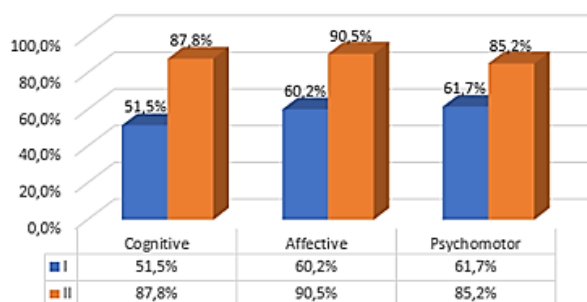


Figure 3. Learning Outcomes Based on Cycles I and II

According to the graph, in cycle II, the percentage of student learning outcomes that meet the minimum mastery requirements in the cognitive domain increased by 36.3 %, while aspects of affective and psychomotor assessment saw learning outcomes increase by 30.3 % 23.5 %, respectively. This study looked at the motivation and interest of students in learning. The findings revealed increased motivation for the learning outcomes depicted in this diagram. High learning motivation grew by 17.7 %, while medium and low learning motivation declined by 11.7 % and 6.9 %, respectively. Although student motivation remains moderate, this indicates a promising trend.

3.2 Discussion

3.2.1 Student Learning Outcomes Cycle 1

According to the strategy used by Kemmis and McTaggart, this study was conducted in two cycles. As demonstrated in the diagram from Figure 4, the research approach is constructed in such a way that it delivers student learning results.

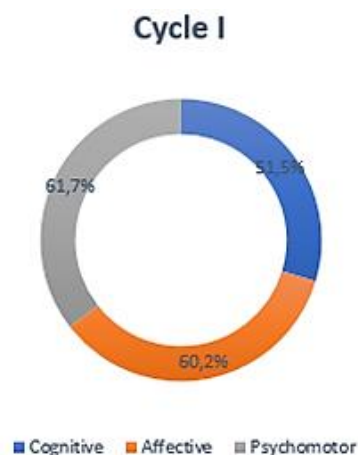


Figure 4. Percentage of learning outcomes cycle I

The percentage value of student learning outcomes is based on cognitive, affective, and psychomotor values. The cognitive value in the first cycle is 51.5 %, the affective value is 60.2 %, and the psychomotor value is 61.7 %. Changes in learning environments have a considerable impact on student accomplishment, according to the acquisition of student learning outcomes [16]. Several factors contribute to pupils' poor performance in the first cycle. This is attributable, first and foremost, to the implementation of modern online-based learning. Students still need clarification on utilizing online learning systems like Google Meet and Google Classroom. Students need help accessing the offered class code, and they need help understanding how to exchange files for presentations, just like they did in Google Meet. Students still need to figure out where to find the many tools of Google Classroom, how to change the language, or how to submit homework. As a result, students cannot fully participate in learning because they need a thorough understanding of the distance learning programs deployed. In this scenario, the teacher must comprehend and ask students what they don't understand to reduce the number of pupils who are still hesitant or embarrassed to ask questions.

Second, it is still unable to run optimally in the first cycle. This is because students must still follow a new learning strategy when implemented. Because students are still accustomed to past learning patterns in which they only receive information directly from the teacher, their learning tends to be passive, and they sit and listen to explanations from the teacher online; it takes a longer time to change their learning habits for a student like that. Student engagement still needs to be improved in terms of proposing interim solutions to the challenges that have been presented. Students are still hesitant to voice their ideas and opinions because they are bashful and frightened that their answers will be incorrect. To reduce this difficulty, the researcher will strive to emphasize that the first ideas students communicate will never be criticized in the next cycle. As a result, pupils should be more fearless in expressing their views or opinions. Another thing that needs to be done is re-socializing the practical learning approach so students can gradually adopt it.

Third, students need to be more engaged in voicing their viewpoints in group and class debates, relying instead on the perspectives of knowledgeable peers in their groups. Some students wait silently for the answers of their classmates in their group, regardless of whether or not the answers are accurate. Only a young %age of students participates in conversations, ask questions and receive responses. Even if they disagree, most students accept the viewpoints or outcomes of other group discussions. Furthermore, students only want to present the results of their group talks when the researcher asks them to. Students are still hesitant to voice their ideas and opinions because they are bashful and frightened that their answers will be incorrect. To address this issue, an alternative was devised: bonus points for students who asked and responded, both group and individual scores.

Fourth, some students still have learning outcomes that fall below the specified criteria, i.e., less than a score of 70. This is because some students must pay more attention to the learning process, resulting in better learning outcomes and student activities. In this case, student learning outcomes in the first cycle are still considered suboptimal, even though the %age of students meeting the requirements has reached half. Implementing the actions in rotation, I had many flaws; however, to improve the action process in the next cycle, this will be reflected and addressed in the next cycle [1].

3.2.2 Student Learning Outcomes Cycle II

The implementation of the second cycle of action is adjusted to the results of the first cycle's reflection by carrying out several corrective actions as described in the first cycle's reflection results. The average value of student learning outcomes is given [Figure 5](#).

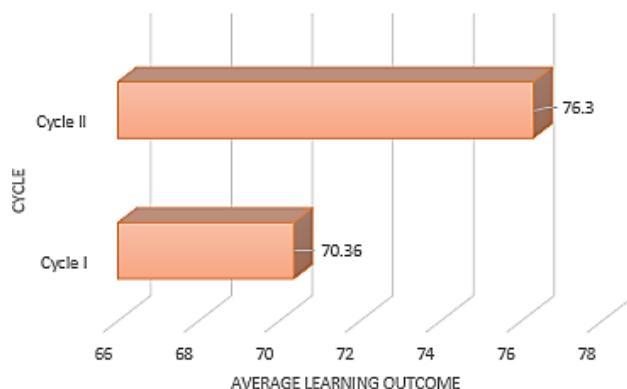


Figure 5. Average Learning Outcome Score

In the first cycle, the score of student learning outcomes that meet the requirements of the graduation standard with a minimum score of 70 is 17 students. In comparison, those who do not meet the criteria are 16 students, with an average grade of 70.36 and an increase in the second cycle of 76.3. In the second cycle, the percentage of students who meet minimum completeness is 87.8 %. In comparison, the percentage of students who do not meet the minimum totality is 12.2 %. The percentage increases to 90.5 % in the affective domain and 85.2 % in the psychomotor domain, as shown in the image below.

Several factors contributed to improving the quality of learning outcomes and student learning activities in cycle II. First, students stayed caught up in their learning because they had already mastered the features of the Google Meet and Google Classroom applications during the first cycle. Second, in general, the learning process in cycle II has been able to run according to the planned learning scenario, resulting in optimal achievement of the expected learning outcomes. Learning in cycle II appeared more conducive, as students could adapt to the lecturer's problem-based learning approach, indicating that students received this learning method well.

Third, students' participation in accomplishing tasks, debating in groups (applying a problem-based approach), and making observations increases with each cycle II meeting. This practice also revealed that students were enthusiastic about using the problem-based approach. Fourth, because the concept of distance learning is learning to be more independent, creative, and innovative, students' independence in distance learning is an equally important factor in this regard. The accuracy of the components used to achieve the learning objectives themselves indicates effective learning [17]. on the other hand, online and distance learning, necessitate the use of high-quality, easily accessible technology. Furthermore, students must be prepared to adapt to changes in learning that are mandated by schools and universities. Distance learning can now be accessed more freely and flexibly from home [18].

Based on the results of the 2-cycle assessment of the application of problem-based learning that has been carried out, this researcher is also in line with research conducted by Komariah et.al, (2019) said that “which states that problem-based learning can improve scientific knowledge, especially in the final stage of education” [19]. This is also in line with Pambudi and Nurbiyanto, (2019), who also stated that “applying problem-based learning models can improve students' learning outcomes” [20]. Wastono, (2016) also said that “using the Problem-Based Learning strategy can improve independence and learning outcomes of Mechanical Technology on the competence of using hand tools for grade X students majoring in Mechanical Engineering at SMK Negeri 2 Pengasih Kulon Progo” [21].

3.2.3 Student's Motivation

During this pandemic, student learning motivation significantly impacts student learning outcomes because learning motivation includes efforts to achieve learning objectives, such as

understanding the material and developing learning. The results of the learning motivation observation were obtained through indicators in the questionnaire given to students during the classroom action research cycle in cycles I and II. The data is then processed into a graph, as shown in the Figure 6.

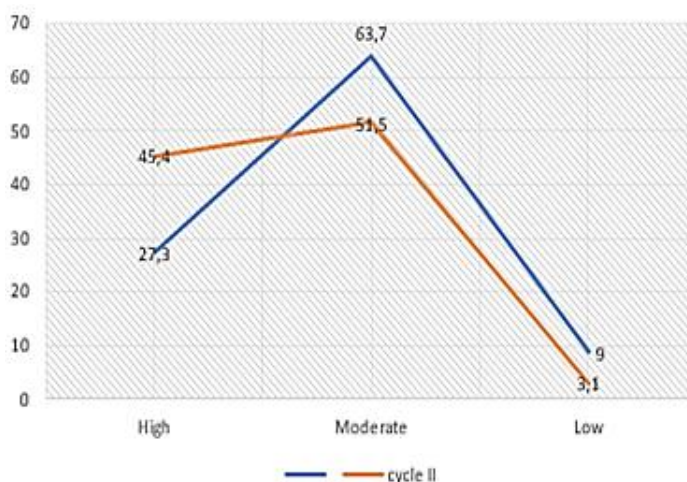


Figure 6. Ratio of the percentage of students learning motivation in cycle I and cycle II

In cycles I and II, student motivation was divided into three categories: high, medium, and low. In cycle 1, 27.3 % of students have a high learning cycle, 63.7 % have a medium learning cycle, and 9.9 % have a low learning motivation. Students' low motivation to learn is caused by various factors, including boredom with monotonous learning and a lack of socializing space. Learning that was initially enjoyable turned out to be tedious. As a result, steps must be taken to re-motivate students to learn. Online learning does not have to compel students to meet learning objectives like face-to-face learning does. However, they create a comfortable heart so that they can continue learning and facing the future amid the Covid-19 pandemic.

There are two types of student learning motivation: intrinsic and extrinsic motivation. Intrinsic motivation is a motivation that comes from within students, whereas motivational motivation is motivation that comes from outside of students. The role of the lecturer is one of the extrinsic motivations that have a significant influence here. Lectures must not only transfer knowledge to students but also be a learning motivator for students. Students, especially during a pandemic like this, need to be encouraged to learn away from their parents at home. With the shift from face-to-face learning activities to online learning activities, this has become a challenge for lecturers.

Several improvements were made or improved based on the results of the cycle I reflection. In this case, lectures must continue to invite students to maintain health, keep the spirit of carrying out social distancing, and motivate each other to keep the spirit of learning. For example, students are invited to send photos of their activities at home and their opinions on carrying out online learning and preventing Covid-19, encouraging each other and sharing in study groups. He aims to improve the family atmosphere, treat homesickness when not meeting, and promote the learning process to improve.

In the second cycle, it was explained that the percentages of high, medium, and low student motivation were 45 %, 52 %, and 3 %, respectively. This demonstrates increased motivation toward the learning outcomes depicted in this diagram. High learning motivation increased by 17.7 %, while medium and low learning motivation decreased by 11.7 % and 6.9 %, respectively. Although student motivation remains moderate, this indicates a positive trend.

Student motivation is related to their learning success [22]. External factors related to student learning motivation will only be optimal if balanced with internal factors, specifically those present in each student. Students must also instill in themselves a strong motivation that learning is not a burden but a foundation for achieving goals. Setting goals for success, compiling a daily study schedule, not being afraid to ask questions if they don't understand the subject matter, discussing with friends, or exchanging ideas with parents are some of the motivations that can be used that must be instilled in everyone. Based on the research and discussion findings, effective, efficient, and innovative online learning methods combined with problem-based learning methods can improve student learning

outcomes in mass and heat transfer courses. This result is empirically supported by research data demonstrating increased student learning outcomes.

The results obtained from this study are also in line with research conducted by Wiliyanti Then ,(2019) showing that “student interest in learning positively affects academic achievement and student learning motivation” [23]. The results showed that students with a high interest in learning had better academic achievement than those with a low interest in education. This result aligns with previous research conducted by Nurwahidah (2019), which showed that “interest in learning is essential in motivating students to learn” [24].

4. Conclusion

The application of distance learning using problem-based learning methods is effective in improving student learning outcomes and motivation. Based on this study percentage of student learning outcomes in cognitive, affective, and psychomotor have increased in the second cycle in a row, which is equal to 36.3%, 30.3%, and 23.5%. In comparison, motivation is one factor that also affects student achievement. In the first cycle, 27.3% of students have a high learning cycle, 63.7% have a medium learning cycle, and 9.9%. In the second cycle, students' learning motivation increased from high, medium, and low, respectively, by 45%, 52%, and 3%, although the process in the moderate category still dominated. These external and internal factors will significantly affect the progress of student motivation.

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