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Case Method in The Problem-Based Learning Model to Increase Student Participation in The Basic Physics Course

Hebat Shidow Falah[1*], Jufrida[1]

[1] Physics Education, Faculty of Teacher Training and Education, Universitas Jambi, Jambi, Indonesia

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Corresponding Author:
Hebat Shidow Falah
hebatshidowfalah@unja.ac.id

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Abstract: Today's lecture activities require more active learning. However, lecture activities in Basic Physics courses often always focus on the lecturer. This research analyzes the application of the case method in increasing student participation in the Basic Physics I course. This research is a 2 cycle of classroom action research applied to the Basic Physics I course in the 2023/2024 academic year. The research design uses a spiral model by Kemmis and McTaggart. The research results showed that there was an increase in student activity scores in cycle 1 and cycle 2, namely 38.86% (poor category) to 69.14 (fair category).

Keywords: Case method; Learning model; Student participation; Basic Physics.

Introduction

Learning the Basic Physics course in the Physics Education Study Program aims to provide students with the ability to apply the basic principles of mechanics and magnetic electricity to solve problems involving simple basic physics systems. This is stated in the 2021 Physics Education Study Program curriculum document which directs the development of intellectual abilities through providing knowledge that is eternal, universal, and absolute with essential values through methods that have been proven to be valid. The development of learning activities in Physics Education was carried out by referring to the Indonesian National Qualifications Framework and Indonesian National Higher Education Standards.

Based on the keywords workability in the Indonesian National Qualifications Framework, learning activities at the undergraduate qualification level, students must be able to apply, study, create designs, and utilize science and technology in solving procedural problems. This cognitive process domain in Bloom's revised taxonomy includes the levels of analyzing, evaluating, and creating (Krathwohl, 2002). The three highest levels in Bloom's taxonomy are usually also referred to as higher-order thinking Skills (HOTS) or high-level thinking abilities (Vahlepi et al., 2021).

In the aspect of learning activities, the performance indicators used as reference are collaborative and participatory classes. In this indicator, two learning strategies are recommended for implementation in higher education, namely the case method and the team-based project method. The use of these two methods can be adjusted to the needs and suitability of the courses to be implemented.

The suitability of the strategies requires harmony between learning indicators and learning objectives. The Basic Physics I course is a course that is by default intended for elementary class students, as an initial course and prerequisite for other courses in the Physics Education study program. As a prerequisite course, Basic Physics I is a course that students must master because it includes basic concepts that can explain phenomena that occur in everyday life.

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Based on an observational study conducted at Jambi University on students attending lectures in the 2022 academic year, learning activities in the Basic Physics I course that year tended to be non-participatory. Furthermore, students are not able to solve questions at a high level of thinking. This can be caused by a lack of student participation in teaching and learning interactions in class and can impact students understanding the concepts. If this problem is not resolved immediately, this could have a negative impact on students, study programs, and universities. Therefore, it is necessary to improve the learning quality through the implementation of learning strategy that can increase student activity in learning.

The learning strategies used previously was lecture learning accompanied by practice questions in the form of assignments and quizzes. This kind of learning turns out to be less able to attract student participation in learning activities because learning activities are teacher-centered. This method can also limit students' creativity in solving existing problems using only the example questions provided.

One learning model that can increase student participation and include learning with higher-level thinking skills according to Bloom is using a case-based learning model (Sangam et al., 2021; Zhang et al., 2023). The case method is a learning that stimulates students to think at a higher level in solving the cases given in learning. The case method is a participatory discussion-based learning method for solving problem cases (Fauzi et al., 2022). Several studies that have been conducted show that the case method with team discussion classes is effective in increasing student participation in learning activities (Mardiah, 2021).

Case-based learning is classified as inductive learning (Warimun & Murwaningsih, 2015; Giang et al., 2018). Through an inductive approach, the cultivation of a concept can last longer, because students do not immediately receive a concept raw, but instead, students construct these conceptions. The inductive approach is in line with constructivist learning theory, which emphasizes the construction of conceptions for each student. In this way, the cultivation of concepts will last longer, because students do not just observe learning, but go through a deep thinking process (Svinicki, 1999).

The case method can be held in various ways: discussion format, debate format, public hearing format, problem-based learning format, or team-learning format (Herreid, 2007). Research shows that learning strategies that use problem-based learning can increase the transfer of concepts to a problem, and integrate basic concepts in a clinical problem. In terms of its ability to attract attention, the problem-based learning model can increase students' interest in the subject matter. This model also offers other advantages, in that it can improve students' independent learning skills (Norman & Schmidt, 1992). Previous research has found that implementing the problem-based learning model can increase student participation in school, with various subjects and learning materials (Dian et al., 2017; Kamala et al., 2022). Furthermore, other research also shows that the use of problem-based learning models can improve scientific literacy (Yani et al., 2020) and critical thinking skills in students (Aufa et al., 2021; Jariah & Aminatun, 2022; Khairunnisa et al., 2022; Rahmadita et al., 2021; Yana et al., 2022). Norman states that there is no strong evidence that learning strategies using PBL produce general improvements. However, the use of a PBL learning format allows for a reduction in learning rates but can promote long-term knowledge retention rates.

This research plays a role in enriching scientific literature related to physics learning activities that occur in higher education environments, especially in basic physics courses. Furthermore, this research aims to add to the literature on the results of implementing the case method strategy by using the case method strategy and the PBL model in terms of student activities in learning.

The implementation of the case method learning model in the Basic Physics I course is expected to increase student participation in learning activities. Apart from that, the phenomenological nature of the course is more suited to the case method learning model. Many natural phenomena can be used as sources for cases that can be analyzed and evaluated by students. In this way, it can also indirectly improve the training of students to be able to think at a higher level.

Method

This research is Classroom Action Research which is applied to the Basic Physics I course in the 2023/2024 academic year. The subjects studied were students who took the Basic Physics I course in the Physics Education Study Program, at Jambi University. Classroom action research is carried out to deal with problems in the classroom through action (Arikunto, 2021). The research design used is a spiral model initiated by Kemmis and Mc Taggart (Kemmis et al., 2014). Learning activities are carried out repeatedly and continuously in 2 cycles. The stages to be implemented consist of three implementation stages, namely planning, action and observation, and reflection.

The classroom action research procedure begins with preparing planning, implementing actions, observing, and reflecting. The planning is prepared based on actions that will change student attitudes and behavior as a solution to problems that occur in increasing student learning creativity. A scheme of the

stages carried out in this research can be seen in Figure 1 (McNiff & Whitehead, 2002).

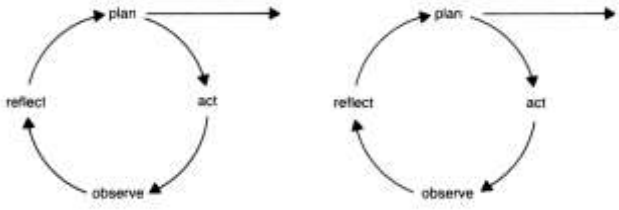

Figure 1. Classroom Action Research Cycle

Data was collected using the direct observation method. The aspect observed is student activity when learning activities take place. The observation sheet used is a Likert scale observation sheet with five levels.

Table 1. Student Activity Assessment

Indicator	Score
Students provide opinions or responses to problem solving,	
Students are tolerant and willing to accept and respect other people's opinions,	
Students pay attention to and respond to other people's opinions,	
Students are responsible for group work	
Students have motivation to do assignments,	
Students ask questions,	
Students carry out the assignments given.	

Result and Discussion

The learning strategy used in this research uses the case method with the Problem-based Learning model initiated by Barrows (Barrows, 1986, 1996). Learning activities are carried out using the Problem-Based Learning (PBL) model.

The data obtained from the results of this research are presented in the form of a table that describes student activities in responding to the case study. The use of the case-solving learning method (case method) is a form of learning that is bound to the provisions for estimating student study time which is then expressed in credit weights. Offline, online, and/or mixed learning forms are designed according to the characteristics of the course and written clearly to make it easier to identify appropriate materials and media. A very valuable key in designing semester learning plan is through the formulation of course learning outcomes that are in accordance with action verbs from Bloom's taxonomy, the preparation of learning indicators which ultimately influence the preparation of learning activities.

Participation skills can be divided into three aspects: action, interaction, and task completion (Hesse et al., 2015). Action refers to the general level of participation of an individual, regardless of his or her relationship to other group members. Interaction refers to behavior that shows interactions and responses to others. Interaction between problem solvers is the minimum requirement to achieve good coordination, both verbally and nonverbally (Clark, 1996; Rubleske & Howison, 2015).

Carrying out Focus Group Discussion (FGD) activities can be the initial capital for lecturers to develop dynamic lectures through the case method. There is an implementation where in both research cycles, the cases analyzed by students are taken from problems in everyday life and then analyzed accompanied by relevant and realistic explanations in line with the material and the Semester Learning Plan (RPS). The cases observed are cases that are varied and up-to-date with the material of motion kinematics, including differentiating the concepts of displacement and distance, motion with constant acceleration, and motion with constant velocity concepts in everyday phenomena, and implementing appropriate concepts in solving particle kinematics (Motion) problems. vertical upward motion, vertical downward motion, and free fall motion), as well as implementing appropriate concepts in solving motion kinematics problems (combining motion and circular motion). The advantage of the case study method is that students are better trained in analyzing a problem can increase active participation and can solve problems that occur and find solutions from various perspectives.

Classroom action research activities were carried out in two cycles. The results of the assessment of student activities in taking the Basic Physics Course are presented in Table 2 and Figure 2.

Table 2. Student Activity Score for Each Group

Group number	1st cycle	2nd cycle
1	14	20
2	15	22
3	13	25
4	13	26
5	13	28
Number of scores per cycle	68	121
Maximum total score	175	175
Mean (%)	38.86	69.14

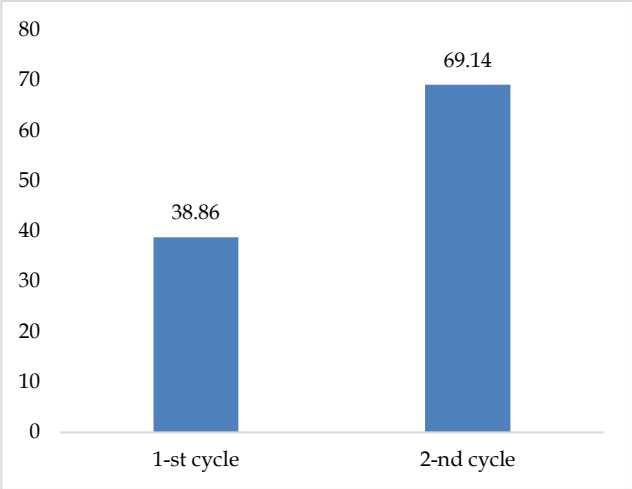

Figure 2. Student Activity Score Graph

From the diagram above, it is known that there has been an increase in student activity with the application of the case method in the Basic Physics I course. Students are better able to understand the material provided, with this understanding, students increasingly enjoy studying physics, especially in the Basic Physics I course. In the case method learning model, students are given a case related to the concept being studied. This case-based learning is in line with constructivist learning theory. In constructivist learning theory, learners construct knowledge as a result of cognitive processes (Gerace & Beatty, 2005). Furthermore, the main aim of learning physics is to help students build physics knowledge, develop problem-solving abilities, and introduce themselves to scientific culture (Yerushalmi et al., 2010). It is hoped that such physics learning can make students more active and make learning student-centered. By becoming more active, students will try to gain new knowledge based on existing knowledge through active mental experience (Redish, 2003). This follows the findings of (Ding et al., 2011), which found that students who often carry out problem-solving activities have better abilities in applying concepts to problems.

Conclusion

The implication of implementing the case method learning model in the Basic Physics I course in the physics education study program is that it can increase student activity which is marked by an increase in students' ability to provide opinions or responses to problem-solving, be tolerant and willing to accept and respect other people's opinions, pay attention and respond to other people's opinions, be responsible for group work, have motivation to do assignments, ask questions, do assigned tasks. Furthermore, by increasing student activity, it is hoped that it can improve the quality of learning which can be seen from student learning outcomes in class.

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Author Contributions
Conceptualization, H.S.F., and J.; methodology: J.; validation, H.S.F., and J.; formal analysis, H.S.F.; investigation, H.S.F.; resources, H.S.F.; data curation, J.; writing—original draft preparation, H.S.F., and J.; writing—review and editing, H.S.F.; supervision, J.; project administration, H.S.F.

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The authors of this article declare no conflict of interest.

References

Arikunto, S. (2021). *Penelitian Tindakan Kelas: Edisi Revisi*. Bumi Aksara.

Aufa, M. N., Rusmansyah, R., Hasbie, M., Jaidie, A., & Yunita, A. (2021). The Effect of Using e-module Model Problem Based Learning (PBL) Based on Wetland Environment on Critical Thinking Skills and Environmental Care Attitudes. *Jurnal Penelitian Pendidikan IPA*, *7*(3), 401–407. https://doi.org/10.29303/jppipa.v7i3.732

Barrows, H. S. (1986). A taxonomy of problem-based learning methods. *Medical Education*, *20*(6), 481–486. https://doi.org/10.1111/j.1365-2923.1986.tb01386.x

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning*, *1996*(68), 3–12. https://doi.org/10.1002/tl.37219966804

Clark, H. H. (1996). *Using Language*. Cambridge University Press; Cambridge Core. https://doi.org/10.1017/CBO9780511620539

Dian, E., Sunarmi, S., & Suhadi, S. (2017). Penerapan Model Pembelajaran Think Pair Share Dipadu Problem Based Learning untuk Meningkatkan Partisipasi dan Pemahaman Konsep Siswa. *Jurnal Pendidikan Biologi, 7*(2), 52-60. Retrieved from http://journal2.um.ac.id/index.php/jpb/article/view/719

Ding, L., Reay, N., Lee, A., & Bao, L. (2011). Exploring the role of conceptual scaffolding in solving synthesis problems. *Physical Review Special Topics -*

Physics Education Research, *7*(2), 20109–20109. https://doi.org/10.1103/PhysRevSTPER.7.020109

Warimun, E. S., & Murwaningsih, A. (2015). Model Pembelajaran Induktif untuk Meningkatkan Pemahaman Konsep dan Keterampilan Generik Fisika Siswa SMA. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *1*(1), 105-110. https://doi.org/10.21009/1.01115

Fauzi, A., Ermiana, I., Nur, A., Rosyidah, A. N. K., & Sobri, M. (2022). Implementasi Case Method (Pembelajaran Berbasis Pemecahan Kasus) Ditinjau Dari Kemampuan Kolaboratif Mahasiswa. *Jurnal Eduscience*, *9*(3), 809–817. https://doi.org/10.36987/jes.v9i3.3446

Gerace, W. J., & Beatty, I. D. (2005). Teaching vs. Learning: Changing Perspectives on Problem Solving in Physics Instruction. *arXiv preprint physics*, 1–10. Retrieved from https://arxiv.org/ftp/physics/papers/0508/0508131.pdf

Giang, T. T., Hong, N. T. T., Phuong, N. N., & Khanh, M. Q. (2018). Teaching Education Courses Based on Case Study Method in Pedagogical Universities in Vietnam. *American Journal of Educational Research*, *6*(6), 681–687. https://doi.org/10.12691/education-6-6-15

Herreid, C. F. (2007). *Start with a Story: The Case Study Method of Teaching College Science*. NSTA Press.

Hesse, F., Care, E., Buder, J., Sassenberg, K., & Griffin, P. (2015). A Framework for Teachable Collaborative Problem Solving Skills. In *Assessment and Teaching of 21st Century Skills: Methods and Approach*, 37–56. https://doi.org/10.1007/978-94-017-9395-7_2

Jariah, S. A., & Aminatun, T. (2022). Implementation of the Socio-scientific Issues Approach with the Investigative Group Learning Model to Improve Students' Critical Thinking Skills on Environmental Change Materials. *Jurnal Penelitian Pendidikan IPA*, *8*(3), 1042–1048. https://doi.org/10.29303/jppipa.v8i3.1197

Kamala, I., Idayanti, Z., & Ulfah, T. T. (2022). Increasing Student Participation in Science Learning Through Problem Based Learning Models. *Jurnal Penelitian Pendidikan IPA*, *8*(4), 2068–2076. https://doi.org/10.29303/jppipa.v8i4.1850

Kemmis, S., McTaggart, R., & Nixon, R. (2014). *The action research planner: Doing critical participatory action research*, 200. https://doi.org/10.1007/978-981-4560-67-2

Khairunnisa, K., Abdullah, A., Khairil, K., & Rahmatan, H. (2022). The Influence of Problem Based Learning Models combined with Flashcard Media on Creative Thinking Skills of Students: *Jurnal Penelitian Pendidikan IPA*, *8*(1), 247–251. https://doi.org/10.29303/jppipa.v8i1.1154

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2

Mardiah, M. (2021). Penerapan Pembelajaran Kooperatif Teknik Stad Melalui Papan Monopoli Untuk Meningkatkan Partisipasi Siswa Dan Hasil Belajar Fisika. *Educational Technology Journal*, *1*(1), 1–10. https://doi.org/10.26740/etj.v1n1.p1-10

McNiff, J., & Whitehead, J. (2002). *Action Research: Principles and Practice*. RoutledgeFalmer.

Norman, G. R., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. *Academic Medicine*, *67*(9). Retrieved from https://journals.lww.com/academicmedicine/fulltext/1992/09000/the_psychological_basis_of_problem_based_learning_.2.aspx

Rahmadita, N., Mubarok, H., & Prahani, B. K. (2021). Profile of Problem-based Learning (PBL) Model Assisted by PhET to Improve Critical Thinking Skills of High School Students in Dynamic Electrical Materials. *Jurnal Penelitian Pendidikan IPA*, *7*(4), 617–624. https://doi.org/10.29303/jppipa.v7i4.799

Redish, E. F. (2003). *International School of Physics "Enrico Fermi*. IOP Press.

Rubleske, J., & Howison, J. (2015). *Coordination theory Coordination Theory: A Ten-Year Retrospective.* In Human-computer interaction and management information systems: Foundations.

Sangam, M. R., K, P., G, V., Bokan, R. R., Deka, R., & Kaur, A. (2021). Efficacy of Case-Based Learning in Anatomy. *Cureus*, *13*(12), e20472. https://doi.org/10.7759/cureus.20472

Svinicki, M. D. (1999). *Teaching and learning on the edge of the millennium: Building on what we have learned*. Jossey-Bass

Vahlepi, S., Helty, & Tersta, F. W. (2021). Implementasi Model Pembelaaran berbasis Case Method dan Project Based Learning dalam rangka mengakomodir Higher Order Thinking Skill mahasiswa dalam Mata Kuliah Psikologi Pendidikan Bahasa Arab di Masa Pandemi. *Jurnal Pendidikan Tambusai*, *5*(3), 10153–10159. Retrieved from https://jptam.org/index.php/jptam/article/view/2593

Yana, S., Yusrizal, Y., Halim, A., Syukri, M., & Elisa, E. (2022). Application of Problem Based Learning (PBL) Model to Improve Problem Solving Skill from Critical Thinking Skill Students on Dynamic Fluid

Materials. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 521–527. https://doi.org/10.29303/jppipa.v8i2.1329

Yani, Y. P., Hardeli, H., Oktavia, B., & Kurniawati, D. (2020). The Development of an Integrated E-Module of Scientific Literacy and Video Demonstration Using a Problem-Based Learning Model for High School Students on Acids and Bases. *Jurnal Penelitian Pendidikan IPA*, *8*(2), 452–462. https://doi.org/10.29303/jppipa.v8i2.1306

Yerushalmi, E., Cohen, E., Heller, K., Heller, P., & Henderson, C. (2010). Instructors' reasons for choosing problem features in a calculus-based introductory physics course. *Physical Review Special Topics - Physics Education Research*, *6*(2). https://doi.org/10.1103/PhysRevSTPER.6.020108

Zhang, X., Zhang, B., & Zhang, F. (2023). Student-centered case-based teaching and online–offline case discussion in postgraduate courses of computer science. *International Journal of Educational Technology in Higher Education*, *20*(1), 6. https://doi.org/10.1186/s41239-022-00374-2