KONSTAN
JURNAL FISIKA DAN PENDIDIKAN FISIKA
Volume 7, Nomor 1, June 2022
E-ISSN : 2460-9129 dan P-ISSN : 2460-9110
http://jurnalkonstan.ac.id/index.php/jurnal

The Effect of Participatory Learning Models Using Critical Problem Solving Techniques on the Learning Achievements of Physics Students

Nevi Ernita [1*)]

[1)] *Physics Education Study Program, Mataram State Islamic University, Mataram*

* E-mail correspondence: nevi.ernita@uinmataram.ac.id

Article Info:

Sent:
25 July 2022
Review:
31 July 2022
Accepted:
31 July 2022

Keywords:
critical problem solving, learning achievement, Participative teaching and learning metodh.

Abstract

The choice of teaching strategies made by teachers is one of the elements that influences how well students learn. The teacher-centered method, causing less meaningful learning for students. Learning is still largely theoretical and infrequently relates what student are taught to their everyday live. The purpose of this study is to evaluate how well students learn physics utilizing a participatory learning model and critical problem-solving skills. The study used an experimental design (control group pre-test post-test design) involving class VIII SMPN 3 Batukliang, with the research sample being class VIII A students as the experimental class and class VIII B students as the control class. A straightforward random sample method was used for sampling. Learning outcomes determined by testing are used to determine student achievement. A descriptive and statistical analysis of student achievement in two classrooms (experimental and control) was conducted. Average scores for each treatment group are used in the descriptive analysis, whereas variance is questioned in the statistical analysis using the t-test. The effect of the participatory learning model using critical problem solving techniques (experimental group) was measured by the difference in student achievement when compared to the control group after analysis using a t-test. The t-test findings show that, at the 95 percent confidence level, the t-count value (4.249) is higher than the t-table (1.675). Based on these results, it can be concluded that the participatory learning model using critical problem-solving techniques has a significant impact on increasing students' learning achievement in physics.

INTRODUCTION

Quantitatively, it can be said that education in Indonesia has progressed. This indicator of success can be seen in the progress of community literacy achieved as a result of the education equity program. However, success in terms of qualitative education in Indonesia has not succeeded in building intelligent and creative national character, let alone superior ones [1]. From this, it can be concluded that the quality of education in Indonesia is still relatively low. The low quality of this education, especially in formal education at schools, will have an impact on the low learning achievement of students [2]. This can be seen directly from the less than optimal quality of learning. The efficiency of the learning process that takes place in schools can be determined by the high and low quality of learning. The technique or learning model that the teacher chose is inappropriate, which is one of the contributing variables [3]. The learning methods used are more teacher-centered,

with teachers who control almost all learning activities, thus causing less meaningful learning for students [4]. Especially the more academically inclined instructors in the subjects of mathematics and the scientific sciences. The connection between topics taught in class and real experiences or students' everyday lives is almost never made; instead, it is occasionally only through dictation, which then needs students to memorize formulas and finish written test questions [5].

Examples of actual experiences or actions that may be seen first-hand are swinging or using a pulley to draw water. These can be used as illustrations of the kinds of tasks that students frequently complete when they apply MIPA learning concepts, particularly when studying physics. Learning physics as a component of math and science need to be able to help students perform better, specifically by maximizing the accomplishment of learning goals through the selection of efficient learning models, methods, or approaches [6]. Models and teaching strategies are essential components of the learning process. The models and techniques employed must be in line with the intended learning outcomes. The method that is often used by some teachers is the lecture method, as it is considered the most powerful method to achieve learning objectives. Since the lecture technique has always been utilized as a mode of spoken communication between teachers and students, it can actually be stated to be a traditional method or to be classified as expository [7]. In its application, the learning process is more teacher-centered, students only listen, write and memorize the material being taught and work on individual questions in their respective places. Even though this is not in accordance with the expected objectives of learning physics. So that various efforts are needed to make changes in order to improve the process or teaching and learning activities, especially changes in the way of delivering material or teaching teachers [8].

Developing teaching skills can help teachers change the way they conduct lessons so that ineffective old behaviors can be quickly identified and gradually eradicated. In order to improve student learning and their ability to think critically, it is important for teachers to adjust their teaching practices, which are expected to have an impact on how students learn [9]. Based on observations and conversations with physics teachers at SMP Negeri 3 Batukliang in the Central Lombok region, the researchers discovered that a significant number of student continue to struggle with the ideas being taught in physics. Physics is perceived by students as being a challenging topic, particularly if it simply uses the lecture technique. Students will therefore have trouble understanding these concepts if instruction consists solely of informative activities without being followed by brainstorming activities. Low student accomplishment is a direct result of students becoming passive and lacking the comprehension and intellectual capacity to apply physics topics in daily life [10].

Additionally, the findings of teacher interviews at SMP Negeri 3 Batukliang revealed that the mid-semester physics exam's average score ranged from 52.45 to 60.59, or a mean of 57.45. This number is relatively low because it is still far below the Minimum Completeness Criteria (KKM) set by the school. As a result, this issue requires urgent attention, and efforts must be made to help students study more actively, critically, participate more in the learning process, and interact with one another. In this situation, it is crucial for the teacher to select the best learning model and approach so that the students can comprehend the physics lessons being taught and improve their low academic achievement [11].

Applying a learner-centered learning approach, such as interactive learning, is one way to combat student boredom during the learning process [12]. Learning activities are carried out in groups when students are actively involved in the planning, carrying out, and assessing of their learning. This type of learning paradigm is known as "participatory learning." The participatory learning model is a method of teaching in which the teacher makes an effort to assume the role of a child's learning partner and guardian while also serving as a resource, mentor, or friend [13]. In the current study, critical problem-solving strategies that potentially boost student accomplishment are combined with participatory learning. Participatory learning can be used to train critical thinking in problem solving, according to previous studies [14]. Participatory learning is the same as collaborative learning, and it promotes students' critical thinking and problem-solving abilities when it is taught through problem-based learning strategies [15].

more information on how the participatory learning model and its use in educational activities work together. This approach is appropriate for use in advanced learning that is related to the ideas of material taught to students earlier, learning based on experiences of students' daily lives, and learning with a goal of assisting in the resolution of issues encountered in daily life [16]. Further research must be done in light of the difficulties students have learning physics and the significance of enhancing their academic performance. The current study intends to investigate how students' achievement in learning physics is impacted by a participatory learning approach that employs critical problem-solving strategies.

METHOD

This study is an experimental study with a control group pre-test and post-test design [17]. The research design is presented in Table 1. The experimental class was given treatment (X) in the form of participatory learning using critical problem-solving techniques, while the control class used conventional/traditional methods (lectures). Observations of student achievement were carried out in both classes as pretest (O1) and posttest (O2).

Table 1. Research Design

Class	*Pre-test*	Treatment	*Post-test*
Experiment	O_1	X	O_2
Control	O_1	C	O_2

The research population consisted of all three eighth-grade classrooms at SMP Negeri 3 Batukliang. Two of these three classes were chosen as samples. Using a straightforward random sampling technique, the class to be sampled is determined by selecting samples from the population at random without taking into account the population's stratification. Class VIII A served as the experimental class for the study (n = 31), while class VIII B served as the control class (n = 30).

The instrument used in this study was a multiple-choice test developed by the researcher. After participating in the teaching and learning process using a participatory learning paradigm and critical problem-solving strategies, this test is used to assess students' cognitive achievement. The used learning achievement test had 25 questions, and each right response received a score of 1, while each incorrect response received a score of 0. The test instrument's validity and reliability were empirically validated in classes outside of the scope of this study prior to implementation. The test tool can therefore be used as a data collection tool in this study because it satisfies the valid and reliable criteria.

Furthermore, pre-test and post-test student learning outcomes examinations were used to gather information on student achievement in the cognitive area. Before giving the subject matter with basic aviation material, the pre-test (control and experiment class) was conducted, and the post-test (control and experiment class) was conducted after giving the subject matter with the same material. The pre-test and post-test were administered using the same format and quantity of questions.

The impact of participatory learning models utilizing critical problem-solving approaches on student accomplishment is evaluated using descriptive and statistical analysis of student achievement data. Each class of learning treatment underwent a descriptive study with average learning achievement scores. The t-polled variance test is utilized for statistical analysis, and the study question is if there is a relationship between student learning achievement and participatory learning models of crucial issue solving strategies (t-count > t-table at 95% confidence level). If the test data are normally distributed, the t-polled variance test can be applied. Therefore, the normality analysis of the data was performed as a precursor to the t-polled variance test.

RESULTS AND DISCUSSION

Table 2 displays the findings of a descriptive analysis conducted on student accomplishment data before and after treatment (pre-test and post-test), respectively, for the experimental class and control class.

Table 2. The results of measuring student achievement in each class (experimental and control)

Assesment Acievement	Class	N	Score Max	Score Min	Average
Pre-test	Experiment	31	60	20	35,48
	Control	30	56	16	36,53
Post-test	Experiment	31	96	40	71,10
	Control	30	80	32	60,27

Table 2 show that the highest score for the pre-test was 60 (in the experimental class), while the lowest score was 16 (in the control class). However, when averaged, the experimental class outperforms the control class in terms of student achievement (pre-test). The experimental class received a post-test score of 96, whereas the lowest score was 32. (in the control class). Averaged out, the experimental class outperformed the control class in terms of student success (post-test). Figure 1 displays a visual representation of student performance as shown in Table 2.

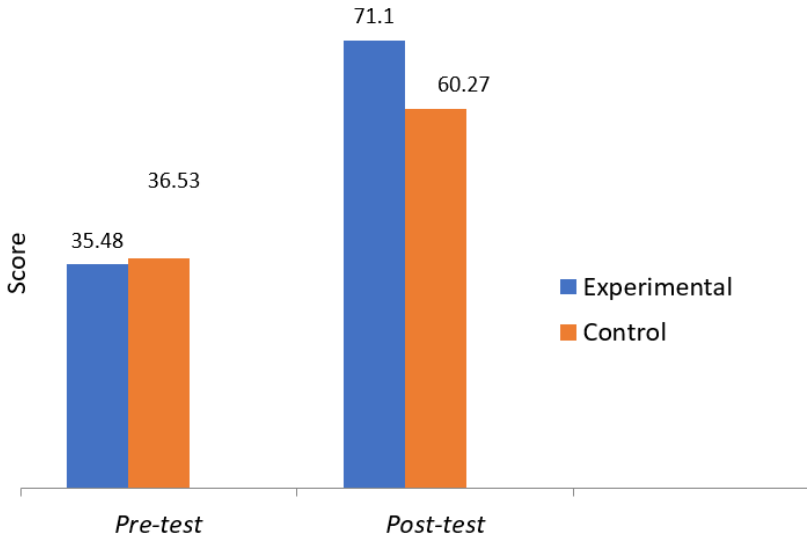

Figure 1. The results of measuring learning achievement in the experimental and control classes

Figure 1 shows a tendency to increase in achievement test scores. This was found in both classes (experimental and control), but from the achievement of the average score on the post-test, the two groups are different. In the experimental class, the average score on the learning achievement test was 71.10, while in the control group it was lower at 60.27. These results clearly indicate that the participatory learning model using critical problem solving techniques is better at improving student achievement than conventional teaching (teacher-centered). The effect of the applied learning model was then tested statistically (t-polled variance test), which was preceded by a normality test. The results of the normality test are presented in Table 3.

Table 3. The result of the normality test in both classes (experimental and control)

Class	X^2_{count}	X^2_{table}	Conclusion
Experimental	3,4127	11,070	$\chi^2_{hitung} < \chi^2_{tabel}$ Data is normally distributed
Control	9,2158	11,070	$\chi^2_{hitung} < \chi^2_{tabel}$ Data is normally distributed

In the two classes tested for normality, the results showed that both were normally distributed (at the 95% confidence level). These results serve as a reference for statistical testing using the t-polled variance test, the results are as shown in Table 4.

Table 4. The result of t-test

Test Variable	$t\text{-}_{count}$	$t\text{-}_{table}$	Conclusion
Post-test (Experimental vs control)	4,249	1,675	$t\text{-}_{count} > t\text{-}_{table}$ Ha accepted, H_0 rejected

Based on the results in Table 4, it can be seen that t-count > t-table, (at the 95% confidence level). This means that the null hypothesis (H_0) is rejected and the alternative hypothesis (Ha) is accepted. This indicates that there is an effect of a participatory learning model using critical problem-solving techniques on the achievment of physics student. The significant increase in scores obtained by students in the experimental class was due to the use of participatory learning techniques to stimulate children to be actively involved in learning activities. In this case, the teacher plays a role in involving students in learning activities, namely throughout the planning, execution, and assessment phases. Aspects of student involvement, motivation, and learning outcomes are 3 processes that are interrelated with one another [18]. This indicates that in order to get higher learning results, motivation and student involvement in the learning process are both necessary. Student involvement in recognizing learning needs, issues, and challenges that frequently arise in the learning process are further types of student participation in the learning planning process. This is made clear by earlier research that indicated that student participation in the learning process affects students' academic progress [19].

Other ways to get students involved in the planning stage of the learning process include allowing students the opportunity to lead discussions or groups and inviting other students to join groups before the discussion activity, which is then followed by the program implementation stage. Learning Exercises Students' motivation to learn will increase as a result, and learning outcomes may also be enhanced [20]. The implementation step of the learning activity program comes next, including student involvement. This entails students actively taking part in fostering a positive learning environment and fostering an open environment between students and teachers in order to forge strong bonds based on mutual respect, assistance, and learning. Previous research has shown that using participatory learning approaches can help students learn more effectively. In addition to teaching students how to answer evaluation questions, it also teaches them how to communicate (verbal skills), ask questions during conversations, give feedback, and solve problems. All of these tasks are carried out during the implementation stage of the learning process [21].

Finally, the active participation of students in the assessment phase of the learning program, among others, in the implementation of learning, including an assessment of the process, results and impact of learning. Included in the assessment of strengths and weaknesses during the learning activities [22]. As an indicator of success in this stage, in its application, students will feel

comfortable to carry out learning activities, feel their learning needs have been met in accordance with the teaching materials provided. [23].

The accomplishment of learning objectives is considerably aided by these three types of engagement. The learning method in this study is able to improve student accomplishment by being more adaptable and by boosting students' emotional enthusiasm [24]. Participatory learning is one of the best learning techniques to encourage students to learn better and increase their awareness of themselves, in this case about planning, implementing, and assessing the process. what they have to do in class. Previous studies have found that it is not only related to improving student achievement [25].

CONCLUSION

The results showed that students' learning achievement in physics was significantly impacted by the participatory learning model using critical problem-solving strategies. The interactive learning model utilizing critical problem solving approaches can be applied to the study of basic planes as well as other subjects, and even other subjects, according to the research's conclusions. The use of different learning models in the classroom is strongly encouraged in an effort to increase the quality of instruction, and the participatory learning model utilizing critical problem-solving techniques is one such alternative model that is ideal for developing a learning environment that is centered on the needs of the students. And as additional material, the participatory learning model using this critical problem-solving technique can be implemented by integrating it with other learning approaches.

REFRENCES

[1] D. Salirawati, "Identifikasi Problematika Evaluasi Pendidikan Karakter di Sekolah," *J. Sains dan Edukasi Sains*, Vol. 4, No. 1, Art. no. 1, Apr. 2021, doi: 10.24246/juses.v4i1p17-27.

[2] Y. R. Dewi, "Analisis Sosial Mutu Pendidikan Mempengaruhi Prestasi Siswa Smu Melalui Learning Organization," *WACANA J. Ilm. Ilmu Komun.*, Vol. 12, No. 3, Art. no. 3, 2013, doi: 10.32509/wacana.v12i3.125.

[3] M. Ulfa and S. Saifuddin, "Terampil Memilih dan Menggunakan Metode Pembelajaran," *Suhuf*, vol. 30, no. 1, Art. no. 1, Apr. 2018.

[4] S. Sulthon, "Pembelajaran IPA yang Efektif dan Menyenangkan bagi Siswa MI," *Elem. Islam. Teach. J.*, vol. 4, no. 1, Art. no. 1, Jan. 2017, doi: 10.21043/elementary.v4i1.1969.

[5] M. Bakri, "Pemberdayaan Guru Melalui Perencanaan Dan Proses Pembelajaran Partisipatif Guna Mewujudkan Kualitas Pendidikan Yang Bermutu," *Pros. KNPI Konf. Nas. Pendidik. Islam*, p. 23, 2020.

[6] N. N. S. P. Verawati, L. S. Handriani, and B. K. Prahani, "The Experimental Experience of Motion Kinematics in Biology Class Using PhET Virtual Simulation and Its Impact on Learning Outcomes," *Int. J. Essent. Competencies Educ.*, vol. 1, no. 1, Art. no. 1, Jun. 2022, doi: 10.36312/ijece.v1i1.729.

[7] N. N. S. P. Verawati, N. Ernita, and S. Prayogi, "Enhancing the Reasoning Performance of STEM Students in Modern Physics Courses Using Virtual Simulation in the LMS Platform," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 17, no. 13, doi: 10.3991/ijet.v17i13.31459.

[8] M. Ahmad, "Efektivitas Penerapan Pembelajaran Berdasarkan Masalah Untuk Membelajarkan Kemampuan Berpikir Kritis Matematika Siswa Smp," *J. Educ. Dev. STKIP Tapanuli Selatan*, vol. 6, no. 04, p. 7, 2017.

[9] H. Fitriani, T. Samsuri, F. Rachmadiarti, and C. D. Mantlana, "Development of Evaluative-Process Learning Tools Integrated with Conceptual- Problem-Based Learning Models: Study of Its Validity and Effectiveness to Train Critical Thinking," vol. 1, no. 1, p. 11, 2022.

[10] F. A. Yanti, A. Desstya, and R. Perdana, "Analysis of Physics Learning Outcomes in Terms of Student Learning Habits," *Lensa J. Kependidikan Fis.*, vol. 9, no. 1, pp. 19–31, May 2021, doi: 10.33394/j-lkf.v9i1.3727.

[11] M. Marušić and J. Sliško, "Influence of Three Different Methods of Teaching Physics on the Gain in Students' Development of Reasoning," *Int. J. Sci. Educ.*, vol. 34, no. 2, pp. 301–326, Jan. 2012, doi: 10.1080/09500693.2011.582522.

[12] T. B. K. Tsien and M. Tsui, "A Participative Learning and Teaching Model: The Partnership of Students and Teachers in Practice Teaching," *Soc. Work Educ.*, vol. 26, no. 4, pp. 348–358, Jun. 2007, doi: 10.1080/02615470601081654.

[13] D. Aguilera and F. J. Perales-Palacios, "Learning biology and geology through a participative teaching approach: the effect on student attitudes towards science and academic performance," *J. Biol. Educ.*, vol. 54, no. 3, pp. 245–261, May 2020, doi: 10.1080/00219266.2019.1569084.

[14] J. Kimoga, N. Justine, A. M. Omar, A. Betty, and K. Faith, "Critical thinking through participatory learning: analysing the nature of freedom of expression in Makerere University lecture theatres," *Adv. Soc. Sci. Res. J.*, vol. 4, no. 5, Art. no. 5, Mar. 2017, doi: 10.14738/assrj.45.2718.

[15] G. C. Karantzas *et al.*, "Enhancing critical analysis and problem-solving skills in undergraduate psychology: An evaluation of a collaborative learning and problem-based learning approach," *Aust. J. Psychol.*, vol. 65, no. 1, pp. 38–45, Mar. 2013, doi: 10.1111/ajpy.12009.

[16] N. M. Budiani, "Penerapan Model Pembelajaran Partisipatif dengan Metode Study Kasus Untuk Meningkatkan Prestasi Belajar IPA Siswa Kelas VIII B Semester I SMP Negeri 1 Tampaksiring Tahun Pelajaran 2018/2019," vol. XXII, no. 27, 2020.

[17] J. R. Fraenkel, N. E. Wallen, and H. H. Hyun, *How to design and evaluate research in education*, 8th ed. New York: McGraw-Hill Humanities/Social Sciences/Languages, 2012.

[18] T.-L. Hsieh and P. Yu, "Exploring achievement motivation, student engagement, and learning outcomes for STEM college students in Taiwan through the lenses of gender differences and multiple pathways," *Res. Sci. Technol. Educ.*, pp. 1–16, Jan. 2022, doi: 10.1080/02635143.2021.1983796.

[19] Y. Tao, Y. Meng, Z. Gao, and X. Yang, "Perceived teacher support, student engagement, and academic achievement: a meta-analysis," *Educ. Psychol.*, vol. 42, no. 4, pp. 401–420, Apr. 2022, doi: 10.1080/01443410.2022.2033168.

[20] A. Ramdhayani and H. H. Pardi, "The differences in the effectiveness of the participatory model and the discovery learning model on the results of mathematics learning in madrsah," vol. 06, no. 01, p. 14, 2021.

[21] M. Alisalman, "Pembelajaran Partisipatif Sebagai Metode dalam Meningkatkan Hasil Belajar Mahasiswa," *DIKLUS J. PendidikanLuar Sekol.*, vol. 6, no. 1, p. 12, 2022, doi: 10.21831/diklus.v6i1.48572.

[22] S. Sumarni, M. Nasir, and B. Herlina, "Strategi Pembelajaran Partisipatif pada Proses Penyelenggaraan Program Paket C di Kabupaten Wajo," *J. Educ. Teach. JET*, vol. 1, no. 1, pp. 9–18, Oct. 2020, doi: 10.51454/jet.v1i1.10.

[23] M. Arbarini, S. Jutmini, and S. Joyoatmojo, "Effect of Participatory Learning Model on Functional Literacy Education," *JNE J. Nonform. Educ.*, vol. 4, no. 1, p. 12, 2018, doi: 10.24914/pnf.v4i1.13570.

[24] S. Thornton-Taylor, "The Case for Participatory Education," *Clevel. State Univ.*, p. 85, 2009.

[25] A. Philominraj, M. Bertilla, and R. Ranjan, "Participatory learning: An appealing classroom method to Foster English Language Teaching," *Rev. Espac.*, vol. 41, no. 06, p. 10, 2020.