International Journal of Advanced Educational Research
www.educationjournal.org
ISSN: 2455-6157
Received: 08-04-2022, Accepted: 24-04-2022, Published: 09-05-2022
Volume 7, Issue 1, 2022, Page No. 51-55

The effectiveness of the project based learning on student learning outcomes on impulse and momentum materials in SMA Negeri 1 Kaudiatan

Elsyanti[1], Cosmas Poluakan[2], Patricia M Silangen[2]
[1] Mahasiswa Jurusan Fisika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Manado, Indonesia
[2] Dosen Jurusan Fisika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Manado, Indonesia

Abstract
This study aims to determine the effectiveness of the *project based learning* on learning outcomes. Students of SMA Negeri 1 Kauditan class XI on Impulse and Momentum material. The method used is a *quasi-experimental* with a research design using a *nonequivalent control group design.* The research sample amounted to 40 people using 2 treatments, namely, the treatment for the experimental class and the treatment for the control class. Data collection used a test with a test instrument in the form of a multiple choice objective test of 20 questions and science process skills and project performance assessment. The results of this study were tested using the t-test. Calculation results through the *SPSS* with a significance level of 0.05 through *the independent samples t-Test t test*. Calculation result of $t$count = 6,757 and $ttab$le = 1,725 which is obtained. The average results of the assessment of science process skills in both classes are in very good criteria (80%-100%) while the assessment of project performance skills is in very good criteria. Because $t$count = 6,757 > $ttabl$e = 1,725 then h1 is accepted and h0 is rejected with h1 = $\bar{x} > \mu 0$. Thus, it can be concluded that the average score of the experimental class physics learning outcomes treated using the *project based learning* is higher than the control class students' average physics learning outcomes without using the *project based learning model.*

Keywords: effectiveness, student learning outcomes, project based learning, impulse and momentum

Introduction

Physics is a lesson that provides knowledge about the universe to practice thinking and reasoning, through a person's reasoning ability which is continuously trained so that it grows, then that person will increase the power of knowledge (Supardi, 2012). In relation to learning physics, it is known that physics studies physical objects that are abstract and concrete. Physics, which is descriptive and predictive, makes it difficult for students to understand it. The descriptive part of physics involves understanding the concepts used in solving the predictive aspects of physics problems (Poluakan, et al., 2019) [5]. On this basis, Physics is absolutely mandatory to be taught to every student. This phenomenon is a serious problem and needs full attention from all parties, both the government, schools, communities/parents and the students themselves. According to Ningsih, et al. (2012:45) The low physics learning outcomes of students are caused by many things, including: a dense curriculum, material in textbooks that are felt to be too difficult to follow, less effective learning media, inadequate laboratories, inappropriate use of the selected learning media. by the teacher, less than optimal and the lack of harmony of the students themselves, or the conventional nature, where students are not much involved in the learning process and class activities are mostly dominated by teachers. Adegoke and Ajadi (2016) stated that the low student achievement in physics occurs due to the use of teaching methods that are less precise and less effective. Of the various factors that cause the low learning outcomes of Physics, the author is more inclined and tends that the main factor that causes the low quality of Physics learning is because Teachers still use expository learning strategies with lecture, discussion, and question and answer methods in learning, even though currently guidelines have been applied. Implementation of the national standards described in Permendiknas No. 41 of 2007 concerning process standards. This fact is supported by research Wiyanto, et al. (2007) that the activities usually carried out by teachers in learning are lecturing or explaining, asking questions, giving assignments or orders. While student activities are listening, taking notes, answering questions, asking questions, and doing assignments. Based on the explanation, a solution is needed to solve the problems encountered in the learning process, especially the problem regarding the low student learning outcomes. To overcome the low student learning outcomes, in the learning process teachers must apply innovative learning models. One of the innovative learning models that can be used in the learning process is the project-based learning model (MPBP) (Kamaraj, 2021). In the project-based learning model students go through six stages of learning, namely: (1) start with the essential question, (2) design a plan for the project, (3) create a schedule, (4) monitor the students and the progress of the project. , (5) assess the outcome, (6) evaluate the experiences (The George Lucas Educational

Foundation, 2005). Project-based learning model is a learning model centered on student activity (student center learning), teachers learn from and with students (Trianto, 2014). During project creation, students can practice and develop their science process skills, such as observing, using tools and materials, interpreting, planning projects, applying concepts, asking questions and communicating well (Filippatuo, 2010). And this learning model can also be applied to the Impulse and Momentum material because the impulse and momentum material asks concepts related to real or everyday life so that it will be easier to develop their scientific process skills and creative thinking skills in improving learning outcomes (Ramadhani & Santosa , 2013). From this thought, this research was conducted with the aim of knowing the effectiveness of the project-based learning on impulse and momentum material.

Method

This research was conducted in SMA Negeri 1 Kauditan class XI science. In this study, the population is class XI science students for the academic year 2021/2022. Sampling used purposive sampling technique and involved two classes, namely students of class science 1 as the experimental class which amounted to 20 people and students of class science 2 as control class totaling 20 people. This study uses two variables, namely the independent variable (the independent variable) is a project based learning and the dependent variable (the dependent variable) is the student learning outcomes specifically for impulse and momentum material. This study uses a quasi-experimental or quasi-experimental method with a research design that is nonequivalent control group design. Experimental class is a class that is given treatment with a project based learning, while the control class is a class without using a project based learning model. In this study the instruments used were in the form of tests (pretest and posttest) in the form of multiple choice and science process skills as well as project performance assessment. The data analysis technique used t-test analysis as a measure of the effectiveness of the project based learning on impulse and momentum material as well as to see the students' physics process used the process observation sheet.

Results and Discussion of Research

Results

Overall this research activity was carried out in three stages. The first stage is to give a pretest to determine the initial abilities, the second stage is to provide treatment using a project based learning model. After being given treatment, the final step is to give a posttest to determine the effectiveness of using the project based learning on impulse and momentum material. The results of the study obtained statistical analysis of the results of pretest, posttest, and students as follows.

Tables 1: Recapitulation of Pretest and Posttest Values for the control class and the experimental class

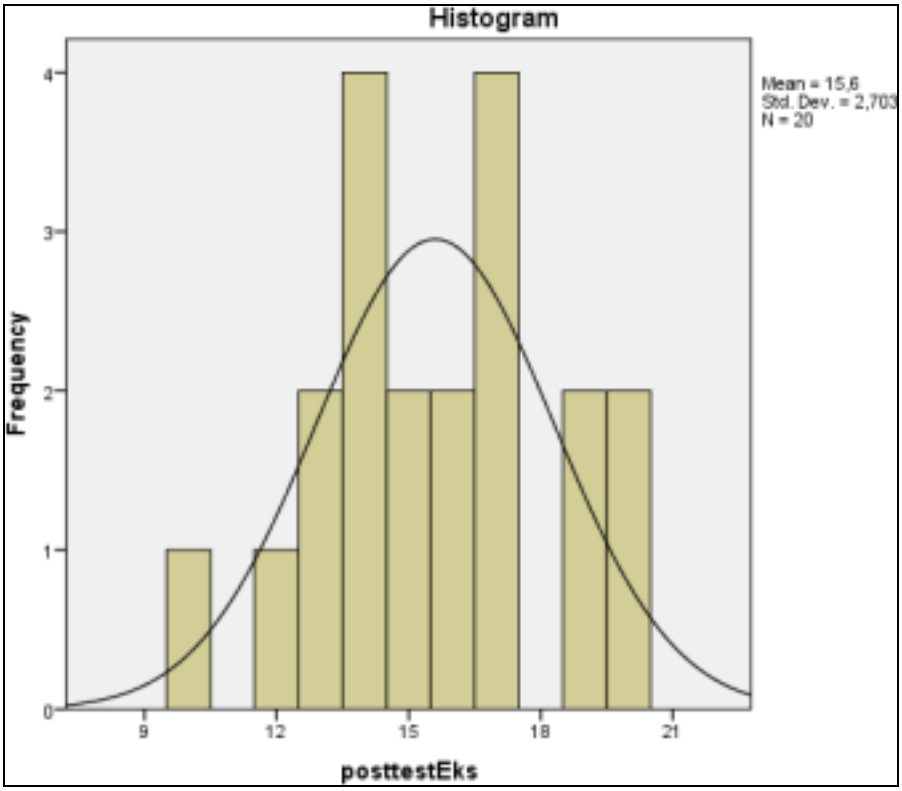
Data Centering and Data Dissemination	Eksperimental class		Control class	
	Pretest	Posttest	Pretest	Posttets
Minimum	1	5	1	6
Maximum	6	20	7	14
Average	3.48	15.10	4.65	9.80
Standard deviation	1.278	3.597	1.785	2.726

Based on table 1 above, it can be seen that the average value of the pretest of the control class is greater than the average value of the pretest of the experimental class. The mean value of the pretestof the control class was 4.65, while the average value of the pretest of the experimental class was 3.48. The average posttest of the experimental class is greater than that of the experimental class. The average value of posttest the control classThe average posttest value for the experimental class is 15.10, while the average post the control class is 9.80. These results indicate that the values obtained by the experimental class and control class have increased after being given treatment. The results of the increase in the experimental class were higher than the results of the increase that occurred in the control class.

In Figure1 above, the average posttest value for the experimental class is 15.20 and the standard deviation is 3.597. Meanwhile, the average posttest value for the control class was 9.80 and the standard deviation was 2.726.

Table 2: Results of assessment of experimental class science process skills

No	Indicator	Percentage Assesment
1	Identifying Variables	88%
2	Formulate Hypotheses	84%
3	Conduct Expreiments	85%
4	Interpret Data	84%
5	Analyzing	86%
6	Summing Up	89%
7	Communicating	93%



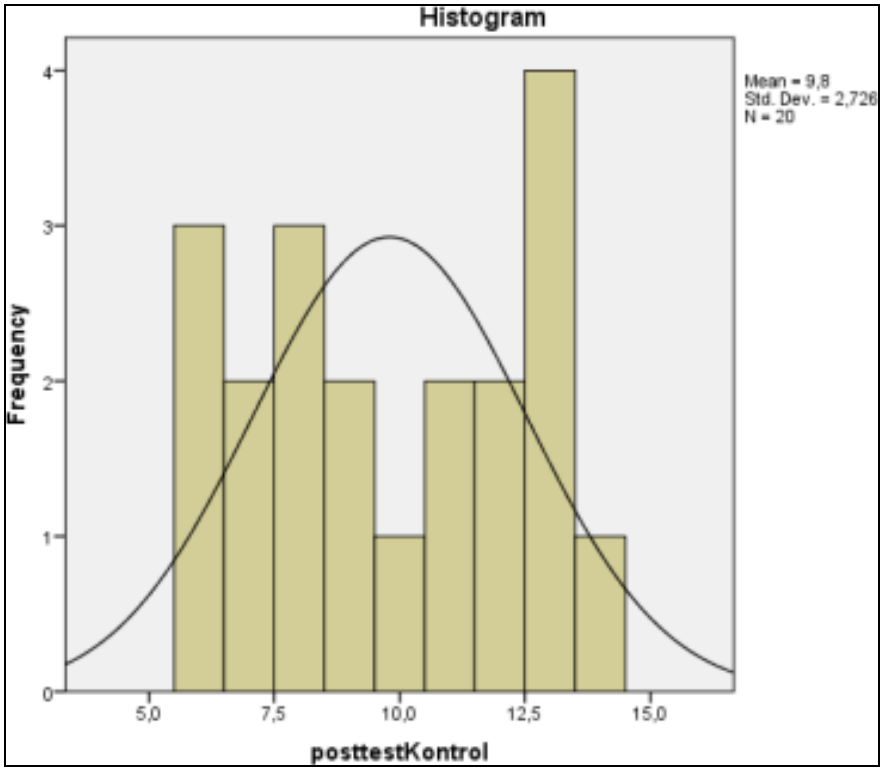


Fig 1

Table 3: Results of assessment of Control class science process skills

No	Indicator	Percentage Assesment
1	Observing	86%
2	Using tools and materials	86%
3	Interpreting data	86%
4	Planning project	84%
5	Applying concepts	83%
6	Asking question	84%
7	Communicating	85%

Table 4: Experimental Class Project Performance Assessment

No	Indicator	Percentage Assessment
1	Identifying Variables	81%
2	Formulate Hypotheses	80%
3	Conduct Experiments	85%
4	Interpret Data	80%
5	Analyzing	83%
6	Summing Up	80%
7	Communicating	80%

From the three tables above, the assessment of science process skills shows the percentage gain for the experimental class and the control class is included in the very good criteria 80% -100% and the project performance assessment in the experimental class shows the percentage gain which includes the very good criteria 80% -100%.

Discussion

Based on the results of research conducted at SMA Negeri 1 Kauditan, different results were obtained in the two classes after being given different treatment, class XI science 1 as an experimental class, which in the learning process uses a project based learning and a control class, namely XI science 2, whose learning process uses 5M learning based on the 2013 curriculum. Based on the results of the pretest conducted by two classes, namely experimental and control, the two classes have not too big differences. This difference can be seen from the average value of each class, namely the experimental class of 15.10 and the control class of 9.80. The difference from the average of the two classes is 5.3. The difference in average is not too large because the distribution of student learning outcomes from the two classes is almost the same and there is no treatment given to the two classes. After posttest was conducted, both the experimental class and the control class both experienced an increase. However, the experimental class experienced a more significant increase compared to the control class. This statement is in accordance with what was conveyed by Dian Hardianti, Muhammad Ali, and Syamsu. His research proves that student learning outcomes using project-based learning are better than students using direct learning. In the process of collecting data through worksheets, seven indicators are used, namely identifying variables, formulating hypotheses, conducting experiments, and interpreting data, analyzing, concluding and communicating. From the seven indicators, the average results of the student assessment process are obtained from the worksheet of the two classes, which are included in the very good category (80% - 100%).

In the experimental class learning process that was treated with project based learning , the results of the project performance assessment were 86% observing, using tools and materials 86%, interpreting 84%, planning projects 83%, applying concepts 84%, asking questions 86%, and communicated as much as 85%, so that in this case it was included in the very good category (80% - 100 %) . This is supported by the results of the hypothesis test of the pretest and posttest of the experimental class and control class, with a value of $t$table which is greater than $t$count, which is $t$count= 6,757 > $ttab$le = 1,725, which means $H0$ rejected and $H1$ accepted. This is in line with research conducted by Musriatul Fikriyah, Indrawati, and Agus Abdul Gani, whose research proves that there is a significant difference in learning outcomes of knowledge competence between the experimental class and the control class. These results are also supported by research conducted by Ni Wayan Rati, Nyoman Kusmaryanti, Nyoman Rediani, that there are differences in creativity and student learning outcomes between students who follow the project-based learning model and follow the conventional learning model. This is in line with the project based learning model, where students are involved in problem solving activities and solving other meaningful tasks, by involving project work. Project work itself contains complex tasks based on very challenging questions and problems and leads students to design, solve problems, make decisions, conduct investigations and provide opportunities for students to work independently. Learning using the project-based learning involves students in an applicative manner who puts forward creativity and very bright ideas in making projects, but at certain times students tend not to have ideas in making projects. Although it has several weaknesses, the use of project based learning in the learning process has been able to improve learning outcomes and get good responses from students, meaning that overall the use learning project based learning has a positive influence on student learning outcomes.

Conclusion

Based on the data obtained and the analysis that has been done rejected and $H1$ accepted. So it can be concluded that learning using project based learning is more effective because the average physics learning outcomes of the experimental class learning are higher than the average physics learning outcomes of control class students who were treated without using the project based learning model. Based on the student response questionnaire to learning physics after using the project-based learning model.

Acknowledgment

The author would like to thank the lecturers of the Department of Physics at the Faculty of Mathematics and Natural Sciences Manado State University Prof. Dr. Cosmas Poluakan, M.Si, and Dr. Patricia M. Silangen, S.Pd,

M.Si for constructive criticism and advice of my journal. Thanks are conveyed to the research subjects, namely students of class XI natural sciences for their participant and cooperation.

References

1. Adegoke BA, Ajadi FY. Structural modeling of teacher characteristic, skills in teaching, and students' achievement in secondary school physics. Journal of Studies in Education,2016:6(2):81-94
2. Filippatuo D. The Effectiveness Of Project Based Learning On Pupils With Learning Difficulties Regarding Academic Performance, Group Work And Motivation. International Journal of Special Education,2010:25(1):17-26.
3. Kamaraj DP. Efficacy: Project-Based Blended Learning in Acquiring Microteaching Skills among B.Ed Student-Teacher. International Journal of Advance Research, Ideas and Innovations in Technology,2021:7(3):447-450.
4. Ningsih SM, Dkk. Implementasi Model Pembelajaran Process Oriented Guided Inquiry Learning (POGIL) untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. Unnes Physics Education Journal (UPEJ). ISSN 1907-7157,2012:1(2):45.
5. Poluakan Cosmas. Implementation of the revised bloom taxonomy in assessment of physics learning. In: Journal of physics: conference Series, 2009.
6. Sugiyono PD. Metode Penelitian Kuantitatif Kualitatif, R & D. Bandung: Alfabeta Bandung, 2013.
7. Supardi US, Leonard Suhendri H, Rismurdiyanti. Pengaruh Media Pembelajaran Dan Minat Belajar Terhadap Hasil Belajar Fisika. Jurnal Formatif,2012:2(1):71-81.
8. Trianto. Mendesain Model Pembelajaran Inovatif, Progresif dan Kontekstual. Jakarta: Prenadamedia Group, 2014.
9. Ramadhani F, Santosa SN. Upaya Peningkatan Kualitas Pembelajaran Akuntansi Melalui Penerapan Model Pembelajaran Berbasis Proyek (Project Based Learning). Jurnal Pendidikan Universitas Negeri Sebelas Maret,2013:1(1):1-12.
10. The George Lucas Educational Foundation. Instructional Module Project Based Learning, 2005.
11. Wiyanto A Sopyan, Nugroho, Wibowo SWA. Potret Pembelajaran Sains di SMP dan SMA urnal Pendidikan dan Pengajaran Undiksha, 2007, 2. ISSN 0215- 8250. 386-394