

PROJECT-BASED LEARNING AND STUDENT LEARNING OUTCOMES IN ELEMENTARY SCHOOLS

¹Nela Rofisian, ²Isna Rahmawati, ³Putri Zudhah Ferryka, ⁴Sri Suwartini

¹²³⁴Universitas Widya Dharma Klaten,

nelarofisian491@gmail.com isnarahma@gmail.com zudhah.putri@yahoo.com

ssuwartini66@gmail.co.id

ABSTRACT

This study aims to determine the improvement of learning outcomes of 4th grade students of SD 2 Prambanan through project-based learning model. The type of research used is classroom action research with the Kemmis & Mc Taggart model, each cycle consists of four stages, namely planning, action implementation, observation and reflection. The research subjects were 20 students. Data collection techniques used learning observations, learning outcomes tests, and documentation. the results of data analysis showed that in cycle 1, students' learning outcomes reached a percentage of completeness of 65% with an average score of 74.75, because it did not meet the criteria for classical completeness, the next step was to continue to cycle two which reached a percentage of completeness of 80% with an average score of 80.75.

Keyword: Project Based Learning, Learning Outcomes, elementary school

INTRODUCTION

Education has a fairly broad meaning, depending on the point of view from which we evaluate education (des Kardinal & Dalbeck, 2022; Miranda et al., 2021). On the other hand, education means an effort to educate the nation. Apart from that, education also has the aim of improving the quality of society in Indonesia. Noted in Law no. 20 Article 3 (2003) regarding education which is defined as increasing and developing the skills possessed by students (Irawati & Susetyo, 2017; Khunaifi & Matlani, 2019). The improvement that occurs can be in the form of increasing knowledge, honing the skills one has, being equipped with noble attitudes and morals, being able to think critically, and so on (Anggraini & Wulandari, 2020).

Curriculum exchanges that occur in Indonesia emphasize that students can interpret learning better (Amalia & Asyari, 2023; Hadiansyah et al., 2019). When delivering material, an educator needs to choose which model is appropriate to the class or student situation so that students feel interested in following the lesson (Brahmana, 2022; Hanna et al., 2022). Therefore, it is necessary to use a model that can place students as subjects (actors) of learning and educators only act as facilitators in the learning process (Nagel et al., 2023; Ping et al., 2021). Learning that can facilitate students to work

both individually and in groups includes project-based learning in the process standards stated to encourage students' ability to produce contextual work, both individually and in groups. Efforts that teachers can make are implementing an innovative learning model (Nurhadiyati et al., 2020).

Learning models are very necessary to achieve learning goals (Hosseini-Mohand et al., 2021; Purushotham et al., 2018). A learning model is a planned form of guiding learning activities over a long period of time, forming learning plans or designing learning materials (Sutiani et al., 2021; Tsai et al., 2018). Innovative learning models are needed to create fun and exciting learning for students to be very active and increase their general knowledge. Educators only act as facilitators and mediators of learning so that it is conducive (Maisyarah & Lena, 2023).

Learning outcomes are several events that are obtained and result in students' overall learning abilities which occur due to changes in behavior after following the learning process in accordance with educational objectives (Lin et al., 2017; Supena et al., 2021). Learning outcomes are a benchmark for the success of the teaching and learning process (Hermanto & Sudiyono, 2021; Hurley, 2018). The teacher can find out whether the student has achieved the specified competencies (König et al., 2020; Siri et al., 2020). With learning outcomes, educators can find out how far students can grasp, understand and own the material in certain subjects (Chiu et al., 2023; Vermunt et al., 2023). According to Benjamin S. Bloom, learning outcomes include 3 indicators consisting of cognitive, affective and psychomotor domains. The cognitive domain is a change in behavior that occurs in the thinking process (L., 2019). The affective domain relates to values associated with attitudes and behavior. The psychomotor domain focuses on physical abilities and muscle work (Sa'adah & Pertiwi, 2022).

Based on initial observations in class 4 of SD 2 Prambanan, researchers found that the learning outcomes of class 4 students were relatively low in science learning. There are still some students who get low learning outcomes. These students tend to be less active in learning, do not concentrate when the teacher explains and are reluctant to ask the teacher if there is material they do not understand. Some students also seemed busy with their own activities so they did not focus on learning. This condition results in low student learning outcomes. Of the 20 students in one class who have taken daily

tests, only 48% of students got a score of more than 75. This shows the gap in learning outcomes between students who get high scores and low scores.

This is because the learning implemented by teachers in the classroom is still less innovative. The learning applied in the classroom is more dominant in teacher-centered learning. Students get more explanations from teachers and work on questions in textbooks and worksheets. Teachers use the lecture method more because according to the teacher the material in science subjects contains more theory that must be conveyed to students. This situation makes students passive due to the lack of social interaction in learning. Students listen more than interacting with other students to discuss the material being studied. Many students experience boredom and become unfocused in learning. To overcome this problem, it is necessary to apply a learning model that can increase student activity in learning which makes students more enthusiastic and can improve their learning outcomes.

One of them is the innovative learning model Project Based Learning (PjBL). In the Project Based Learning (PjBL) learning model, students can find the skills to plan, negotiate, organize and reach consensus on the issues of the tasks to be carried out, then communicate scientifically through the application of project-based learning (Armeth Daud Al Kahar & Anjani Putri, 2023; Wulandari et al., 2021). The project-based learning model consists of constructivist learning principles that can promote values that need to be built into soft skills, such as creativity, innovation, teamwork in problem solving, and communication skills in presentations (Fazriani et al., 2024; Pratama et al., 2024). The learning process with projects is innovative, creative and fun learning which is an alternative learning for the 21st century (Amri & Muhajir, 2022). Based on this description, the researcher will conduct research with the title " Project-Based Learning And Student Learning Outcomes In Elementary Schools".

LITERATURE REVIEW

The project-based learning model is a model that can foster student creativity and activeness. Project based learning is a learning model that provides educators with the opportunity to manage learning in the classroom by involving project work (Guo et al., 2020; Lim et al., 2023; Maros et al., 2023; Wang, 2022). Project work contains complex

tasks based on problems (problems) as the first step in collecting and integrating new knowledge based on experience in real activities and guides students to carry out design activities, solve problems, make decisions, carry out investigative activities, and provide opportunities students to work independently or in groups (Darmuki et al., 2023; Huang et al., 2023; Marnewick, 2023). The final result of the project work is a product which includes, among other things, a written or oral report, presentation or recommendation (Sutrisna et al., 2020).

The Project Based Learning learning model is a learning model that uses the help of project media. By using the project learning model, students are directly involved so they are active and think creatively (Ummah et al., 2019; Zhang & Ma, 2023). Project-based learning prepares students for action and encourages them to think creatively by guiding them directly toward future challenges. By using a project learning model, completing assignments will increase student independence in group and individual work and will be strengthened (Rico Ardiansyah et al., 2023).

By implementing the PjBL model, students will be more active in learning, creative and brave in providing input or opinions and can collaborate with their friends to solve problems related to the material being studied so that they can create a project or work product that the students make themselves. The Project Based Learning learning model is a learning model that involves students in problem solving activities and allows students to learn from doing to applying the ideas they have. This model is very suitable for improving student learning outcomes, especially creativity, active interest in learning and providing a pleasant classroom atmosphere so that students are more enthusiastic about learning (Israwaty, 2023).

The steps in the Project Based Learning learning model are: 1) Determining the project: In this step, students determine the theme/topic of the project based on the project assignment given by the teacher (Markula & Aksela, 2022; Uyen et al., 2023). Students are given the opportunity to choose or determine projects to be carried out in groups or independently. For short-term projects (one meeting) determining the project can be started by asking several questions to encourage students to think about what project to create. 2) Designing the steps for project completion: In this step, students design the steps for project completion activities from start to finish along with their

management, selecting activities that can support project tasks, planning/preparing the tools and materials that will be used. 3) Preparing a project implementation schedule: In this step, students schedule all the activities they have designed along with the time period needed to complete the project stage by stage (Agnes Tri Ekatni et al., 2023; Yamin et al., 2023). This step is continued by consulting the activity schedule that has been made with the teacher. For short-term projects (completed in one lesson/meeting), the time period for the project completion stages does not need to be determined for each completion step, only determine the timeline and deadline. 4) Completion of the project with teacher facilitation and monitoring: In this step, students apply the project design that has been created to produce a product or complete a project. Students report the progress of their projects to the teacher. 5) Preparation of reports and presentations/project publications: In this step, the results of the projects that have been created, whether in the form of written products, works of art, or technological works are presented and/or published to friends and teachers. Students receive an assessment from the teacher. 6) Evaluation of project processes and results: In this step, teachers and students at the end of learning reflect on the activities and results of project tasks (Joydiana, 2023).

The use of the PjBL learning model trains the growth of creativity, independence and responsibility, critical thinking, and self-confidence in students . The project based learning model has several advantages over the PjBL learning model, namely, PjBL can increase student learning motivation (Prajoko et al., 2023; Yusikah & Turdjai, 2021). The PjBL learning model has a positive effect on student learning motivation; PjBL improves students' ability to learn cooperatively and collaboratively; PjBL can increase student creativity; PjBL can improve students' academic abilities (Uyen et al., 2023). The PjBL learning model can improve student learning outcomes; PjBL improves students' communication skills. Because students are required to work with other people; PjBL can improve problem solving abilities, management abilities and the ability to coordinate learning resources; PjBL also creates a fun learning environment (Sa'adah & Pertiwi, 2022). Behind several advantages, the PjBL learning model also has disadvantages. The PjBL learning model increases the workload and takes time for both teachers and students. In addition, the interaction process allows for unfriendliness between group members which can cause negative experiences for all students. Working in groups

continuously allows the loss of confidence in independent learning due to lack of individual experience (Mia Roosmalisa Dewi, 2022).

Learning outcomes are the results obtained by students after the learning process occurs which are shown by the test scores given by the teacher after each lesson material is given on one subject. Student learning outcomes are influenced by student abilities and the quality of teaching. The quality of teaching in question is the professionalism possessed by the teacher. This means basic abilities both in the cognitive (intellectual), attitudinal (affective) and behavioral (psychomotor) fields (Gore et al., 2017; Noben et al., 2022).

Factors that can influence learning outcomes are: a) factors that come from within the student and b) factors that come from outside the student. Factors that originate from within students are in the form of psychological aspects, namely: 1) students' intelligence level, 2) students' attitudes, 3) students' creativity, 4) students' interests, and 5) students' motivation. Factors that come from outside students are aspects of the social environment and non-social environment, such as aspects of classmates, while aspects of the social environment and non-social environment, such as aspects of classmates, while aspects of the non-social environment are home, school, learning equipment and weather (Wicaksono & Iswan, 2019).

METODOLOGY

This research is Classroom Action Research. The research design used is the Kemmis & Taggart model which consists of four stages, namely planning, implementing actions, observing and reflecting. The stages of the classroom action research carried out are presented in Figure 1 (Yusita et al., 2021).

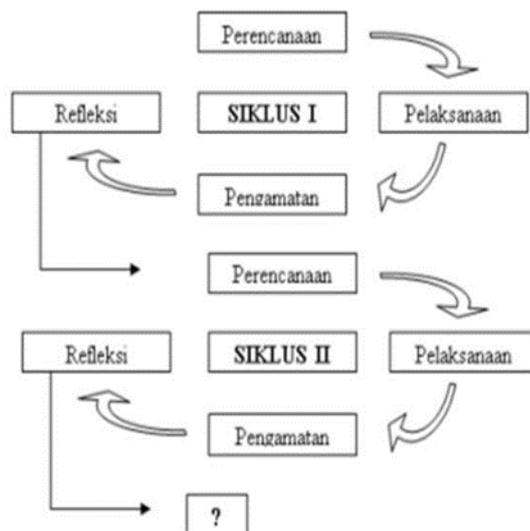


Figure 1: Stages of Classroom Action Research

As can be seen in the figure, each cycle consists of planning, implementation, observation and reflection stages. The aim of this model is that if deficiencies are found at the beginning of the implementation of the action, improvements can be made in the next action or cycle until the desired target is achieved.

Data collection techniques use learning observation sheets, measuring learning test results, and documentation. The observation sheet is used to determine the implementation of teacher learning activities using the Project Based Learning (PjBL) model. The measurement of learning test results is in the form of evaluation questions. Documentation is used to collect and analyze data, including written documents, images and electronic forms. The data analysis technique in this research uses descriptive analysis with percentages. The success indicator in this research is determined by achieving the learning objective achievement criteria (KKTP) which is set at 75 in the science and science subject. This research is considered successful if it meets the criteria for success of the action, namely 80% of students experience an increase in learning outcomes according to the KKTP.

RESULT AND DISCUSSION

Implementation of actions in cycle I will be carried out on Monday, January 15 2024 with a time allocation of 2 x 35 minutes. In cycle I, the following data was obtained on the learning outcomes of class 4 students:

Table 1. Complete Learning Results for Class 4 Cycle I Students

Total Students	The number of students		Average value
	Complete	Not Completed	
20	13	7	74,75

Calculation of the value of Cycle I student learning outcomes in the material Indonesiaku Kaya Budaya shows that of a total of 20 students, 13 students were declared complete with a completion percentage of 65%, and 7 students did not complete with a percentage of 35%. The average student score can be seen from the total score of all students, namely 74.75. Based on the data above, it can be concluded that student learning outcomes have not reached the predetermined criteria for success in action, so the researcher took action in the next cycle, namely cycle II, so that learning outcomes reached the predetermined criteria for success in action, namely 80% of students got a score ≥ 75 .

Implementation of actions in cycle II will be carried out on Monday, January 22 2024 with a time allocation of 2 x 35 minutes. In cycle I, the following data was obtained on the learning outcomes of class 4 students:

Table 2. Complete Learning Results for Class 4 Cycle II Students

Total Students	The number of students		Average value
	Complete	Not Completed	
20	16	4	80,75

Calculation of the value of Cycle II student learning outcomes in the material Indonesiaku Kaya Budaya shows that of a total of 20 students, 16 students were declared complete with a completion percentage of 80%, and 4 students did not complete with a percentage of 20%. The average student score can be seen from the total score of all students, namely 80.75. Based on the data above, it can be concluded that student learning outcomes have reached the predetermined success criteria for action, so the research was stopped in cycle II.

CONCLUSION

Based on the results of classroom action research (PTK) which has been carried out for two cycles using the Project Based Learning learning model on the material Indonesiaku Kaya Budaya which was carried out in class 4 of SD 2 Prambanan, the following conclusions can be drawn: The Project Based Learning learning model can improve the learning outcomes of grade 4 students at SD 2 Prambanan. The improvement in the learning outcomes of grade 4 students at SD 2 Prambanan on the material Indonesiaku Kaya Budaya which was carried out using Project Based Learning is shown by the value of student learning outcomes in cycle I and cycle II. In cycle I, the average student score was 74.75 to 80.75 in cycle II and student learning outcomes increased from cycle I by 65% of the number of students completed and in cycle II by 80% the number of students completed. The action was stopped in cycle II because the student learning outcomes had met the criteria for the success of the action determined in this research, namely 80% of grade 4 students had received a score of ≥ 75 .

REFERENCE

- Agnes Tri Ekatni, Fransiskus Janu Hamu, & Agnes Angie Dian Winei. (2023). Penerapan Model Pembelajaran Project Based Learning Pada Mata Pelajaran PAK Di SMA Kota Palangka Raya. *Sepakat: Jurnal Pastoral Kateketik*, 9(2). <https://doi.org/10.58374/sepakat.v9i2.199>
- Amalia, F., & Asyari, L. (2023). Analisis Perubahan Kurikulum di Indonesia & Pengembangan Pendekatan Understanding By Design. *CaXra: Jurnal Pendidikan*

- Sekolah Dasar*, 3(1). <https://doi.org/10.31980/caxra.v3i1.2590>
- Amri, A., & Muhajir, H. (2022). KETERAMPILAN BERPIKIR KREATIF PESERTA DIDIK MELALUI MODEL PROJECT BASED LEARNING (PjBL) SECARA DARING. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, 6(1). <https://doi.org/10.32502/dikbio.v6i1.4380>
- Anggraini, P. D., & Wulandari, S. S. (2020). Analisis Penggunaan Model Pembelajaran Project Based Learning Dalam Peningkatan Keaktifan Siswa. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, 9(2). <https://doi.org/10.26740/jpap.v9n2.p292-299>
- Armeth Daud Al Kahar, A., & Anjani Putri, R. (2023). Project Base Learning dalam Implementasi Kurikulum Merdeka di PAUD. *Murhum : Jurnal Pendidikan Anak Usia Dini*, 4(2). <https://doi.org/10.37985/murhum.v4i2.165>
- Brahmana, A. A. A. (2022). The Implementation of Quizizz in Vocabulary Learning Activities : EFL Students ' Perception and Motivation. *RETAIN (Research on English Language Teaching in Indonesia)*, 10(01).
- Chiu, T. K. F., Xia, Q., Zhou, X., Chai, C. S., & Cheng, M. (2023). Systematic literature review on opportunities, challenges, and future research recommendations of artificial intelligence in education. In *Computers and Education: Artificial Intelligence* (Vol. 4). <https://doi.org/10.1016/j.caeai.2022.100118>
- Darmuki, A., Nugrahani, F., Fathurohman, I., Kanzunudin, M., & Hidayati, N. A. (2023). The Impact of Inquiry Collaboration Project Based Learning Model of Indonesian Language Course Achievement. *International Journal of Instruction*, 16(2). <https://doi.org/10.29333/iji.2023.16215a>
- des Kardinal, A. B., & Dalbeck, M. (2022). Patient education. *Padiatrische Praxis*, 98(2). https://doi.org/10.5005/jp/books/12533_10
- Fazriani, H. N., Choirunni'mah, V. A., Wulandari, K., Fikri, M. A., Fakhriyah, F., & Fajrie, N. (2024). PENGARUH MEDIA PEMBELAJARAN BERBASIS APLIKASI JARJUKU TERHADAP HASIL BELAJAR MATEMATIKA DI SDN 02 SINGOCANDI. *Walada: Journal of Primary Education*, 3(3). <https://doi.org/10.61798/WJPE.V3I3.168>
- Gore, J., Lloyd, A., Smith, M., Bowe, J., Ellis, H., & Lubans, D. (2017). Effects of professional development on the quality of teaching: Results from a randomised

- controlled trial of Quality Teaching Rounds. *Teaching and Teacher Education*, 68. <https://doi.org/10.1016/j.tate.2017.08.007>
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, 102. <https://doi.org/10.1016/j.ijer.2020.101586>
- Hadiansyah, R. R., Pradana, R. Y., & Mustiningsih. (2019). Dinamika Perubahan Kurikulum di Indonesia. *Seminar Nasional - Jurusan Administrasi Pendidikan Fakultas Ilmu Pendidikan Universitas Negeri Malang*, 3.
- Hanna, I. D., Listyowati, R., & Rabi'ah, R. (2022). Developing Speaking Instructional Materials through Contextual Teaching and Learning. *English Education : English Journal for Teaching and Learning*, 10(01). <https://doi.org/10.24952/ee.v10i01.5655>
- Hermanto, W., & Sudiyono. (2021). The Effect of Learning Activity, Teacher Teaching Skills and Achievement Motivation on the Learning Outcomes of Social Studies Lessons. *Proceedings of the 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020)*, 542. <https://doi.org/10.2991/assehr.k.210413.090>
- Hossein-Mohand, H., Trujillo-Torres, J. M., Gómez-García, M., Hossein-Mohand, H., & Campos-Soto, A. (2021). Analysis of the use and integration of the flipped learning model, project-based learning, and gamification methodologies by secondary school mathematics teachers. *Sustainability (Switzerland)*, 13(5). <https://doi.org/10.3390/su13052606>
- Huang, W., Li, X., & Shang, J. (2023). Gamified Project-Based Learning: A Systematic Review of the Research Landscape. *Sustainability (Switzerland)*, 15(2). <https://doi.org/10.3390/su15020940>
- Hurley, K. S. (2018). Assessment Competence through In Situ Practice for Preservice Educators. *Journal of Physical Education, Recreation and Dance*, 89(3). <https://doi.org/10.1080/07303084.2017.1417927>
- Irawati, E., & Susetyo, W. (2017). IMPLEMENTASI UNDANG-UNDANG NOMOR 20 TAHUN 2003 TENTANG SISTEM PENDIDIKAN NASIONAL DI BLITAR. *Jurnal Supremasi*, 7(1). <https://doi.org/10.35457/supremasi.v7i1.374>
- Joydiana, M. (2023). PENERAPAN MODEL PEMBELAJARAN PROJECT BASED LEARNING UNTUK MENINGKATKAN HASIL BELAJAR BAHASA INDONESIA KELAS II SDN 01/IV KOTA JAMBI. *Didaktik: Jurnal Ilmiah*

- PGSD STKIP Subang, 9(2). <https://doi.org/10.36989/didaktik.v9i2.921>
- Khunaifi, A. Y., & Matlani, M. (2019). Analisis Kritis Undang-Undang Sisdiknas Nomor 20 Tahun 2003. *Jurnal Ilmiah Iqra'*, 13(2). <https://doi.org/10.30984/jii.v13i2.972>
- König, J., Jäger-Biela, D. J., & Glutsch, N. (2020). Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, 43(4). <https://doi.org/10.1080/02619768.2020.1809650>
- L., I. (2019). ANALISIS PSIKOLOGIS KOMPARATIF PENDEKATAN PEMBELAJARAN KI HADJAR DEWANTARA DAN BENJAMIN S. BLOOM. *DIDAKTIKA: Jurnal Kependidikan*, 13(1). <https://doi.org/10.30863/didaktika.v13i1.326>
- Lim, S. W., Jawaw, R., Jaidin, J. H., & Roslan, R. (2023). Learning history through project-based learning. *Journal of Education and Learning*, 17(1). <https://doi.org/10.11591/edulearn.v17i1.20398>
- Lin, M. H., Chen, H. C., & Liu, K. S. (2017). A study of the effects of digital learning on learning motivation and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(7). <https://doi.org/10.12973/eurasia.2017.00744a>
- Maisyarah, M., & Lena, M. S. (2023). Penerapan Model Project Based Learning (Pjbl) pada Pembelajaran Tematik Terpadu di Sekolah Dasar. *E-Jurnal Inovasi Pembelajaran Sekolah Dasar*, 10(3). <https://doi.org/10.24036/e-jipsd.v10i3.12132>
- Markula, A., & Aksela, M. (2022). The key characteristics of project-based learning: how teachers implement projects in K-12 science education. *Disciplinary and Interdisciplinary Science Education Research*, 4(1). <https://doi.org/10.1186/s43031-021-00042-x>
- Marnewick, C. (2023). Student experiences of project-based learning in agile project management education. *Project Leadership and Society*, 4. <https://doi.org/10.1016/j.plas.2023.100096>
- Maros, M., Korenkova, M., Fila, M., Levicky, M., & Schoberova, M. (2023). Project-based learning and its effectiveness: evidence from Slovakia. *Interactive Learning Environments*, 31(7). <https://doi.org/10.1080/10494820.2021.1954036>
- Mia Roosmalisa Dewi. (2022). Kelebihan dan Kekurangan Project-based Learning untuk Penguatan Profil Pelajar Pancasila Kurikulum Merdeka. *Inovasi Kurikulum*, 19(2).

- Miranda, J., Navarrete, C., Noguez, J., Molina-Espinosa, J. M., Ramírez-Montoya, M. S., Navarro-Tuch, S. A., Bustamante-Bello, M. R., Rosas-Fernández, J. B., & Molina, A. (2021). The core components of education 4.0 in higher education: Three case studies in engineering education. *Computers and Electrical Engineering*, 93. <https://doi.org/10.1016/j.compeleceng.2021.107278>
- Nagel, I., Guðmundsdóttir, G. B., & Afdal, H. W. (2023). Teacher educators' professional agency in facilitating professional digital competence. *Teaching and Teacher Education*, 132. <https://doi.org/10.1016/j.tate.2023.104238>
- Noben, I., Deinum, J. F., & Hofman, W. H. A. (2022). Quality of teaching in higher education: reviewing teaching behaviour through classroom observations. *International Journal for Academic Development*, 27(1). <https://doi.org/10.1080/1360144X.2020.1830776>
- Nurhadiyati, A., Rusdinal, R., & Fitria, Y. (2020). Pengaruh Model Project Based Learning (Pjbl) terhadap Hasil Belajar Siswa di Sekolah Dasar. *Jurnal Basicedu*, 5(1). <https://doi.org/10.31004/basicedu.v5i1.684>
- Ping, C., Schellings, G., Beijaard, D., & Ye, J. (2021). Teacher educators' professional learning: perceptions of Dutch and Chinese teacher educators. *Asia-Pacific Journal of Teacher Education*, 49(3). <https://doi.org/10.1080/1359866X.2020.1725808>
- Prajoko, S., Sukmawati, I., Maris, A. F., & Wulanjani, A. N. (2023). PROJECT BASED LEARNING (Pjbl) MODEL WITH STEM APPROACH ON STUDENTS' CONCEPTUAL UNDERSTANDING AND CREATIVITY. *Jurnal Pendidikan IPA Indonesia*, 12(3). <https://doi.org/10.15294/jpii.v12i3.42973>
- Pratama, A., Pangestika, R. R., & Anjarini, T. (2024). ANALISIS KESULITAN BELAJAR SISWA PADA PEMBELAJARAN MATEMATIKA MATERI PERKALIAN BILANGAN CACAH DI SEKOLAH DASAR. *Walada: Journal of Primary Education*, 3(3). <https://doi.org/10.61798/WJPE.V3I3.180>
- Purushotham, S., Meng, C., Che, Z., & Liu, Y. (2018). Benchmarking deep learning models on large healthcare datasets. *Journal of Biomedical Informatics*, 83. <https://doi.org/10.1016/j.jbi.2018.04.007>
- Rico Ardiansyah, Dian Nur Antika Eky Hastuti, & Maya Kartika Sari. (2023). P PEMBELAJARAN Pjbl PADA MATERI IPAS KELAS IV SEKOLAH DASAR. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang*, 9(04).

<https://doi.org/10.36989/didaktik.v9i04.1519>

- Sa'adah, I. L., & Pertiwi, F. N. (2022). Pengaruh Model PjBL Berbasis Literasi Ilmiah Terhadap Peningkatan Hasil Belajar Siswa. *Jurnal Tadris IPA Indonesia*, 2(1). <https://doi.org/10.21154/jtii.v2i1.464>
- Siri, A., Supartha, I. W. G., Sukaatmadja, I. P. G., & Rahyuda, A. G. (2020). Does teacher competence and commitment improve teacher's professionalism. *Cogent Business and Management*, 7(1). <https://doi.org/10.1080/23311975.2020.1781993>
- Supena, I., Darmuki, A., & Hariyadi, A. (2021). The influence of 4C (constructive, critical, creativity, collaborative) learning model on students' learning outcomes. *International Journal of Instruction*, 14(3). <https://doi.org/10.29333/iji.2021.14351a>
- Sutiani, A., Situmorang, M., & Silalahi, A. (2021). Implementation of an Inquiry Learning Model with Science Literacy to Improve Student Critical Thinking Skills. *International Journal of Instruction*, 14(2). <https://doi.org/10.29333/iji.2021.1428a>
- Sutrisna, G. B. B., Sujana, I. W., & Ganing, N. N. (2020). PENGARUH MODEL PROJECT BASED LEARNING BERLANDASKAN TRI HITA KARANA TERHADAP KOMPETENSI PENGETAHUAN IPS. *Jurnal Adat Dan Budaya Indonesia*, 1(2). <https://doi.org/10.23887/jabi.v2i2.28898>
- Tsai, H. Y., Chung, C. C., & Lou, S. J. (2018). Construction and development of iSTEM learning model. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(1). <https://doi.org/10.12973/ejmste/78019>
- Ummah, S. K., Inam, A., & Azmi, R. D. (2019). Creating manipulatives: Improving students' creativity through project-based learning. *Journal on Mathematics Education*, 10(1). <https://doi.org/10.22342/jme.10.1.5093.93-102>
- Uyen, B. P., Tong, D. H., & Ngan, L. K. (2023). Online project-based learning for teacher education during the COVID-19 pandemic: A systematic review. In *Contemporary Educational Technology* (Vol. 15, Issue 3). <https://doi.org/10.30935/cedtech/13238>
- Vermunt, J. D., Vrikki, M., Dudley, P., & Warwick, P. (2023). Relations between teacher learning patterns, personal and contextual factors, and learning outcomes in the context of Lesson Study. *Teaching and Teacher Education*, 133. <https://doi.org/10.1016/j.tate.2023.104295>
- Wang, S. (2022). Critical Thinking Development Through Project-Based Learning.

- Journal of Language Teaching and Research*, 13(5). <https://doi.org/10.17507/jltr.1305.13>
- Wicaksono, D., & Iswan. (2019). Upaya Meningkatkan Hasil Belajar Peserta Didik Melalui Penerapan Model Pembelajaran Berbasis Masalah Di Kelas IV Sekolah Dasar Muhammadiyah 12 Pamulang, Banten. *Jurnal Ilmiah PGSD*, 3(2).
- Wulandari, D., Rahayuningtyas, W., & Widyawati, I. W. (2021). Pengaruh Model Project Base Learning terhadap Kemampuan Berpikir Kreatif pada Materi Bermain Alat Musik Sederhana di SMP Negeri 3 Singosari. *JoLLA: Journal of Language, Literature, and Arts*, 1(3). <https://doi.org/10.17977/um064v1i32021p320-330>
- Yamin, M., Halim, A., & Muhayyang, M. (2023). The Implementation Steps of Project-based Learning in English Language Teaching at Islamic Boarding School. *Celebes Journal of Language Studies*. <https://doi.org/10.51629/cjls.v3i1.126>
- Yusikah, I., & Turdjai. (2021). APPLICATION PROJECT BASED LEARNING MODELS (PjBL) TO IMPROVE STUDENT CREATIVITY. *DLADIK: Jurnal Ilmu Teknologi Pendidikan*, 11(1).
- Zhang, L., & Ma, Y. (2023). A study of the impact of project-based learning on student learning effects: a meta-analysis study. In *Frontiers in Psychology* (Vol. 14). <https://doi.org/10.3389/fpsyg.2023.1202728>