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EFFECTIVENESS OF THE PROBLEM BASED LEARNING (PBL) MODEL INTEGRATING STEAM ON SCIENCE LEARNING OUTCOMES

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Abstract

This problem stems from the low learning outcomes of grade V students in the IPAS subject. The purpose of this study was to improve IPAS learning outcomes. The research methodology used is quantitative. The population of this study were all fifth grade students of SD N Mlekang 1, totaling 15 students selected using the saturated sample technique. The type of research used is pre-experimental with a one group pretest-posttest design. Data collection techniques in the form of tests and observation sheets. Data analysis using the N-Gain Test. The results stated that there was an increase in IPAS learning outcomes using STEAM-integrated PBL. The application is effective in learning and gets a score of 0.7513 with a high category, so it can be concluded that using the Problem Based Learning (PBL) learning model integrated with STEAM is effective in improving IPAS learning outcomes.

Keywords: Problem Based Learning (PBL), STEAM, Learning Outcomes, IPAS.

Abstrak

Permasalahan ini berasal dari rendahnya hasil belajar siswa kelas V pada mapel IPAS. Tujuan dari penelitian ini adalah untuk meningkatkan hasil belajar IPAS. Metodologi penelitian yang digunakan adalah kuantitatif. Populasi penelitian ini adalah seluruh siswa kelas V SD N Mlekang 1 yang berjumlah 15 siswa yang dipilih dengan teknik sampel jenuh. Jenis penelitian yang digunakan yaitu *pre-experimental* dengan desain *one group pretest-posttest design*. Teknik pengumpulan data berupa tes dan lembar observasi. Analisis data menggunakan Uji N-Gain. Hasil penelitian menyatakan bahwa terjadi peningkatan hasil belajar IPAS menggunakan PBL berintegrasi STEAM. Penerapan tersebut efektif dalam pembelajaran dan mendapat skor sebesar 0,7513 dengan kategori tinggi, sehingga dapat disimpulkan bahwa dengan menggunakan model pembelajaran *Problem Based Learning* (PBL) berintegrasi STEAM efektif meningkatkan hasil belajar IPAS.

Kata Kunci: *Problem Based Learning* (PBL), STEAM, Hasil Belajar, IPAS

INTRODUCTION

Along with technological advances in the 21st century, the dynamics of the education industry have changed significantly. Due to the needs and expectations created by this transformation, changes to current realities are necessary, with education being a key area of focus. To apply these ideas in everyday life, learning strategies are necessary for Education (Zayyinah, 2022).

Education seeks to foster an active learning environment to maximize the potential of each student. It is very important that education be designed with cognitive, effective, and psychomotor components. To fulfill the educational mission, these aspects need to be implemented continuously (Prasetya, 2023). In this day and age, the Independent Curriculum is seen as progress in the world of education. The four Cs are critical thinking, creativity, communication and collaboration. The 4Cs are the four abilities highlighted in the Independent Curriculum (Nopiani, 2023). This curriculum gives teachers the freedom to create quality learning that suits students' needs and environment. By using the Independent Curriculum, it is hoped that learning outcomes will improve and meet the desired criteria (Khusna, 2023)

However, student learning outcomes continue to show inadequate achievement, far below the Minimum Completeness Criteria (KKM), especially in Natural Sciences (IPA) and Social Sciences (IPS) subjects. Only 47% of the 15 students who participated in observations and interviews at SD N Mlekang 1 got full marks, which indicates that most students have not reached the KKM, especially in science and science subjects. This is also related to conventional methods that are still used by educators in the classroom, which makes students less likely to participate. Interviews with homeroom teachers showed a lack of knowledge about fun, creative and innovative teaching strategies. So, there are still students who are less involved and not interested in science lessons. As a result, students become passive, and are no longer the center of the learning process.

Therefore, educators must be able to choose models, strategies, or processes that are appropriate to the lessons to be taught. When a teacher uses inappropriate models, techniques or methods, students become disinterested and unenthusiastic in learning, which makes it more difficult for them to understand and leads to poor learning outcomes (Arukah, 2020). To overcome this problem is to combine the Problem-Based Learning (PBL) model with the

STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach.

PBL challenges students to think critically, learn new things, and find solutions to pressing problems (Indiyanti, 2023). PBL, or problem-based learning, fosters an environment where students actively participate in a variety of activities. PBL helps students develop long-lasting knowledge based on practical situations, strengthen or improve thinking processes, and increase self-confidence (Yunitasari & Hardini, 2021). PBL aims to improve students' ability to solve problems rationally. Another name for the PBL model is a learning technique that increases students' ability to think at a higher level (Masfuah, 2018).

The STEAM approach, which combines information from five disciplines namely Science, Technology, Engineering, Arts and Mathematics into one lesson, can also be applied to education in the 21st century. This approach takes into account the relationships between the five disciplines and emphasizes helping students develop their skills (Saihu, 2022). In addition to encouraging the application of technology to solve real-world problems, STEAM is a popular approach to improving education (Ulfayani, Jeranah, & Asrawati, 2022). Apart from that, developing and improving students' critical, creative, moral and ethical thinking abilities is one of the benefits of the STEAM method. This method also broadens students' perspectives on learning, improves their teamwork and communication skills, and piques their interest in pursuing jobs in STEM fields (Rilianti, 2023).

Like Project-based learning theory, also referred to as project-based learning (PBL), is a teaching strategy that engages students in long-term examination and solving difficult problems. This means that the value of learning is focused on student needs and the need to use real context in the classroom (van der Ploeg, 2016). This was further strengthened by Vygotsky, who stated that group study is a more effective way for students to develop their intellectual abilities than studying alone (Masfuah, 2019).

Learning outcomes themselves are a general description of the skills and attributes that students have acquired as a result of their educational journey provided by student learning outcomes (Masfuah, 2020). Learning outcomes are changes in behavior that result from interactions between teachers and students during the learning process (Fitri Alfiaturrohmaniah, 2022). An important technique for determining the success or failure of the learning process is to use learning outcomes (Arukah, 2020). The abilities acquired during the learning process, whether cognitive, emotional or psychomotor, are known as learning outcomes (Ilfa, 2023).

Learning outcomes, according to Gagne, are divided into five categories, namely verbal knowledge, intellectual abilities, cognitive methods, attitudes and motor skills. Benjamin Bloom, on the other hand, stated that learning outcomes can be broadly divided into three domains: cognitive, emotional, and psychomotor (Shafira, 2021). The changes obtained after going through the learning process are known as learning outcomes. Learning outcomes are essentially a person's behavior patterns that change as evidence that he has completed certain activities (Syafria, 2023).

So it can be concluded that the assessment of business results or learning achievements expressed in the form of words, symbols or other forms that reflect the development that has been achieved by each student in a certain period, can be concluded as learning outcomes.

Thus, further investigation is needed to determine how effective the STEAM-integrated PBL approach is on the learning outcomes of science and science topics in fifth grade students at SD N Mlekang 1.

METHODS

This research uses quantitative research, pre-experiment with experimental research type. Because there was only one class in this study that received a pre-test and post-test, the "One group pre-test and post-test design" was chosen as the research design because it allows for more precise measurement of treatment results and allows comparison of before and after conditions. application (Utami, 2020).The research design used in this research is as follows:

01 x 02

Source: Sugiono (2016)

Information:

01 = pretest score before treatment

02 =posttest score after being given treatment

X = learning treatment using the PBL model integrating STEAM in the IPAS subject

This research was conducted at SD N Mlekang 1 in May 2024. A total of 15 students in class V were used as subjects for this research, consisting of 10 male students and 5 female students. In sampling, this research used a saturated sampling technique, which means samples were taken from the entire population. The data collection instruments used consisted of test techniques and observation sheets. Where the test is used to test understanding of the science concept and the observation sheet is used to test the science process skills. The data analysis technique used in this research includes the N-Gain test. The N-Gain test is used to measure the increase in science learning outcomes before and after implementing PBL with STEAM integration (Supriadi, 2021).

RESULTS AND DISCUSSION

The results of research carried out at SD N Mlekang 1 in May 2024 with a research focus on improving science and science learning outcomes for fifth grade students. Research data obtained from the results of the pretest and posttest on science material in class V elementary school were used to determine the objectives of science and science learning. The purpose of the pretest is to determine students' initial abilities before receiving treatment. On the other hand, the posttest aims to determine the effect of STEAM integrated PBL model treatment on student learning outcomes.

The science and science learning outcomes consist of two components, namely understanding science and science concepts and science as process skills. The form of the test in this research is in the form of 12 descriptive questions given in accordance with indicators according to Bloom's Taxonomy theory. A framework called Bloom's Taxonomy Theory is used to categorize aspects that help in improving student learning outcomes. By using this theory, learning objectives can be measured, competencies can be categorized, and each aspect can be further divided into a number of categories and subcategories which are ordered in stages so that they are beneficial for the progress of the educational field. Bloom's taxonomy consists of delicious aspects, namelyconsists of six aspects, namely: knowledge (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), creating (C6) (Mahmudi, 2022). Meanwhile, the observation sheet instrument is in accordance with the IPAS process skill indicators which consist of six aspects, namely observing or observing, questioning, planning and carrying out, processing and analyzing data, evaluating and reflecting,

communicating results (Kemendikbud, 2022).

The N-Gain test was used in this research. The purpose of this test is to find out whether the application of the STEAM-integrated Problem Based Learning (PBL) learning model on the science map material for class V students has experienced an increase in pretest and posttest learning outcomes. Pretest and posttest data on science learning results were used to create this test. The results of the N-Gain test on science learning outcomes are as follows.

Table 1. Output Data N-Gain
Science Learning Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
SCORE_N_GAIN	15	.65	.85	.7513	.06494
Valid N (listwise)	15				

The test results for increasing science learning outcomes in the pretest and posttest scores show that 0.7513 > 0.7 so it is included in the high category. Thus, it can be said that after using the STEAM-integrated Problem Based Learning (PBL) learning model on the science and science learning outcomes of class V students at SD N Mlekang 1, from the results of the N-Gain test analysis there was an increase in the high category in the pretest and posttest learning outcomes.

Science learning outcomes are divided into two categories, namely process skills and concept understanding. The pretest and posttest results show the learning objectives of these two components. Tables 2 and 3 present the IPAS learning outcome scores for the concept understanding and process skills sections for each indicator.

Table 2. N-Gain Test for Each Learning Outcome Indicator IPAS
Concept Understanding Elements

INDICATOR	***Pre***	***Post***	**N-GAIN**	**DESCRIPTION**
Indicator 1	35	44	.14	Low
Indicator 2	39	45	.10	Low
Indicator 3	32	44	.18	Low
Indicator 4	15	36	.25	Low
Indicator 5	17	33	.19	Low
Indicator 6	23	39	.21	Low

Based on Table 2, it shows that the analyzing indicator (C4) has the highest N-Gain for understanding the science concept, namely 0.2, while the understanding indicator (C2) has the lowest N-Gain, namely 0.10.

Table 3.N-Gain Test for Each Learning Outcome Indicator
Elements of Process Skills IPAS

Indicator	***Pre***	***Post***	**N-Gain**	**DESCRIPTION**
Indicator 1	33	45	.18	Low
Indicator 2	33	45	.18	Low

Indicator 3	30	45	.21	Low
Indicator 4	24	36	.16	Low
Indicator 5	18	30	.15	Low
Indicator 6	24	45	.28	Low

Based on Table 3, the indicator of IPAS process skills with the highest N-Gain is indicator 6 communicating results, namely 0.28, while indicator 5 evaluating and reflecting has the lowest N-Gain, namely 0.15.

Class V science and science subjects benefit greatly from the implementation of the STEAM-based PBL model, which has a high category effect on science and science learning outcomes. Students become more involved, enthusiastic, creative, and think critically after using the STEAM-based PBL model, and learning becomes more fun.

Based on analysis of pretest and posttest data, students in class V Science and Technology at SD N Mlekang 1 showed an increase in learning outcomes. This can be seen from the results of the N-Gain test that the researchers obtained, which showed 0.7513 > 0.7 in the high group.

According to Asyari & Zakir, (2023) states that using the PBL-STEAM methodology for teaching can significantly improve student learning outcomes. The average pretest score of 51.30 and posttest score of 80.80 shows this. Apart from that, there was an increase of 0.621 in student learning outcomes in the intermediate category. Meanwhile, according to Mustofa, (2021) Improving critical thinking skills and student learning outcomes can be achieved through the use of a STEAM-based PBL model. The average results for the control class, namely 55.5, and the experimental class, namely 72, clearly show this. H0 is rejected if the P-Value from the t test is 0.000. As a result, compared to before STEAM-based PBL was used, the STEAM-based Problem Based Learning (PBL) paradigm was more effective in improving science learning outcomes.

Learning carried out Students only listen when learning from their teacher, which makes them passive. When given a problem, students have difficulty understanding it and producing solutions or ideas to overcome the problem. Students are often given problem-based learning throughout the IPAS subject. The IPAS assessment not only tests understanding but also skills. The N-Gain test is used to *analyze* the increase in science learning outcomes for each indicator of these two elements. The first indicator, namely understanding of the science and science concept in Table 2, can increase in each indicator because students become what is known as "*student center learning*" or student-centered learning, when the stages in the learning process are modified according to the teacher's plan. As a result, students learn more actively and develop their critical thinking skills (Khusna, 2023). Being active here is not only actively asking questions, students are also active in expressing opinions and having the courage to explain the material to their friends, as well as thinking critically to solve problems in accordance with the material given, namely changes in the earth.

This is in line with research Handayani, (2023) which states that STEAM (science, technology, engineering, art, and mathematics) activities can improve students' cognitive abilities during the learning process. Students are not only expected to work together, but they are also the center of attention in the learning process because every STEAM activity involves direct student contributions in learning. As a result, students are more engaged and have greater freedom to explore their ideas. Apart from that, this method also helps stimulate students'

critical thinking. Therefore, students can understand the material being taught.

These six indicators are the content of the science learning outcomes in the second part, namely process skills. In this procedure, students carry out basic experimental tasks related to natural disasters such as floods. In the low category, indicator 1, namely observation, experienced an increase of 0.18. Experiencing an increase in learning activities through direct experience in practicum, students can collect relevant facts and make observations using all five senses. In line with findings from Nahdi, (2018) through the use of authentic tasks carried out by students under guidance to think logically. In this way, students are better able to understand and remember the material taught.

Indicator 2 is questioning which received the low category, with an increased score of 0.18. There was an increase because more and more students dared to voice their opinions and ask questions regarding the activities carried out. This is the result of students' increased curiosity, which also stimulates students to think critically. In line with research from Aini (2024) Students' critical thinking skills can be strengthened and their engagement with content can be increased through hands-on experiments, so that students can understand and accept the material presented.

Indicator 3, namely planning and carrying out, got the low category, with an increase of 0.21. This is because students' creativity increases when planning and carrying out experiments when they are actively involved, and by talking about them, they can share ideas with others. In line with findings from Prasetyo (2021) states that student-centered discussions and learning can inspire children to be brave, creative, and appreciate the perspectives of their classmates. So that students are more confident, creative and respect other people's opinions.

Indicator 4, namely analyzing information data, obtained the low category, with an increase of 0.16. After students carry out hands-on experiments that allow them to obtain information effectively, improvement occurs. In line with Faroh (2024) stated that students' ability to be active and think critically can be improved by engaging in hands-on activities, which will help them gather information for practicum. So that students can collect information well and in accordance with the material provided through experimental activities.

Indicator 5, namely evaluating and reflecting, obtained a low category with an improvement score of 0.15. After students carried out practical exercises that allowed them to assess and reflect appropriately, improvement occurred. This is in line with OMA (2021) which states that students' ability to think critically can be improved by inviting them to participate in practical activities. Apart from that, students will also more easily accept the material provided.

Indicator 6, namely communicating results, obtained the low category, with an improvement score of 0.28. Communication skills also increase. This is the result of active learning strategies, which encourage students to be brave and engage in active communication while involving them directly in the learning process. In line with research Matsna (2023) states that direct instruction can increase student engagement, critical thinking, creativity, teamwork, and communication. So that students dare to express their opinions firmly, loudly and without thinking twice.

The reasons mentioned above lead to the conclusion that the STEAM-based PBL model is a teaching method that can improve learning outcomes and maximize science learning. This is reinforced by previous research which has shown increased science learning outcomes using the STEAM-based PBL paradigm.

CONCLUSION

The findings and analysis regarding the effectiveness of the STEAM-integrated Problem Based Learning (PBL) model on the learning outcomes of fifth grade students at SD N Mlekang 1 IPAS can be explained as follows, based on research that has been conducted, there is an increase in IPAS learning outcomes with the application of the Problem Based Learning (PBL) model STEAM integration. Fifth grade students at SD N Mlekang 1 who used the PBL model with STEAM integration experienced an increase in science learning outcomes as measured by the N-Gain Test, with a value of 0.7513, meeting the high criteria. Thus, learning with the Problem Based Learning (PBL) model integrating STEAM is effective in improving science learning outcomes.

REFERENCES

Aini, A. N., Masfuah, S., & Fakhriyah, F. (2024). Pengembangan Media Jejak Petualangan Sains (JPS) untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar. *Jurnal Basicedu*, *8*(1), 719–728. https://doi.org/10.31004/basicedu.v8i1.7204

Arukah, D. W., Fathurohman, I., & Kuryanto, M. S. (2020). Peningkatan Hasil Belajar Siswa Kelas IV Sekolah Dasar Negeri 2 Karangbener Menggunakan Model Think Pairs Share. *EduBase : Journal of Basic Education*, *1*(2), 54. https://doi.org/10.47453/edubase.v1i2.141

Asyari, S., & Zakir, A. (2023). Efektivitas Pendekatan STEAM dalam Model Problem Based Learning pada Materi Relasi dan Fungsi Kelas VIII UPT SPF SMP Negeri 27 Makassar. *LP2M-Universitas Negeri Makassar*, 1777–1788. Retrieved from https://ojs.unm.ac.id/semnaslemlit/article/view/54851

Faroh, N., Siti, M., & Syaffruddin, K. (2024). *Penerapan Model Pembelajaran Problem Solving Untuk Meningkatkan Kemampuan Berfikir Kritis Siswa Sd N Demaan Dengan Menggunakan Permainan Mokshapat*. *10*.

Fitri Alfiaturrohmaniah, Masfuah, S., & Roys, M. (2022). Dampak Pembelajaran Daring Terhadap Hasil Belajar Siswa Sekolah Dasar. *Journal of Educational Learning and Innovation (ELIa)*, *2*(2), 157–170. https://doi.org/10.46229/elia.v2i2.386

Ilfa, M. K., Ardianti, S. D., & Kuryanto, M. S. (2023). Pengaruh Discovery Learning Berbantu Media Audiovisual Terhadap Peningkatan Kemampuan Pemecahan Masalah Matematika. *Prismatika: Jurnal Pendidikan Dan Riset Matematika*, *6*(1), 141–152. https://doi.org/10.33503/prismatika.v6i1.2979

Indiyanti, C. E., Ardianti, S. D., & Masfuah, S. (2023). *Implementasi Model Problem Based Learning Berbasis Edutainment Untuk Meningkatkan Pemahaman Konsep Siswa SD*. *08*(September).

Kemendikbud. (2022). Ilmu Pengetahuan Alam dan Sosial (IPAS) SD-SMA. *Merdeka Mengajar*. Retrieved from https://guru.kemdikbud.go.id/kurikulum/referensi-penerapan/capaian-pembelajaran/sd-sma/ilmu-pengetahuan-alam-dan-sosial-ipas/

Khusna, S., Khasanah, I., Musa, M. M., & Juwita Rini. (2023). *Kurikulum Merdeka Belajar Melalui Pembelajaran Abad 21 Untuk Meningkatkan Kompetensi 4c Siswa Madrasah Ibtidaiyah*. 22–34.

Mahmudi, I., Athoillah, M. Z., Wicaksono, E. B., & Kusumua, A. R. (2022). Taksonomi Hasil Belajar Menurut Benyamin S. Bloom. *Jurnal Multidisiplin Madani*, *2*(9), 3507–3514.

Masfuah, S., & Pratiwi, I. A. (2018). Peningkatan Kemampuan Pemecahan Masalah Siswa Melalui Pembelajaran Problem Based Learning Berbasis Socio Scientific Issues. *Edukasi*,

10(2), 179–190.

Masfuah, S., & Pratiwi, I. A. (2019). *Peningkatan Kemampuan Pemecahan Masalah Siswa Melalui Pembelajaran Problem Based Learning*. *10*(2), 179–190.

Masfuah, S., Sidiq, D. A. N., & Fakhriyah, F. (2020). Hubungan Minat Belajar IPA Siswa Kelas V SD Negeri 2 Pelemkerep Terhadap Hasil Belajar Selama Pembelajaran Daring. *Progres Pendidikan*, *1*(3), 72–79.

Matsna, F. U., Rokhimawan, M. A., & Rahmawan, S. (2023). Analisis Keterampilan Proses Sains Siswa Melalui Pembelajaran Berbasis Praktikum Pada Materi Titrasi Asam-Basa Kelas Xi Sma/Ma. *Dalton : Jurnal Pendidikan Kimia Dan Ilmu Kimia*, *6*(1), 21. https://doi.org/10.31602/dl.v6i1.9187

Mustofa, M. R., Arif, S., Sholihah, A. K., Aristiawan, & Rokmana, A. W. (2021). Efektivitas Model Pembelajaran Problem Based Learning Berbasis STEM Terhadap. *Jurnal Tadris IPA Indonesia*, *1*(3), 375–384. Retrieved from http://ejournal.iainponorogo.ac.id/index.php/jtii

Nahdi, D. S., Yonanda, D. A., & Agustin, N. F. (2018). Yonanda Nahdi. *Jurnal Cakrawala Pendas*, *4*(2), 9–16.

Nopiani, S., Purnamasari, I., Nuvitalia, D., & Rahmawati, A. (2023). *Kompetensi 4c Dalam Implementasi Kurikulum Merdeka Di Kelas Iv Sekolah Dasar*. *09*, 5202–5210.

OMA, O. (2021). Penerapan Metode Eksperimen Untuk Meningkatkan Hasil Belajar Ipa Tentang Pengaruh Gaya Dalam Mengubah Gerak Suatu Benda. *Jurnal Pedagogiana*, *8*(84). https://doi.org/10.47601/ajp.33

Prasetya, A., Kuryanto, M. S., & Hilyana, F. S. (2023). Hubungan Motivasi Belajar Terhadap Hasil Belajar Siswa Kelas Iv Sd 1 Mijen Kaliwungu Kota Kudus. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *8*(1), 5052–5061. https://doi.org/10.23969/jp.v8i1.8714

Prasetyo, T. (2021). Pendekatan Pembelajaran Berpusat Pada Siswa. *Journal Pendidikan Dasar, Universitas Negeri Jakarts*, (September), 1–23.

Rilianti, A. P., Handayani, M., & Nugroho, W. (2023). *Pendekatan Science , Technology , Engineering , Art , & Math (STEAM) untuk Mengembangkan Keterampilan Abad 21 Siswa Sekolah Dasar*. *1*(2), 78–85.

Saihu, A. C. (2022). *Meningkatkan Aktivitas Dan Hasil Belajar Siswa Melalui Model Pbl Dengan Pendekatan STEAM*.

Shafira, A., Yeni, E. M., & Almuslim, U. (2021). *Penerapan Pendekatan STEAM Dalam Meningkatkan Hasil Belajar Siswa Kelas V Pada Materi Rantai dan Piramida Makanan*. *10*, 51–56.

Supriadi, G. (2021). *Statistika Penelitian Pendidikan.pdf*.

Syafria, M. N., Pratiwi, I. A., & Kuryanto, M. S. (2023). *Pengaruh Media Ular Tangga Keberagaman dalam Meningkatkan Hasil Belajar Muatan PPKn Siswa Sekolah Dasar*. *7*(5), 3111–3117.

Ulfayani, H., Jeranah, & Asrawati, N. (2022). Efektivitas pendekatan Pembelajaran STEAM Terhadap Hasil Belajar Siswa pada pembelajaran Matematika Kezlas VII. *Aritmatika: Jurnal Inovasi Pendidikan Matematika*, *3*(1), 65–70.

Utami, A. D., & Yuliyanto, E. (2020). Concept Map: Does It Increase Learning Motivation of Student? *Journal of Science Education Research*, *4*(2), 49–54. https://doi.org/10.21831/jser.v4i2.35714

van der Ploeg, P. (2016). Dewey versus 'Dewey' on democracy and education. *Education,*

Citizenship and Social Justice, *11*(2), 145–159. https://doi.org/10.1177/1746197916648283

Yunitasari, I., & Hardini, A. T. A. (2021). Penerapan Model PBL Untuk Meningkatkan Keaktifan Peserta Didik Dalam Pembelajaran Daring Di Sekolah Dasar. *Jurnal Basicedu*, *5*(4), 1700–1708. https://doi.org/10.31004/basicedu.v5i4.983

Zayyinah, Z., Erman, E., Supardi, Z. A. I., Hariyono, E., & Prahani, B. K. (2022). STEAM-Integrated Project Based Learning Models: Alternative to Improve 21st Century Skills. *Proceedings of the Eighth Southeast Asia Design Research (SEA-DR) & the Second Science, Technology, Education, Arts, Culture, and Humanity (STEACH) International Conference (SEADR-STEACH 2021)*, *627*, 251–258. https://doi.org/10.2991/assehr.k.211229.039