ISSN 2964-4291
https://proceeding.unnes.ac.id/index.php/iset

Literacy Practice on Project Bassed Learning (PBL) Assisted by Peer Assessment in Hybrid Learning to Improve the Students' Critical Thinking Ability in Tertiary Level of Education

Aswadi Jaya*, Rudi Hartono, Sri Wahyuni, Henrikus Joko Yulianto

Universitas Negeri Semarang, Indonesia

*Corresponding Author: aswadijaya4@gmail.com

Abstract. The students' literacy became lower since the hybrid learning also has its weaknesses, namely students feel bored because the learning process is monotonous and less interesting. Thus, the students are not interested in learning and completing learning carried out in *e-learning*. The aim of this study was to analyze the effect of learning*project-based learning* assisted by peer assessment in hybrid learning to improve students' critical thinking skills as the implementation of literacy practices. The study uses the *posttest only control group design*. The population of this study was all second semester English Education Study Program students in PGRI University of Palembang, totaling 170 students. Descriptive statistical analysis techniques are used to describe the data obtained. The hypothesis testing used is the t-test to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t-count with t-table. The results of the analysis show that the value of Sig. obtained less than 0.05. This means that there are differences in students' critical thinking skills being taught *project-based learning*(PBL) assisted by peers with students who are taught without learning *project-based learning*(PBL) assisted by peers. The implications of this research are that it is hoped that with this learning model students will learn more actively in building their own knowledge as the literacy processes which will have an impact on critical thinking skills.

Keywords: Project-Based Learning; Peer Assessment; Critical Thinking Ability

INTRODUCTION

The first fact, UNESCO said that Indonesia ranks second from the bottom in terms of world literacy, meaning that interest in learning is very low. One of the demands of education today is the ability to think critically. Critical thinking ability is the ability to analyze facts, convey ideas, defend opinions, make comparisons, draw conclusions and evaluate the arguments given and the ability to solve problems (Barta et al., 2022; Pramestika et al., 2020; Rati & Rediani, 2020). Critical thinking is a person's cognitive ability to state something with confidence because it is based on logical reasons and strong evidence(Meilana et al., 2020). Critical thinking skills provide opportunities for students to use information sources to produce solutions and provide opportunities for students to build relationships (Jiang, 2022; Polat & Aydın, 2020). Critical thinking ability is one of the important learning outcomes in education (Hart et al., 2021; Yu et al., 2021)The ability to think critically is related to the ability of students to deal with everyday problems (Odebiyi & Odebiyi, 2021). Efforts to develop critical thinking skills require an innovative learning process that provides opportunities for students to develop critical thinking skills (Seibert, 2020; Silberman et al., 2021). So, the ability to think critically will have a positive influence on the readiness of students in facing global competition. To improve abilities, a proper learning model is needed that can be used in the Hybrid learning process.

In the midst of the Covid-19 pandemic, all learning processes are carried out Hybrid. Hybrid learning provides opportunities for students to learn more flexibly and the learning process is carried out without knowing space and place. Students can meet anytime and anywhere. In the midst of the onslaught of the Covid-19 Pandemic and Hybrid learning, learning is required to produce students who are able to think critically. However, the problem that occurs is that Hybrid learning has a weakness, namely students feel bored because the learning process is monotonous and less interesting. So that students are not interested in learning and completing learning carried out in e-learning. Another thing is the lack of feedback given is also the reason why students lose interest in learning. Students' critical thinking skills are still relatively lacking. This can be seen from the lack of active students in the lecture process such as asking questions and expressing opinions (Davut Gul & Akcay, 2020). Students tend to be passive only to listen to

explanations of lecture material (Indriani et al., 2022). If this is allowed, it will certainly have an impact on student learning outcomes. One of the solutions offered is to implement PBL learning assisted by peer assessment.

The application of the learning model is expected to reduce student boredom in the learning process and the peer assessment process provides opportunities for students to be motivated to take part in learning.One of the learning models that can be used is PBL. Project-based learning relates to the real world of students which requires collaborative inquiry and the production and series of projects (Muhammad, 2018; Simamora et al., 2020). Project-based learning is an innovative learning that emphasizes complex activities with the aim of solving problems based on inquiry activities (Kurniawan et al., 2018; Triana et al., 2020). Learning with PBL, the teacher is responsible for monitoring student activities while completing projects, so that students are able to develop an idea and produce satisfactory results (Rahmazatullaili et al., 2017; Tika & Agustiana, 2021).

The focus of learning lies on the core concepts and principles of a discipline of study, involving students in problem-solving investigations and other meaningful task activities, giving students the opportunity to work autonomously constructing their own knowledge, and culminating in producing real products. (Fauzia & Kelana, 2021; Sumarni, 2020). So, the application of the PBL learning model in the learning process has a positive impact on the learning process. In addition to models, to make the learning atmosphere more enjoyable, you can do it by using peer assessment.

Peer assessment is one of the assessments carried out by peers to assess the work of their friends (Alias et al., 2015; Jalili & Shishavan, 2020). Peer assessment is used in the process of assessing projects or presentations. Peer ratings are important in evaluating and encouraging positive feedback (Liang et al., 2020; Luaces et al., 2018). Peer assessment increases accountability and inspires them to increase interaction with peers so that heterogeneous judgments are produced (James et al., 2018; Mahayukti & Suweken, 2022). Peer assessment strategies are needed in the learning process because it will develop social interaction between peers. Several previous research findings stated that students understand learning by using a project-based learning model. (Fauzia & Kelana, 2021). STEM-PBL-based environmental change learning tools are effective on students' 4C skills (Triana et al., 2020). The advantages of each component, namely the model and type of assessment, are one of the reasons why this research was conducted. This study aims to analyze the PBL model supported by peer research on critical thinking skills. The application of the learning model is expected to reduce student boredom in the learning process and the peer assessment process provides opportunities for students to be motivated to take part in learning.

METHODS

Research objectives namelyto determine the effect of peer-assessment-assisted project-based learning (PBL) learning in Hybrid learning to improve students' critical thinking skills in social studies education courses.In this study there are two variables used, namely the independent variable, namelyproject-based learning (PBLl) learning assisted by peer assessmentwith the dependent variable, namely students' critical thinking skills. This type of research is quasi-experimental.Pseudo-experiment is a type of comparison that compares the effect of giving a treatment (treatment) to an object (experimental group) and seeing the magnitude of the effect of the treatment (Arikunto, 2015). The design of this study used the posttest only control group design. The population of this study was all English Education Study Program, semester II students in PGRI University of Palembang, totaling 170 students who were spread evenly across 8 classes, namely class A-1.The sample of this research was second semester English Education Study Program students, or in other words, sampling is done by group random sampling technique. Sampling was carried out in two stages. In the first stage, the two classes in PGRI University of Palembang, English Education Study Program was drawn randomly and the results were used as a research sample, from the two classes, then randomly selected into 1 experimental class and 1 control class. From these results obtained class H as the experimental group with a total of 30 students and class I as the control class with 32 students.

The object of this research is the score of critical thinking skills in the social studies elementary school subject that has been given an experiment in the form ofthat isproject-based learning (PBL) learning assisted by peer assessment with the dependent variable, namely

student learning outcomes. Critical thinking ability is measured by a test instrument. This essay test consists of multiple choice questions with cognitive levels from C4-C6. The test was taken from model material, social studies learning methods and social studies learning evaluation. The data collected in this study is data on the score of critical thinking skills in the second semester of English Education Study Program participating in project-based learning (PBL) assisted by peer assessment which is implemented in the experimental class and learning without project-based learning (PBL) assisted by peer assessment. The data were obtained from the results of calculating student critical thinking ability test scores. Descriptive statistical analysis techniques were used to describe the data obtained. The data that has been obtained from the research is described according to the learning outcome variable. Descriptive analysis displays the average, standard deviation, mode, median, minimum value, maximum value, range, and amount of data for each variable studied. In addition to obtaining these prices, a table of frequency distributions and histograms for each research variable is also shown. Inferential analysis is used to test the research hypothesis. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t-table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. median, minimum value, maximum value, range, and amount of data from each variable studied. In addition to obtaining these prices, a table of frequency distributions and histograms for each research variable is also shown. Inferential analysis is used to test the research hypothesis. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. median, minimum value, maximum value, range, and amount of data from each variable studied. In addition to obtaining these prices, a table of frequency distributions and histograms for each research variable is also displayed. Inferential analysis is used to test the research hypothesis. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. In addition to obtaining these prices, a table of frequency distributions and histograms for each research variable is also shown. Inferential analysis is used to test the research hypothesis. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. In addition to obtaining these prices, a table of frequency distributions and histograms for each research variable is also displayed. Inferential analysis is used to test the research hypothesis. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is assisted by SPSS 20. The hypothesis testing used is the t test used to test the significant level of the influence of the independent variables partially on the dependent variable. The test is carried out by comparing t count with t table. With the provision that if t count > t table and significant value < 0.05 (α: 5%), then the independent variable partially has a significant effect on the dependent variable. Testing this hypothesis is

assisted by SPSS 25.

RESULTS AND DISCUSSION

Results

The results of the analysis of the description showed that the average value of critical thinking skills was between students who were taught by peer-assisted project-based learning (PBL) and students who were taught by peer-assisted learning without project-based learning (PBL). This is shown by the difference in the mean value of 4.91, where the average value of the group of students taught with peer-assisted project-based learning (PBL) is greater, in more detail in table 1.

Table 1. Analysis Results Description

Table 1. Analysis Results Description

Measured Variables	Ability Critical thinking	
	Experimen t	Control
Means	87.50	82,69
std. Deviation	6,78	6,61
Variances	45.98	43.70
Range	29.00	25.00
Minimum	71.00	68.00
Maximum	100.00	93.00

After the descriptive test is carried out, it is continued to the inferential test. The results of the analysis show that the value of Sig. obtained less than 0.05. This means that there is a difference in the critical thinking abilities of students who are taught project-based learning (PBL) with the help of peers and students who are taught without peer-assisted project-based learning (PBL). The results of the analysis are shown in Table 2.

Table 2. Results of Inferential Analysis Test t

Table 2. Results of Inferential Analysis Test t

Model		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	std. Error difference	95% Confidence Intervals of the Difference	
							Lower	Upper
Critical thinking skills	*Equal variances assumed*	2.85	60.00	0.00	5.00	1.75	1.49	8.51
	Equal variances not assumed	2.85	59.90	0.00	5.00	1.75	1.49	8.51

Discussion

The results of the analysis of the description obtained that the average value of critical thinking skills was between students who were taught by project-based learning (PBL) assisted by peer assessment and students who were taught by learning without project-based learning (PBL) assisted by peer assessment. These results are certainly inseparable from how the learning process is carried out. Learning with project-based learning (PBL) assisted by peer assessment will provide opportunities for students to learn more comfortably by generating and exploring their own knowledge. feeling comfortable in the learning process with the project-based learning (PBL) model assisted by peer assessment will make students more confident in generating ideas for solving the problems they face. Because this learning process does not only play a role in one scientific discipline but learning that involves interdisciplinary learning. Project-based learning is an innovative learning that emphasizes complex activities with the aim of solving problems based on inquiry activities (Kurniawan et al., 2018; Simamora et al., 2020). The focus of learning lies on the core concepts and principles of a discipline of study, involving students in problem-solving investigations and other meaningful task activities, giving students the opportunity to work autonomously constructing their own knowledge, and culminating in producing real products.(Niswara et al., 2019; Sumarni, 2020). So, the application of the PBL model in the learning process has a positive impact on the learning process. The project-based

learning model is a learning model that uses projects (Fauzia & Kelana, 2021; Surya et al., 2018; Tika & Agustiana, 2021).

Apart from that, involving peers in the learning process greatly impacts the learning process. Having peers in the learning process will make students able to learn well. Learning with peers will encourage students to play an active role in learning(Oh, 2019). The peer-to-peer method increases self-learning, students go through experiences that are feedback from their friends(Gabriele et al., 2016). Peers help, guide and support fellow peers so that they are able to build learning through interaction and collaboration(Andersen & Watkins, 2018). Learning that involves peers will reduce anxiety and stress, with guidance assisted, and given feedback by peers students will be able to increase self-confidence(Han et al., 2015; Stone et al., 2013). Based on these descriptions, to create learning that is conducive and in accordance with current conditions, learning must provide opportunities for students to share learning expectations. In this study, peers are tasked with assessing what their friends have done, which of course has an impact on student motivation. Peer assessment is one of the assessments carried out by peers to assess the work of their friends (Alias et al., 2015; Jalili & Shishavan, 2020). Peer assessment is used in the process of assessing projects or presentations. Peer ratings are important in evaluating and encouraging positive feedback(Liang et al., 2020; Luaces et al., 2018). Peer assessment increases accountability and inspires them to increase interaction with peers so that heterogeneous judgments are produced(James et al., 2018). Strategy Peer assessment is very necessary in the learning process because it will develop social interaction between peers.

Based on these descriptions, the peer-assessment-assisted project-based learning (PBL) model will have an impact on students' critical thinking skills because students are already accustomed to solving problems with abilities that involve multidisciplinary knowledge. Critical thinking skills provide opportunities for students to use information sources to produce solutions and provide opportunities for students to build relationships (Indriani et al., 2022; Polat & Aydın, 2020). Critical thinking ability is one of the important learning outcomes in education(Hart et al., 2021; Yu et al., 2021)The ability to think critically is related to the ability of students to deal with everyday problems(Odebiyi & Odebiyi, 2021; Sinaga et al., 2022). To develop critical thinking skills, an innovative learning process is needed that provides opportunities for students to develop critical thinking skills(Seibert, 2020; Silberman et al., 2021). So, the ability to think critically will have a positive influence on the readiness of students in facing global competition. Based on these descriptions, it can be said that the application of project-based learning (PBL) assisted by peer assessment with students has a positive impact on the learning process. This finding is reinforced by previous research which stated that there was an effect of applying the project based learning model assisted by Puzzle media on students' high order thinking skills(Niswara et al., 2019). This project learning model has a positive influence on science learning outcomes (Sari et al., 2021). The implications of this research are that it is hoped that with this learning model students will learn more actively in building their own knowledge which will have an impact on critical thinking skills as their literacy practices.

CONCLUSION

The results of the study showed differences in the critical thinking abilities of students who were taught with project-based learning (PBL) assisted by peer assessment and students who were taught without project-based learning (PBL) assisted by peer assessment. Thus, it can be recommended that this learning model can be used as an alternative to innovative learning models to improve critical thinking skills.

REFERENCES

Alias, M., Masek, A., & Salleh, HHM (2015). Self, Peer and Teacher Assessments in Problem Based Learning: Are They in Agreements? *Procedia Social and Behavioral Sciences*, 204 (November2014),309317.https://doi.org/10.1016/j.sbspro.2015.08.157.

Andersen, T., & Watkins, K. (2018). The value of peer mentorship as an educational strategy in nursing. *Journal of Nursing Education*, 57(4), 217–224.https://doi.org/10.3928/01484834-20180322-05.

Arikunto, S. (2015). *Fundamentals of Educational Evaluation*. Script Earth.

Barta, A., Fodor, LA, Tamas, B., & Szamoskozi, I. (2022). The development of students' critical thinking abilities and dispositions through

the concept mapping learning method – A meta-analysis. *Educational Research Review*, 37, 100481.https://doi.org/10.1016/j.edurev.2022.100481.

Davut Gul, M., & Akcay, H. (2020). Structuring a new socioscientific issue (SSI) based instruction model: Impacts on pre-service science teachers' (PSTs) critical thinking skills and dispositions. *International Journal of Research in Education and Science*, 6(1), 141–159 .https://doi.org/10.46328/ijres.v6i1.785.

Fauzia, NLU, & Kelana, JB (2021). Natural Science Problem Solving in Elementary School Students Using the Project Based Learning (PBL) Model. Journal of Elementary School Science, 4(4), 596–603.
https://doi.org/10.23887/jisd.v4i4.28377.

Gabriele, KM, Holthaus, RM, & Boulet, JR (2016). Usefulness of Video-Assisted Peer Mentor Feedback in Undergraduate Nursing Education. *Clinical Simulation in Nursing*, 12(8), 337–345.https://doi.org/10.1016/j.ecns.2016.03.004.

Han, J.-S., Baek, HC, & Jeong, A.-S. (2015). The Effects of Psychiatric Nursing Simulation on Anxiety and Self-confidence about Clinical Placement of Nursing Students. Journal of the Korea Academia- Industrial *CooperationSociety*, *16*(11),7812–7819.https://doi.org/10.5762/kais.2015.16.11.7812.

Hart, C., Da Costa, C., D'Souza, D., Kimpton, A., & Ljbusic, J. (2021). Exploring higher education students' critical thinking skills through content analysis. *Thinking Skills and Creativity*, 41(May), 100877.https://doi.org/10.1016/j.tsc.2021.100877.

Indriani, L., Haryanto, H., & Gularso, D. (2022). The Impact of Quizizz Media Assisted Problem Based Learning Model on Students' Critical Thinking Ability. *Journal of Educational Research and Development*, 6(2), 214–222.https://doi.org/10.23887/jppp.v6i2.48139.

Jalili, M., & Shishavan, HB (2020). Responding to student feedback: Individualizing teamwork scores based on peer assessment. *Journal of Education*,1(August),100019.https://doi.org/10.1016/j.ijedro.2020.100019.

ames, S., Lanham, E., Mak-Hau, V., Pan, L., Wilkin, T., & Wood-Bradley, G. (2018). Identifying items for moderation in a peer assessment framework. *Knowledge-Based Systems*, 162(January), 211–219.

Jiang, Y. (2022). Evaluation of pedagogical impact of Business English textbooks on teaching critical thinking skills. Heliyon, 8(11), e11419.https://doi.org/10.1016/j.heliyon.2022.e11419.

Kurniawan, HR, Elmunsyah, H., & Muladi, M. (2018). Comparison of the Application of the Project Learning ModelBased on the Comparison of the Application of Project Based Learning and Think Pair Share Assisted Learning Models on the Independence and Learning Outcomes of Class XI Students at SMKN 3 Malang. *Journal of Education (Theory and Practice)*, 3(2), 80.https://doi.org/10.26740/jp.v3n2.p80-85.

Liang, H.-Y., Tang, F.-I., Wang, T.-F., & Yu, S. (2020). Evaluation of Nurse Practitioners' Professional Competence and Comparison of Assessments Using Multiple Methods: Self-Assessment, Peer-Assessment, and Supervisor-Assessment. *Asian Nursing Research*, December, 1–7. https://doi.org/10.1016/j.anr.2020.10.004.

Luaces, O., Díez, J., & Bahamonde, A. (2018). A peer assessment method to provide feedback, consistent grading and reduce students' burden in massive teaching settings. *Computers and Education*, 126, 283–295.https://doi.org/10.1016/j.compedu.2018.07.016.

Mahayukti, GA, & Suweken, G. (2022). Reflection on Local Wisdom Oriented Hybrid Learning and Peer Assessment. *JournalEducation AndTeaching*,*55*(1), 222–231.

Meilana, SF, Aulia, N., Zulherman, Z., & Aji, GB (2020). The Effect of the Think Pair Share (TPS) Learning Model on Critical Thinking Ability in Elementary Schools. *Basicedu journal*, 5(1), 218–226. https://doi.org/10.31004/basicdu.v5i1.644.

Muhammad, AS (2018). Improving Fluency Skills Through the Application of the Project Based Learning (PBL) Learning Model in Science Learning in Elementary Schools. *Journal of Basic Education*, 6(1).

Niswara, R., Muhajir, M., & Asri Untari, MF (2019). The Influence of the Project Based Learning Model on High Order Thinking Skills. U*ndiksha English Education*, 7(2).https://doi.org/10.23887/jjpgsd.v7i2.17493.

Odebiyi, OM, & Odebiyi, AT (2021). Critical thinking in social contexts: A trajectory analysis of states' K-5 social studies content

standards. *Journal of Social Studies Research*, 45(4), 277–288.https://doi.org/10.1016/j.jssr.2021.05.002.

Oh, E. (2019). Research on the effective of peer instruction and students' involvement. *Asia-Pacific of Multimedia Services Convergent with Art Humanities, and Sociology*, 9, 199–208.https://doi.org/https://doi.org/10.35873/ajmahs.

Polat, Ö., & Aydın, E. (2020). The Effect of Mind Mapping on Young Children's Critical Thinking Skills.*Thinking Skills and Creativity*, 38, 1–17.https://doi.org/10.1016/j.tsc.2020.100743.

Pramestika, NPD, Wulandari, IGAA, & Sujana, IW (2020). Enhancement of Mathematics Critical Thinking Skills through Problem Based Learning Assisted with Concrete Media. *Journal of Education Technology*, 4(3), 254. https://doi.org/10.23887/jet.v4i3.25552.

Rahmazatullaili, R., Zubainur, CM, & Munzir, S. (2017). The ability to think creatively and solve students' problems through the application of a project based learning model. Beta Journal of Tadris Mathematics, 10(2), 166–183. https://doi.org/10.20414/betajtm.v10i2.104.

Rati, NW, & Rediani, NN (2020). E-learning Assisted by Finger Printing on Students' Critical Thinking and Creativity. *Journals of EducationTechnology*, *4*(4), 433https://doi.org/10.23887/jet.v4i4.30214.

Sari, LK, Sunanih, S., & Saleh, YT (2021). Project-Based Learning Models Influence Science Learning Outcomes. *Journal for Lesson and Learning Studies*, 4(1), 112–117. https://doi.org/10.23887/jlls.v4i1.31103.

Seibert, SA (2020). Problem-based learning: A strategy to foster generation Z'scritical thinking and perversion. *Teaching andn Learning in Nursing, 000*,2–5. https://doi.org/10.1016/j.teln.2020.09.002.

Silberman, D., Carpenter, R., Takemoto, JK, & Coyne, L. (2021). The impact of team-based learning on the critical thinking skills of pharmacy students. *Currents in Pharmacy Teaching and Learning*, 13 (2), 116 – 121. https://doi.org/10.1016/j.cptl.2020.09.008

Simamora, AH, Jampel, N., & Tegeh, IM (2020). E-Book Based on the Project-Based Learning Model in Learning Media Courses. *Journal of Pedagogy and Learning*, 5(1), 64–74.https://doi.org/10.23887/jp2.v5i1.46353.

Sinaga, P., Setiawan, W., & Liana, M. (2022). The impact of electronic interactive teaching materials (EITMs) in e-learning on junior high school students' critical thinking skills. *Thinking Skills and Creativity*, 46, 101066.https://doi.org/10.1016/j.tsc.2022.101066.

Stone, R., Cooper, S., & Cant, R. (2013). The Value of Peer Learning in Undergraduate Nursing Education: A Systematic Review. *ISRN Nursing*, 2013(i), 1–10. https://doi.org/10.1155/2013/930901.

Sumarni, I. (2020). Application of the Project Based Learning Model to Increase Student Activity and Learning Outcomes in Science Subjects About the Properties of Light in VA Class Semester II for Bantarkemang 1 Public Elementary School Students in the 2017/2018 Academic Year. *Journal of Educational Technology*, 9(1). https://doi.org/10.32832/tek.pend.v9i1.2764.

Surya, AP, Relmasira, SC, & Hardini, ATA (2018). Application of the Project Based Learning (PBL) Learning Model to Improve Learning Outcomes and Creativity of Grade III Students at SD Negeri Sidorejo Lor01Salatiga. *Journal Charm Base*, *6* (1), 41 54.https://doi.org/10.24815/pear.v6i1.10703.

Tika, IN, & Agustiana, IGAT (2021). The Effect of a Blended Learning Project Based Learning Model on Scientific Attitudes and Science Learning Outcomes. *Journal of Elementary School Science*, 5(4), 557–566. https://doi.org/10.23887/jisd.v5i4.39869.

Triana, D., Anggraito, YU, & Ridlo, S. (2020). Effectiveness of environmental change learning tools based on STEM-PBL towards 4C skills of students. *Journal of Innovative Science Education*, 9(2), 181–187.https://doi.org/10.15294/JISE.V8I3.34048.

Yu, Z., Hu, R., Ling, S., Zhuang, J., Chen, Y., Chen, M., & Lin, Y. (2021). Effects of blended versus offline case-centered learning on the academic performance and critical thinking ability of undergraduate nursing students: A cluster randomized controlled trial. *Nurse Education in Practice*, 53 (May), 103080.https://doi.org/10.1016/j.nepr.2021.103080.