Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 3 : September 2024
E-ISSN: 2442-7667
pp. 1283-1291
Email: jklppm@undikma.ac.id

How to Train Critical Thinking Skills? : Application of Problem-Based Learning Model Lesson Study Pattern

Marhamah*, Baiq Fatmawati, Sarwati, Nunung Ariandani
Education Department Biology, Faculty of Mathematics and Natural Sciences,
Universitas Hamzanwadi, Indonesia.
*Corresponding Author. Email: mansaniki@gmail.com

Abstract: This study aims to describe the critical thinking skills of biology students through the application of the Problem-Based Learning Lesson Study pattern. The research method used was descriptive qualitative. The subjects in this study were Biology students of semester V at Hamzanwadi University. The research instruments consisted of observation sheets to obtain information about the learning process with Lesson Study patterns, as well as essay test instruments to measure students' critical thinking skills. Critical thinking indicators used include the ability to formulate problems, the ability to provide arguments, deductive ability, inductive ability, and evaluation ability. Data analysis was done descriptively and qualitatively. The effectiveness of applying the problem-based learning model to students' critical thinking skills was assessed using the N Gain formula. Based on the N Gain results, the problem-based learning model was quite effective in improving students' critical thinking skills with the following details; the ability to formulate problems was 0.67 (medium), the ability to provide arguments was 0.42 (medium), deductive ability was 0.44 (medium), inductive ability was 0.40 (medium), and evaluation ability was 0.41 (medium). Meanwhile, the learning process with Lesson Study which includes the Plan, Do, and See stages provides valuable learning for the team of lecturers involved when jointly designing learning, observing learning, and reflecting on learning, followed up in the learning process in the class they teach.

Article History
Received: 24-07-2024
Revised: 20-08-2024
Accepted: 30-08-2024
Published: 18-09-2024

Key Words:
Problem Based Learning; Critical Thinking; Lesson Study.

How to Cite: Marhamah, M., Fatmawati, B., Sarwati, S., & Ariandani, N. (2024). How to Train Critical Thinking Skills? : Application of Problem-Based Learning Model Lesson Study Pattern. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran, 10*(3), 1283-1291. doi:https://doi.org/10.33394/jk.v10i3.12751

https://doi.org/10.33394/jk.v10i3.12751

Introduction

The government's policy on an independent curriculum is expected to train 21st-century skills for students. One of the skills in question is critical thinking skills. Critical thinking skills for students are important to be trained in the learning process to prepare them to face problems that will be faced in the present and future. The role of lecturers in training critical thinking skills is essential because it is related to the selection of methods, strategies, and learning models to be used (Risnanosanti, et al. 2019).

Based on observations in the Biology Education study program, fifth-semester students are rarely trained in their critical thinking skills through the learning process, which is indicated by the ability to provide arguments, the ability to analyze, and the ability to make deductive and inductive conclusions that are still low. Based on the problems found, a Lesson Study team consisting of several lecturers of the Biology Education study program was formed. Together with the team of lecturers, the focus of the study that will be planned in overcoming these problems is specifically 'how to train students' critical thinking skills in human physiological anatomy course'. It is in line with the opinion of Ono, et al (2010) who revealed that a Lesson study is a learning study conducted collaboratively by lecturers to

solve learning problems in the classroom. Lesson studies can be conducted collaboratively and continuously in planning, implementing, observing, and reporting the results of learning that has been done (Saito E., et al., 2015, Marhamah, et al., 2016, Lewis, 2019), thus forming a learning community (Betsy Ng. et al., 2022 Marhamah, et al., 2023). In addition, the activities in the Lesson Study will develop the professional skills of the team of lecturers involved (Zubaidah S., 2010, Lewis C., 2020, Chunxia Q., et al., 2022, thus improving the quality of learning (KemenristekDikti, 2018).

The learning process aimed at enhancing critical thinking skills involves the application of the Problem-Based Learning (PBL) model (Kurniahtunnisa et al., 2016; Marhamah et al., 2016; Jamilah F. et al., 2023). This model was chosen because PBL is a student-centered approach that emphasizes learning through problem-solving (Susanti et al., 2020; Liu Y. et al., 2022). According to Dolmans et al. (2005), PBL is characterized by a constructive, independent, collaborative, and contextual philosophy, emphasizing contextual learning and addressing real-world problems relevant to students' lives (Marhamah et al., 2016). The PBL model guides students through solving open-ended problems in several steps: analyzing the problem, setting goals, gathering resources, summarizing ideas, and reflecting on the problem-solving experience (Lin et al., 2010). Several studies have shown that the PBL model positively impacts student learning outcomes (Suciana D. et al., 2023), improves communication skills (Setyawan D. et al., 2021), and enhances both oral and written communication skills (Maridi et al., 2019). However, the specific stages of the PBL process that effectively train critical thinking skills have not been widely discussed (Elaine H.J. et al., 2016). This lesson study will explore in greater depth how each stage of the PBL process can improve students' critical thinking skills.

Research Method

The method in this research was descriptive qualitative, describing two things, namely: (1) how the application of PBL stages in learning with Lesson Study pattern, and (2) how the application of Problem-Based Learning model in improving students' critical thinking skills in human physiological anatomy course. The lesson study was conducted in two cycles. Each cycle was conducted in the stages of Plan, Do, See. Each stage can be seen in Figure 1.

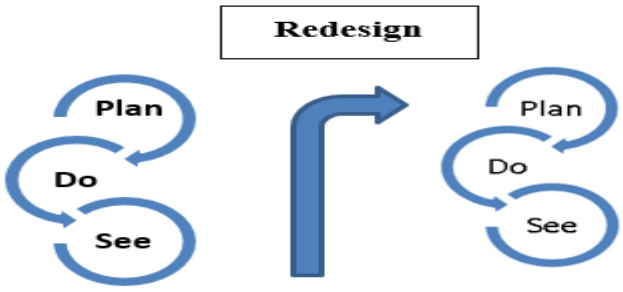

Figure 1. The Lesson Study cycle (Source: Marhamah, et al. 2023)

The subjects in this study were fifth-semester students totaling 17 people. The instruments in this study consisted of (1) observation sheets to get an overview of the application of PBL in the learning process, and (2) essay test instruments to determine the improvement of students' critical thinking skills, which were given before and after the PBL process based on Lesson Study. Critical thinking indicators used include the ability to formulate problems, the ability to provide arguments, deductive ability, inductive ability, and evaluation ability. Data analysis was carried out descriptively and qualitatively based on the results of observations.

Vol. 10, No. 3 : September 2024
E-ISSN: 2442-7667
pp. 1283-1291
Email: jklppm@undikma.ac.id

To determine the increase or effectiveness of the application of the Problem-Based Learning model on students' critical thinking skills, the N Gain formula was used as follows.

$$\text{N Gain} = \frac{\text{Skor Posttest} - \text{Skor Pretest}}{\text{Skor ideal} - \text{Skor Pretest}}$$

N Gain category: Criteria:
$g > 0.7$ = high category
$0.3 \leq g \leq 0.7$ = medium /sufficient category
$g < 0.3$ = low category

Results and Discussion

Based on the research that has been done, the data description is obtained about: (a) the application of problem-based learning model in the learning process with Lesson Study pattern in human physiological anatomy course, and (b) the effectiveness of the application of Problem Based Learning model on students' critical thinking skills.

Lesson Study Implementation In Human Physiology Anatomy Course

Lesson Study on human physiology anatomy course involved five lecturers of biology education study programme. The lesson study was conducted in four cycles, each consisting of Plan, Do, and See stages. The description of the implementation of Lesson Study in human physiology anatomy course in each cycle was described as follows:

Cycle I

a). Plan I

The team of lecturers involved developed a lesson design collaboratively which included: developing learning objectives on Homeostasis material, discussing student learning experiences at each step of problem-based learning, selecting media and learning resources to be used during problem orientation, and determining the schedule for open class.

b). Do I (Open Class)

This stage implemented the Problem-Based Learning model with learning objectives: (1) students are able to analyze the homeostatic mechanism in the human body system, (2) able to provide arguments about the consequences of homeostatic disorders for the body. Stage I, problem orientation, students are played a video about the homeostatic process then the lecturer asks "Why in cold conditions our bodies shiver". Stage II, organizing students to learn, students are directed to form groups to discuss problems that were investigated related to mechanisms and cases of homeostatic disorders. Stage III, guiding students to conduct investigations. At this stage, students in groups look for information about the homeostatic mechanism in one of the cases by using an Android cellphone. The example case discussed is "how the body's mechanism controls blood sugar and what the consequences are if this condition is disturbed". Stage IV, developing and presenting work. All student groups were offered the opportunity to present the results of their investigation or search for information about the case discussed. Other groups put forward their opinions about the cases presented by their friends. Stage V, analyzing and evaluating the problem-solving process. Lecturers together with students reflected and evaluated the learning process that had been carried out, lecturers provided reinforcement and straightened out erroneous concepts. The learning process is shown in Figure 2.

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index
Vol. 10, No. 3 : September 2024
E-ISSN: 2442-7667
pp. 1283-1291
Email: jklppm@undikma.ac.id

Figure 2. The learning process of homeostatic material at Do I stage

c). See I (Reflection)

At the See (reflection) stage, the lecturer team involved conveyed the learning facts found based on the observation results. Some of the learning facts conveyed included: in general, the implementation of learning was carried out as planned, some students still seemed less active in the group discussion process, there were students who dominated the discussion in their groups, some people in the group copied from the internet to answer cases or problems that were solved. The results of the reflection in cycle I were used as learning for improvement in the next stage. The reflection process can be seen in Figure 3.

Figure 3. Learning reflection with the team

Cycle II

a). Plan II

The lecturer team compiled Lesson design on nervous system material. Then discussing learning objectives which must be reached by the student and lecturer activities at each stage of the Problem Based Learning model, discussing what needs to be done in orientation activities, organizing heterogeneous student group members, and selecting learning resources that were used in the learning process of nervous system material.

b). Do II (Open Class)

The learning process at this stage applied the problem-based learning model to the nervous system material. Phase I, problem orientation, began by asking one student at the front of the class to eat the salad that had been prepared. Other students paid attention to their friends and responded to their friends who ate salad. Some responded, "his saliva came out seeing his friend eating salad." Lecturers lead students with questions like "How does the process of saliva come out when seeing his friend eat salad," and "How is it related to the nervous system." Stage II organizes students to learn. Lecturers ordered students to form heterogeneous groups in each group of at least five people. Stage III, guides students to investigate/search for information. At this stage, students in groups looked for information about the mechanism of the nervous system in coordinating one of the body systems, compared the work of the nervous system in ordinary motion and reflex motion, and looked for information about cases of nervous system disorders. Information searches were carried out by utilizing Android phones. Stage IV, developing and presenting work. Stage V analyzes and evaluates the problem-solving process. Lecturers with students reflect and

evaluate the learning process that has been carried out, lecturers provide reinforcement and straighten out erroneous concepts. The learning process on the nervous system material can be seen in Figure 4.

Figure 4. Learning process of nervous system material

c). See II (Reflection)

The second See stage of the lecturer team reflected on the learning process that had been carried out. The reflection process started from the model lecturer who conveyed his feelings and the facts found in the learning process. Furthermore, the team involved conveyed the learning facts found based on the results of their observations. Some of the learning facts conveyed include: in general, the learning implementation process is carried out according to the syntax as planned, some students who previously seemed less active in the group discussion process have begun to be involved, students who dominate in discussions in their groups are asked to provide opportunities for their friends to argue, in evaluating the cases discussed there are still some students looking for answers by copying from the internet. The results of the reflection in cycle II were used as improvements for the learning process in the next stage. The reflection process can be seen in Figure 5.

Figure 5. Learning reflection

Effectiveness of Problem Based Learning Model Application on Students' Critical Thinking Ability

The application of the Problem Based Learning model was effective in improving the critical thinking skills of biology education students in the Anatomy of human physiology course. This can be seen from the data in Table 1.

Table 1. Results of Critical Thinking Ability Gain Score

Critical Thinking Indicator	Pre-test	Post-test	Post-Pre	N Gain	Category
Ability to formulate problems	70,88	90,29	19,41	0,67	Moderate / sufficient
Ability to provide arguments	83,24	90,29	7,06	0,42	Moderate / sufficient
Deductive ability	75,00	85,88	10,88	0,44	Moderate / sufficient
Inductive ability	47,35	68.53	21,18	0,40	Moderate / sufficient
Evaluation ability	28,53	57,65	29,12	0,41	Moderate / sufficient

Based on the data in Table 1, the N Gain results of students' critical thinking skills on all indicators are included in the moderately effective category. When analyzed, indicators of

the ability to formulate problems, the ability to provide arguments, and deductive ability have a high average, while indicators of inductive ability and evaluation have a low average. It is possible because in the learning process when students evaluate the cases discussed, they only take answers from the internet or copy and paste without fully understanding the case.

According to Fakhriyah (2014), the critical thinking ability of each individual varies based on the practice that is given. It is also a finding in the learning process carried out in cycles I and II. The more frequently trained by giving contextual problems will stimulate their critical thinking skills, especially in training the ability to provide arguments. Lesson study is an appropriate pattern for implementing innovative learning (Chunxia Q., et al., 2022) and contextualized, namely problem-based learning models and improving learning quality (Kemenristekdikti, 2018). It is also in line with the research of Ferdianto, et al. 2019 which revealed that critical thinking skills improved with the LS-based PBL model in mathematics learning. In addition, the application of the problem-based learning model can train students to think critically through the stages in it (Marhamah, 2016, Akhdinirwanto B.W., et al., 2020, Darmawati Y., 2023), solve open-ended problems at the stage of analyzing problems and gathering information (Lin et al., 2010).

The cycle stage in the Lesson study is used to try to improve the process of implementing the PBL model based on the learning facts found. For example, organizing students which initially amounted to 6 people per group was found to be less effective during the discussion. The next cycle was reduced to 4-5 people per group. The implementation of problem-based learning affects concept understanding and critical thinking skills because, in the learning process, students are presented with problems with real conditions so that they can train to interpret the problems given (Uliyandari M., et al. 2001), making students remember the concepts they learn longer (Osman A., et al., 2021). According to Sari, W.K., et al., (2023), training students by giving them HOT problems will train critical thinking skills.

Lesson Study provides valuable learning for the team involved on how to implement the problem-based learning model and the things that must be considered in utilizing the learning resources used, such as in finding information to solve the given problem. According to Hidayat A. (2023), Lesson Study provides learning opportunities for model lecturers, for observers involved in it, and has an impact on motivation to improve the learning process (Lewis C., et al., 2019). When a team of lecturers is involved in lesson planning, observing the learning process, and reflecting on learning during LS activities, it will improve teachers' work efficiency and renew their teaching methods (Slavit, D. et al., (2011), and provide experience in meaningful assessment in the learning process (Abate, M. T., et al., 2023). The learning facts found during the observation are used as valuable learning for the lecturers involved with the hope that they can be implemented in their classroom learning. It is in line with the opinion of Chikamori, et al. (2013) who states that the Lesson Study is a collaborative, cyclical, and sustainable professional development process, which aims to improve the quality of learning through critical reflection (Marhamah, et al. 2016), and form a learning community (Betsy Ng, et al., (2022) Marhamah, et al., (2023).

Conclusion

The application of problem-based learning models based on Lesson Study is effective in improving critical thinking skills on the indicators of ability to formulate problems, ability to provide arguments, and deductive ability. The stages of Lesson Study provide valuable learning for the team involved starting from designing learning at the Plan stage, observing the learning process at the Do stage, and reflecting on the learning that has been done at the

See stage. Thus, Lesson Study facilitates lecturers to improve their professionalism through the learning community.

Recommendation

Using learning resources in the form of mobile phones in learning needs to be considered when asking students to analyze and evaluate a problem. Students should understand the concepts given so that they can relate to the problem to be solved. The role of lecturers is essential in guiding students in each stage of the application of the PBL model.

Acknowledgment

We would like to thank the Ministry of Resources and LPDP for funding this programme, which is the implementation of Lesson Study on learning in higher education. Thanks also goes to the team of lecturers of the biology education study programme involved in this Lesson Study activity.

References

Akhdinirwanto B.W., Agustini, B., dan Jatmiko B., (2020). Problem Based Learning with Argumentation as a Hypothetical Model to Increase the Critical Thinking Skills for Junior High School Students. Jurnal Pendidikan IPA Indonesia. Vol. 9, Nomor 3 (2020). ISSN 2089-4392. https://doi.org/10.15294/jpii.v9i3.19282

Betsy Ng., and Aneesah L (2022). Exploring students' tive. *International Journal for Lesson and Learning Studies. Vol 11, Issue 3*. pp. 193-204

Chikamori, Kensuke; Ono Yumiko; Rogan, John. (2013). A Lesson Study Approach to Improving a Biology Lesson). *African Journal of Research in Mathematics, Science and Technology Education*, Vol.17, No.1-2, p:14-25 2013. https://doi.org/10.1080/10288457.2013.826967

Chunxia Qi, Mun Yee Lai, Lizhe Liu, Siyu Zuo, Haili Liang and Ruisi Li. (2022). Examining Teachers' Learning Through A Project-Based Learning Lesson Study: A Case Study In China**.** International Journal for Lesson and Learning Studies 12(2). Vol. 12 No. 1, pp. 106-119. DOI:10.1108/IJLLS-09-2022-0127

Darmawati Y., dan Mustadi A., (2023). The Effect of Problem Based Learning on The Critical Thinking Skills of Elementary School Students. Jurnal Prima Edukasia, Vol. 11, Nomor 2 (2023). ISSN 2460-9927. https://doi.org/10.21831/jpe.v11i2.55620

Dolmans, W. De Grave, I. Wolfhagen, C.P.M. van der Vleuten Problem-based learning: future challenges for educational practice and research Med Educ, 39 (7) (2005), pp. 732-741. https://doi.org/10.1111/j.1365-2929.2005.02205.x

Elaine H.J. Yew, Karen Goh, (2016). Problem-Based Learning: An Overview of its Process and Impact on Learning. Health Professions Education, Volume 2, Issue 2, December 2016, Pages 75-79. https://doi.org/10.1016/j.hpe.2016.01.004

Fakhriyah, (2014). Penerapan Problem Based Learning dalam Upaya Mengembangkan Kemampuan Berpikir Kritis Mahasiswa. Jurnal Pendidikan IPA Indonesia. Vol.3, No.1. 95-101. (2014). DOI: https://doi.org/10.15294/jpii.v3i1.2906

Ferdianto and N B Ningrum. (2019). Lesson study: Increasing mathematical critical thinking ability? Journal of Physics: Conference Series: 1375 012074. DOI 10.1088/1742-6596/1375/1/012074.

Hidayat A., High Quality Lesson Study. Makalah Disampaikan pada In Class Training I, Kemitraan Dosen dan Guru di Sekolah

Jamilah F., Wahyuni P., and Septarianto T.W., (2023). The Effect of the Problem Based Learning Model on Students Critical Thinking Ability. International Journal of Language Education and Cultural Review (IJLECR). Vol. 9, No. 1. ISSN: ISSN: 2461-131x. https://doi.org/10.21009/ijlecr.v9i1.37837

Kementerian Riset, Teknologi dan Pendidikan Tinggi, (2018). Pedoman Program Short Term Training On Lesson Study (STOLS).

Kurniahtunnisa, Dewi N.K., dan Utami N.R., (2016). Pengaruh Model Problem Based Learning terhadap Kemampuan Berpikir Kritis Siswa Materi Sistem Ekskresi. Journal of Biology Education Vol 5 No. 3. ISSN: 2540-833X. https://doi.org/10.15294/jbe.v5i3.14865

Lewis C., Friedkin S., Emerson K., Henn L., and Goldsmith L., (2019). How Does Lesson Study Work? Toward a Theory of Lesson Study Process and impact. https://files.eric.ed.gov/fulltext/ED597592.pdf

Lewis C., (2020). Lesson Study. The Core of Japanese Professional Development. https://www.researchgate.net/publication/228588884

Liu Y., and Pasztor, (2022). Effect of Problem Based Learning Instructional Intervention on Critical thinking in Heigher Education: A meta Analiysis. Thinking Skills and Creativity 45 (2022). https://doi.org/10.1016/j.tsc.2022.101069

Lin CF., Lu, M.S., Chung, C.C., Yang C.M., (2010). A Comparison of Problem Based Learning and Conventional reaching in Nursing Ethics Education. Nursing Ethics, 17 (3) 2010. https://journals.sagepub.com/doi/10.1177/0969733009355380

Marhamah, Irawati M.H., Susilo H., dan Ibrohim, (2016). Improving Critical Thinking Skills through the Integration of Problem Based Learning and Group Investigation. *International Journal for Lesson and Learning Studies, Vol 5. No.1. pp 36-44.* ISSN: 2046-8253. http://doi.org/10.1108/IJLLS-10-2014-0042.

Marhamah, Maimunah, Amin, K., (2023). Practicing 21st Century Skills for SMPN 1 Aikmel Students through A Scientific Approach with a Lesson Study Model. BIOEDUKASI, Jurnal Pendidikan Biologi, Vol. 16, No.1 2023. E-ISSN: 2549-0605. https://doi.org/10.20961/bioedukasi-uns.v16i1.70335

Marhamah, Rohmi Dj., Hartini H. Pendampingan Lesson Study di SMPN 1 Aikmel Dalam Membentuk Komunitas Belajar. Proceeding Biology Education Conference. Vol. 20, No. 1 (2023). 3025-339X

Maridi, Suciati Suciati, Bella Mawar Permata, (2019). *Peningkatan keterampilan Komunikasi Lisan dan Tulisan melalui Model Pembelajaran* Problem Based Learning pada Siswa Kelas X SMA. BIOEDUKASI, Jurnal Pendidikan biologi. ISSN: 549-0605. Vol 12, No 2. (2019). DOI: https://doi.org/10.20961/bioedukasi-uns.v12i2.31932

Melaku Takele Abate, Abbi Lemma Wedajo, Adula Bekele Hunde. (2023). Design-Based Research to Develop Lesson Study for Transformative Assessment: Teachers' Reactions, Learning, Organizational Support, and Use. International Journal for Lesson and Learning Studies. ISSN: 2046-8253. Vol. 12 No. 3, pp. 257-271. https://doi.org/ 10.1108/IJLLS-05-2023-0059.

Ono Yumiko dan Johanna Ferreira, (2010). A Case Study of Contiuning Teacher Profesional Development through Lesson Study in South Africa. *South African Journal of Education, Vol.30, No.1., p 59-74. 2010.* ISSN-0256-0100 http://www.sajournalofeducation.co.za/index.php/saje/index

Osman Ali dan Kriek J., (2021). Science Teachers' Experiences when Implementing Problem-based Learning in Rural Schools. African Journal of Research in

Mathematics Science and Technology Education 25(2):148-159. https://doi.org/10.1080/18117295. 2021.1983307

Risnanosanti, D Susyla and M Syofiana. (2019). Developing students critical thinking ability through lesson study. Journal of Physics; Conference series, 1320 012005. DOI 10.1088/1742-6596/1320/1/012005

Saito E., and Atencio M., (2015). Lesson Study for Learning Community (LSLC): Conceptualising Teachers Practices within a Social Justice Perspective. Disscourse: Studies in Cultural Politics of Education. 36 (6), 795-807, http://doi.org/10.1080/01596306.2014.968095.

Sari W.K., dan Utami U., (2023). High-Order Questions Improve Student' Critical Thinking Skills In Elementary Schools. International Journal of Elementary Education. Vol. 7, Nomor 2, Tahun 2023, pp.196-203. ISSN: 2549-6050. http://doi.org/ 10.23887/ijee.v712.61607.

Setyawan D., Auliyah Shofiyah, Thesa Ihtiar Dimlantika, Yunita Trietika Sakti, Herawati Susilo. (2021). Implementation of problem-based learning model through lesson study on student communication skills. *AIP Conference Proceedings.* Vol. 2330, Issue 1 March 2021. https://doi.org/10.1063/5.0043165

Slavit, D., Kennedy, A., Lean, Z., Nelson, T.H. and Deuel, A. (2011), "Support for professional collaboration in middle school mathematics: a complex web", Teacher Education Quarterly, Vol. 38 No. 3, pp. 113-131.

Suciana D., Hartinawati, Inas Sausan, Meliza. A Meta-Analysis Study: The Effect of Problem Based Learning Integrated with STEM on Learning Outcomes. European Journal of Education and Pedagogy. Vol. 4., No. 2. 2023. https://doi.org/10.24018/ejedu. 2023.4.2.619

Susanti, Yuli I.S., (2020). Improving Students' Critical Thinking Ability Through Lesson Study Activities Nelya Eka. Advances in Social Science, Education and Humanities Research, volume 542 Proceedings of the 2nd Annual Conference on Social Science and Humanities (ANCOSH 2020). ATLANTIS PRESS.

Uliyandari M., Candrawati E., Herawati A.A., dan Latipah N., (2021). Problem Based Learning to Improve Concept Understanding and Critical Thinking Ability of Science Education Undergraduate Student. Vol. 2, Nomor 1. January 2021. ISSN: 2721-7965. https://doi.org/10.46245/ijorer.v2i1.56

Zubaidah S., (2010). Lesson Study sebagai Salah Satu Model Pengembangan Profesionalisme Guru. Makalah Disampaikan pada Pendidikan dan Pelatihan Nasional dengan Tema Peningkatan Profesionalisme Guru melalui Kegiatan Lesson Study, April 2010 di Universitas Brawijaya Malang.