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Implementation of project-based learning containing ESD to improve students' creative thinking skills

Adetia Yeyen Purnamasari[1], Nuryani Rustaman[1], Widi Purwianingsih[1], Weni Lestari[2]
[1]Universitas Pendidikan Indonesia, Indonesia
[2]Universitas Islam Negeri Raden Fatah Palembang, Indonesia

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ABSTRACT

21st century learning demands critical thinking, creativity, collaboration and communication competencies. Therefore, integrating 21st century skills into the learning process effectively is very important, both teachers and students are expected to be able to master these skills. However, there are still many students who have not mastered 21st century skills, one of which is creative thinking skills. To achieve this competency, students need to experience a supportive process, active learning, and involve the problems around them, one of which is learning using PjBL which contains ESD. The data collection technique uses case-based essay questions about the diversity of wild plants in the area. Data were analyzed using the N Gain test, normality test, homogeneity test and hypothesis test. The research was conducted over five meetings with the implementation of PjBL containing ESD which aims to improve students' creative thinking skills. The results of the research that has been carried out show that the creative thinking skills of students in the experimental group obtained an average N Gain value of 0.58 in the medium category, while in the control group an N-Gain value of 0.25 was obtained in the low category. So it can be concluded that the use of the PjBL model containing ESD can improve students' creative thinking skills.

Corresponding Author:

Nuryani Rustaman,
Universitas Pendidikan Indonesia
Email: nuryanirustaman@upi.edu

Introduction

21st century learning demands competence in critical thinking, creativity, collaboration, communication.Creative thinking is one of the skills that must be mastered by every individual in the 21st century. Apart from that, this skill can help individuals in everyday life and in society. By thinking creatively, someone is able to solve a problem from a different perspective so that they can give birth to new ideas and solutions. Creative thinking involves cognitive activities that individuals use based on certain objects they face, whether in the form of problems or unfavorable situations. Creative thinking encourages students to formulate new and authentic designs, as well as different hypotheses to find new solutions to solve problems (Biazus & Mahtari, 2022).Creative thinking is considered a skill required to develop original ideas to face challenges that require adaptive solutions(Behnamnia et al., 2020). According to Torrance (1977), creative thinking skills include six indicators, namely sensitivity to problems, fluency, flexibility, originality, elaboration and redefinition. According to Guilford, indicators of creative thinking consist of fluency (generating ideas in the creative

process), flexibility (finding ideas in various categories), originality (uniqueness of ideas), and elaboration (additional details)(Sugiyanto et al., 2018).

Therefore, integrating 21st century skills in the learning process effectively is very important, both teachers and student teachers are expected to be able to master these skills. However, it is still found that many students have not mastered 21st century skills. Sulistyaningrum et al (2019) in their research stated that 21st century skills including critical thinking, communication, collaboration and student creativity still show low results. The low level of 4C skills is caused by learning which is still lecturer-centered which causes a lack of opportunities for students to think and develop their potential, the learning atmosphere is passive and less enjoyable, which actually makes it difficult for students to understand the material (Yuliati, 2017).(Ardiansyah et al., 2022)in his research stated that the low level of 21st century skills was due to the less than optimal education system in Indonesia, this was motivated by the less than optimal learning process in the classroom.To achieve these competencies, students need to experience a supportive process, one way is by carrying out student-centered learning, active and collaborative learning(Paristiowati et al., 2022). Project-based learning (PjBL) is an example of a student-centered learning model that allows students to learn to build their own learning experiences independently. PjBL is effectively used to develop 21st century skills in students because it involves information and media literacy, collaboration, interpersonal communication, teamwork, leadership, critical thinking, problem solving, as well as creativity and innovation(Tsybulsky & Sinai, 2022).

Project-based learning (PjBL) is a learning model that emphasizes active learning where students are involved in completing real projects or tasks that require the application of their knowledge and skills to achieve certain goals. Currently, project-based learning has been integrated with a particular method or approach. For example, research conducted by(Prajoko et al., 2023)PjBL is integrated with a STEM (Science, Technology, Engineering, and Mathematics) approach showing the results that the use of PjBL with a STEM approach influences student understanding of concepts and creativity. By integrating PjBL with a STEM approach, learning becomes more active, developing critical thinking skills, collaboration, and relevance to the real world. However, this requires teacher readiness and more resources when implementing it. In learning, integrating PjBL with ESD can also be an option for teachers and lecturers because PjBL containing ESD can develop practical skills such as problem solving, collaboration, communication and leadership needed to face complex global challenges. Help students to understand the relationship between different aspects of sustainable development, such as social, economic and environmental dimensions. Students will learn to view global problems from various perspectives and consider the impact of their actions. So it can be said that PJBL containing ESD is learning that is centered on students, to be actively involved in the process and related to the problems around them. The learning contains ESD values related to economic, social and environmental aspects. Students are required to solve problems, make decisions and be responsible for producing products that have long-term benefits. PjBL containing ESD is expected to help students improve thinking skills, especially creative thinking.

In the teaching process, teaching strategies must support biology learning. One of the most complex biological materials is material that discusses biodiversity. The current generation, especially children and teenagers, are the hope for preventing the loss of biodiversity and natural resources (Morar & Peterlicean, 2012;Coracero et al., 2022). However, the fact is that in areas such as rural areas there are still many types of wild plants that are neglected, considered to be weeds even though these plants may have benefits as medicinal plants or plants that have sales value. One example of a plant that was previously considered a wild plant is ciplukan (Physalis angulata L.)Ciplukan has a number of benefits for humans, ciplukan fruit now has a high selling value in several developed countries such as the United States. Abroad this fruit is known as morel berry, golden berry and also cape gooseberry. In fact, in Indonesia this fruit is considered a wild plant and some people still eradicate this plant. Because some people are not aware of it (Rustaman, 2015). Therefore, it is hoped that student teachers will be able to take advantage of environmental conditions to support learning activities. Educating them from an early age can help improve their perspectives and become champions of biodiversity through active involvement in conservation and protection of natural resources(Šoryte& Pakalniskiene, 2019). Simply put, the younger generation will appreciate biodiversity more, especially the diversity of plants around them. Conservation of biological natural resources is an important foundation for the sustainable development process because it reflects a caring attitude towards the environment.

This is in accordance with the principles of ESD (Education for Sustainable Development). The principle of sustainable development focuses simultaneously on human life now and in the future. ESD means creating and living human life on earth in a way that does not destroy life, but maintains various forms of life for the future, not only for human life in the present. The application of ESD aims to encourage students to develop high-level thinking skills through decision making, solving problems, taking responsibility, and evaluating (Paristiowati et al., 2022). Sustainable education (ESD) is a vehicle for achieving sustainable development

goals (SDGs) (Kioupi&Voulvoulis, 2019). Education is the most strategic way to instill and implement the values of sustainable development. In addition, education is considered the most effective in encouraging sustainable development and increasing human capacity to be able to overcome environmental and development issues and problems. ESD also allows students to take part and be responsible for creating a sustainable society (Vilmala et al., 2022).

Implementing PjBL with ESD content in it can provide a learning experience that is not only useful in the present, but will have an impact in the future. Students must know the importance ofunderstanding and implementing ESD values in everyday life. Through ESD-infused PjBL, students not only gain knowledge and skills for today, but also develop attitudes and commitment to sustainable practices that they can apply throughout their lives. The novelty of the research that has been conducted highlights the great potential of PjBL containing ESD to not only improve students' creative thinking skills but also to prepare them to become future leaders who care and are responsible for global challenges, especially related to the problem of plant diversity in Indonesia. Based on these reasons, research was conducted by implementing project based learning (PjBL) containing ESD to improve creative thinking skills in students.

Method

The research design used is a quasiexperimental design method which uses a control class as a comparison (Creswell, 1994).The aim of this research is to determine the effectiveness of using PjBL with ESD mutants in improving students' creative thinking skills. The research design used was a non-equivalent control group design. This research was carried out from December 2023 to April 2024 at one of the PTNs in Palembang City. The reason PTN was chosen based on initial observations was because students had never previously taken a creative thinking skills test. The tests that students usually take lead to cognitive knowledge tests only. The research subjects were 4th semester students who were studying the Taxonomy of Vascular Plants course. Learning using PjBL containing ESD was carried out over five meetings. Students create projects in the form of booklets and other creative products. The ESD-loaded PjBL syntax used refers to the developed syntax(Larmer et al, 2015)There are four syntaxes, namely the first, launching the project, carried out at meetings one and two, second, building knowledge, understanding and skills, carried out at the third meeting, third, developing, criticizing and revising the product, carried out at the fourth meeting, and the fourth, namely presenting the product, carried out at the fifth meeting.

The instruments used are essay questions and student worksheets (LKM). The instruments that have been created and developed are assessed by experts, then revised according to the suggestions given by the experts. Next, it is tested on students in small groups, then tested for validity, reliability, distinguishing power and also the level of difficulty of the questions. Then the instrument is ready to be used in research. The creative thinking ability test is measured using case-based essay questions related to the diversity of wild plants around. The essay questions given are 8 questions from 4 indicators of creative thinking skills. The question grid can be seen in Table 1.

Table 1. Test Question Grid

No	Indicator	Number of questions	Percentage %
1	Fluency	2	25%
2	Flexibility	2	25%
3	Originality	2	25%
4	Elaboration	2	25%
Amount		**8**	**100%**

Results and Discussions

After conducting research using PjBL containing ESD in the vascular plant taxonomy course, data was obtained through pre-tests and post-tests which were used to measure students' creative thinking skills. The results of the research data tested for normality and homogeneity can be seen in Tables 2 and 3, then analyzed whether there are differences. Data is assessed according to the assessment rubric. Through this average, hypothesis testing and N-Gain testing are then carried out. A recapitulation of descriptive statistical analysis of creative thinking skills can be seen in Table 4.

Table 2. Normality Test

Tests of Normality							
	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	df	Sig.
Results	Experimental pretest (PjBL ESD)	,098	29	,200*	,962	29	,367
	Experimental posttest (PjBL ESD)	,187	29	.011	,931	29	,060
	Pretest control (Conventional)	,148	23	,200*	,943	23	,209
	Control posttest (Conventional	,162	23	,119	,939	23	.173

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

On Table 2 The data that has been obtained is normally distributed, then it will be continued with a homogeneity test.

Table 3. Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistics	df1	df2	Sig.
Results	Based on Mean	5,653	3	100	,001
	Based on Median	4,729	3	100	,004
	Based on Median and with adjusted df	4,729	3	83,608	,004
	Based on trimmed mean	5,659	3	100	,001

The results of Table 3, the data that has been obtained is not homogeneous but is still continued with parametric statistics. Independent samples T test is also a requirement for carrying out the N-Gain test. T Test results can be seen in table 4.

Table 4. Recapitulation Of Statistical Analysis Of Creative Thinking Skills From Two Groups

Data Type		Post-test	Post-test
Class		Experiment	Control
N		29	23
Average		80.06	63.04
Standard Deviation		6,545	10,176
Minimum Value		65.62	46.87
Maximum Value		90.62	81.25
Hypothesis Testing Independent sample T-test	Sig.	0.00	
	Int	There are Differences	
N-Gain Test	Sig.	0.58	0.25
	Int.	Currently	Low

Based on the recapitulation results in Table 5, the results of hypothesis testing for creative thinking skills from the experimental group and control group can be determined using the Independent T test. This test was carried out because the pre-test and post-test results from both groups were normally distributed, but the data was not homogeneous but was still continued with parametric statistics. Independent samples T test is also a requirement for carrying out the N-Gain test. In Table 4.3, the results of the Independent samples T test with sig. 0.00 < 0.05, so H0 is rejected while H1 is accepted. So it can be said that the average results of the two groups are different. The next stage was to carry out the N-Gain test for both research groups. The N-Gain Index categories refer to the criteria developed by(Hake, 2002). The results of the N-gain test in the experimental group obtained an average score of students' creative thinking skills with an N-gain achievement of 0.58 or 58.80% and was categorized as medium. For the control class, the average score for students' creative thinking skills was achieved with an N-gain of 0.25 or 25.39% and was categorized as low. It can be said that the application of PjBL containing ESD in the learning process in the vascular plant taxonomy course can improve students' creative thinking skills compared to using conventional learning models. This is in line

with research conducted by(Eka Putri et al., 2024)which states that implementing learning using the PjBL model can improve students' creative thinking skills and creativity.One way to improve students' creative thinking skills in biology learning is to implement learning that encourages students to be good thinkers and able to provide many alternative answers to a problem(Lutfiah et al., 2021).

Project-based learning with ESD content in it is a very effective learning model for improving creative thinking skills because PjBL presents real contexts or real problems that students know directly, thereby encouraging students to look for effective solutions. This is in line with research conducted by(Lubis et al., 2024)which states that project-based learning has a positive effect in improving 21st century skills, one of which is creative thinking skills. PjBL can also encourage collaboration, because in general project-based learning activities are teamwork. Apart from that, PjBL can also involve problem solving skills and train students to be responsible for the projects they are working on. In project learning,students learn actively through real experience. Students not only consume information, but apply it in a relevant context, which naturally encourages creative thinking. Apart from creative thinking skills, project learning also helps in the development of other skills such as teamwork, effective communication, time management, and leadership, all of which support creative thinking skills. Overall, PjBL not only improves conceptual understanding, but also promotes the development of creative thinking skills that are important in facing real-world challenges and advancing innovation in various areas of life.

Based on data from the results of creative thinking skills tests carried out by both groups, namely the experimental group and the control group, data on creative thinking skills was obtained from each indicator, namely fluency, flexibility, originality and elaboration indicators. A recapitulation of the average N-Gain for each indicator of creative thinking skills can be seen in Table 5.

Table 5. Average Recapitulation Of Each Indicator Of Creative Thinking Skills

No	Indicator	Experiment		Control	
		N-Gain Value	Category	N-Gain Value	Category
1	*Fluency*	0.67	Currently	0.29	Low
2	*Flexibility*	0.82	Tall	0.17	Low
3	*Originality*	0.80	Tall	0.11	Low
4	*Elaboration*	0.58	Currently	0.04	Low

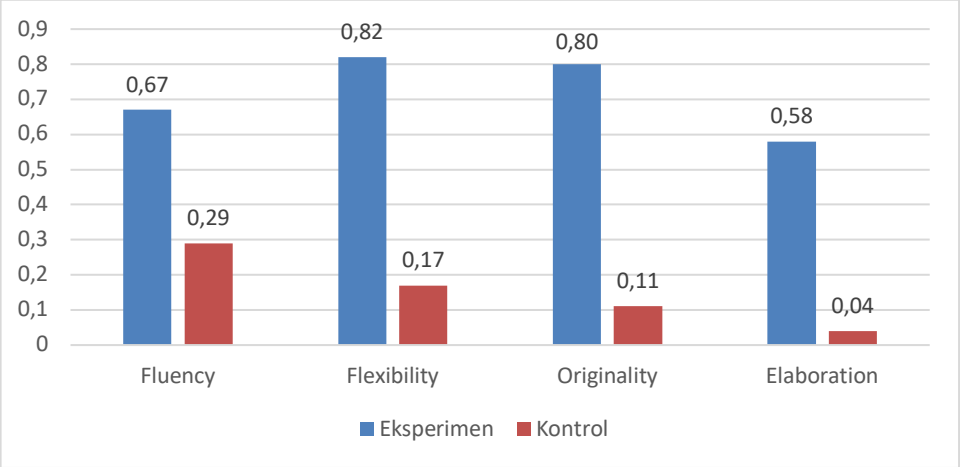

Figure 1. Average of Each Indicator

The recapitulation results for each indicator show that in the experimental class there are two indicators, namely indicators of flexibility and originality which are relatively high, students can see a problem from a different perspective, think of various answers to a question or problem. Students are able to think of new, unique and unusual ways to answer a problem. Fluency and elaboration indicators are in the medium category. Students still lack detail, the ideas conveyed by students are conveyed broadly, and there is less focus on the problems given. In the control class, the four indicators of creative thinking ability were in the low category. In experimental class learning, students create projects in the form of booklets, herbariums and also products that can be utilized from wild plants in the area. When creating projects, students are given an understanding of ESD values, so that they can motivate students to change behavior and take useful actions in

everyday life. In control classes, learning is passive and only focuses on the lecturer, students do not make direct observations so that the learning carried out is less impressive and boring.

So it can be said that the application of PjBL with the ESD mutant is quite effective in improving students' creative thinking skills. Efforts that can be made to improve creative thinking skills are by using innovative learning models, one of which is the project-based learning model (Oktadifani et al., 2017). Through project-based learning, students can train their thinking skills which lead to critical and creative thinking skills. To train creative thinking skills, it is carried out based on the stages in making a project which requires innovation and creativity in making products. Students become motivated in learning, lecturers only act as facilitators and mediators(Chandra & Siskawati, 2021). Students' creative thinking skills can be improved using the Project Based Learning model in the learning process(Rahman et al., 2023).

Figure 2. a. Booklet, b. Herbal Tea

Students are required to find solutions regarding wild plants around them and how to preserve these plants. students identify wild plants first, so that students know that wild plants also have a number of benefits, a booklet is made containing information about wild plants, their use and how to manage them, and contains ESD values in them. Apart from that, students try to make derivative products from these plants that can be used by the wider community. Students make their processed products from purple button grass (Boreria laevis). This processed product can be consumed with honey as an additional sweet taste, can treat gout, diarrhea and so on, but its effectiveness has not been tested. The students immediately tried tasting the drink and there was no reaction whatsoever. However, this research focuses on how students think creatively, so the products produced need further research. Creative thinking is a person's ability to produce new ideas or useful solutions. This involves the ability to see a problem from a different point of view, creating something new or even unexpected. Creative thinking is very important and has a number of benefits for oneself and society. By thinking creatively, someone can produce innovation, solve problems, increase flexibility, creativity and develop potential.

Using PjBL containing ESD in learning certainly has a number of advantages and disadvantages. The advantage of learning using PjBL with ESD content is that it can motivate students to learn, in this case learning is carried out not only in the classroom, students also carry out observation activities in the field so that it provides a new atmosphere, trains students' abilities in finding solutions to real problems in the field, Students are required to be active in their learning. The disadvantage of using PjBL containing ESD is that learning takes longer, so some students will feel bored. Based on the results of research that has been carried out, PjBL containing ESD can be used as innovation in learning, there are several recommendations that the author proposes so that they can be taken into consideration when conducting further research. The recommendation is that it can be considered to conduct research regarding the extent to which PjBL contains ESD to improve creative thinking skills in other courses that have sequential and continuous material and also on other 21st century skills. It can be considered to conduct research that focuses on products. creative materials that can be marketed or used by the wider community, can be considered for developing PjBL learning designs containing ESD that can save more time or for courses that have more than 2 credit hours.

Conclusions

Based on the research that has been conducted, the results of the N-gain test in the experimental group obtained an average score of students' creative thinking skills with an N-gain achievement of 0.58 which is categorized as medium. In the control class the average score of students' creative thinking abilities with an N-gain of 0.25 was categorized as low. Based on the N-gain results obtained, it was concluded that the

application of PjBL containing ESD in the learning process can improve students' creative thinking and collaboration skills compared to using conventional learning models or lectures.

References

Ardiansyah, AS, Agung, GH, Cahya, ND, & Dinasari, A. (2022). Efforts to Develop 4C Skills through Challenge Based Learning. PRISMA, Proceedings of the National Seminar on Mathematics, 5, 627–637. https://journal.unnes.ac.id/sju/index.php/prisma/

Behnamnia, N., Kamsin, A., & Ismail, MAB (2020). The landscape of research on the use of digital game-based learning apps to nurture creativity among young children: A review. Thinking Skills and Creativity, 37(May), 100666. https://doi.org/10.1016/j.tsc.2020.100666

Biazus, M. de O., & Mahtari, S. (2022). The Impact of Project-Based Learning (PjBL) Model on Secondary Students' Creative Thinking Skills. International Journal of Essential Competencies in Education, 1(1), 38–48. https://doi.org/10.36312/ijece.v1i1.752

Chandra, FE, & Siskawati, FS (2021). Project Based Qtl Learning in Web Form to Increase Motivation and 4C Thinking Skills. Sigma, 7(1), 12. https://doi.org/10.36513/sigma.v7i1.1187

Coracero, EE, Facun, MCT, Gallego, RJ, Lingon, MG, Lolong, KM, Lugayan, MM, Montesines, KBG, Sangalang, LR, & Suniega, MJA (2022). Knowledge and Perspective of Students Towards Biodiversity and its Conservation and Protection. Asian Journal of University Education, 18(1), 118–131. https://doi.org/10.24191/ajue.v18i1.17178

Creswell, J. W. (1994). Research design: Qualitative and quantitative approaches. Sage Publications, Inc.

Eka Putri, F., Hidayati Public Health Sciences, Faculty of Medicine and Health Sciences, Jambi University, Jl Letjen Soeprapto no, F., Jambi, K., Jambi, P., autor, C., & Article, I. (2024). Biodik: Scientific Journal of Biology Education Increasing Student Creativity and Learning Outcomes Through the Project Based Learning Model (Increasing Students' Creativity And Learning Outcomes Through The Project Based Learning Model). 10, 91–100. https://online-journal.unja.ac.id/biodik

Hake, R.R. (2002). . Relationship of Individual Student Normalized Learn Gains in Mechanics with Gender, High-School Physics, and Pretest Scores on Mathematics and Spatial Visualization. [On line].

Kioupi, V., & Voulvoulis, N. (2019). Education for sustainable development: A systemic framework for connecting the SDGs to educational outcomes. Sustainability (Switzerland), 11(21). https://doi.org/10.3390/su11216104

Larmer, J., Mergendoller, J., & Boss, S. (2015). Setting the standard for project based learning. ASCD.

Lubis, DC, Khoiroh, F., Harahap, S., Syahfitri, N., Sazkia, N., & Siregar, NE (2024). Project Based Learning: Developing 21st Century Skills in the Classroom Project Based Learning: Developing 21st Century Skills in the Classroom. 4(1), 1292–1300.

Lutfiah, I., Suharti, P., & Asy'ari, A. (2021). Improving Students' Creative Thinking Skills through the IBSC (Investigation Based Scientific Collaborative) Learning Model Based on E-Learning. SEJ (Science Education Journal), 5(2), 85–97. https://doi.org/10.21070/sej.v5i2.1572

Paristiowati, M., Rahmawati, Y., Fitriani, E., Satrio, JA, & Hasibuan, NAP (2022). Developing Preservice Chemistry Teachers' Engagement with Sustainability Education through an Online, Project-Based Learning Summer Course Program. Sustainability (Switzerland), 14(3). https://doi.org/10.3390/su14031783

Prajoko, S., Sukmawati, I., Maris, AF, & Wulanjani, AN (2023). Project Based Learning (Pjbl) Model With Stem Approach on Students' Conceptual Understanding and Creativity. Indonesian Journal of Science Education, 12(3), 401–409. https://doi.org/10.15294/jpii.v12i3.42973

Rahman, N., Nizaar, M., & Sabaryati, J. (2023). Profile of Students' Creative Thinking Skills and Efforts to Improve Them through the Project Based Learning Model. Swordsman: Journal of…, 6(2), 162–166. https://journal.ummat.ac.id/index.php/detikar/article/view/16865%0A https://journal.ummat.ac.id/index.php/detikar/article/download/16865/pdf

Šoryte, D., & Pakalniškiene, V. (2019). Why it is important to protect the environment: reasons given by children. International Research in Geographical and Environmental Education, 28(3), 228–241. https://doi.org/10.1080/10382046.2019.1582771

Sugiyanto, FN, Masykuri, M., & Muzzazinah, M. (2018). Analysis of senior high school students' creative thinking skills profile in Klaten regency. Journal of Physics: Conference Series, 1006(1). https://doi.org/10.1088/1742-6596/1006/1/012038

Sulistyaningrum, H., Winata, A., & Cacik, S. (2019). Analysis of Initial Ability of 21st Century Skills for Prospective Elementary School Teacher Students. Indonesian Journal of Basic Education, 5(1), 142. https://doi.org/10.29407/jpdn.v5i1.13068

Tsybulsky, D., & Sinai, E. (2022). IoT in Project-Based Biology Learning: Students' Experiences and Skill

Development. Journal of Science Education and Technology, 31(4), 542–553. https://doi.org/10.1007/s10956-022-09972-1

Vilmala, BK, Karniawati, I., Suhandi, A., Permanasari, A., & Khumalo, M. (2022). A Literature Review of Education for Sustainable Development (ESD) in Science Learning: What, Why, and How. Journal of Natural Science and Integration, 5(1), 35. https://doi.org/10.24014/jnsi.v5i1.15342

Yuliati, L. (2017). Building Pedagogical Content Knowledge of Physics Teacher Candidates Through Field Experience Practice Based on Lesson Study. Momentum: Physics Education Journal, 1(1), 16. https://doi.org/10.21067/mpej.v1i1.1629