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Transformation of Creative Thinking Skills and Environmental Concern with PBSL Learning in Geography Class

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Abstract
The ability to think creatively is an important skill that must be possessed by 21st century students, while an attitude of caring for the environment is an important foundation in maintaining the balance of nature. This study aims to: (1) measure the influence of Project Based SCAMPER Learning (PBSL) on students' creative thinking skills, and (2) evaluate the influence of PBSL on environmental care attitudes. This research was conducted at SMAN 1 Ngadiluwih with a sample of students in class X, consisting of 36 students in the experimental class and 36 students in the control class. Data were collected using creative thinking skills tests and environmental care questionnaires, and analyzed using statistical tests, including normality, homogeneity, and two-way ANOVA tests. The results show that PBSL has a significant impact on students' creative thinking skills, especially on the originality indicator, which has experienced the greatest improvement. Students are able to produce innovative new ideas in the field of education.

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INTRODUCTION

Geography as a scientific discipline not only studies physical phenomena and the natural environment, but also links human activities with the surrounding environment. The interaction between humans and nature is very important in understanding the various spatial changes that occur in the world (Stoltman et al., 2017). Geography education plays an important role in teaching

students about spatial variability and the importance of maintaining environmental sustainability. Thus, students are expected to be able to make environmentally sound decisions that support sustainable development (Wibowo et al., 2023). In the Indonesian context, the education curriculum has undergone several changes, one of which is the implementation of the Independent Curriculum which prioritizes project-based learning (PBL). However, the implementation of project learning in senior secondary schools (SMA) is still limited, where the role of teachers tends to be dominant and students are less actively involved in developing creative ideas. This shows that even though projects have been introduced, students are not yet fully accustomed to thinking innovatively and creatively in solving problems (Guo et al., 2020). The importance of creative thinking skills in modern education cannot be denied. Creative thinking enables students to face real-world challenges and helps them find innovative solutions. This capability includes steps such as observing problems, identifying causes, and implementing solutions that can be applied in various contexts, including environmental issues (Nagel, 2008). This is where the role of geography education becomes crucial because it trains students to deal with real problems in their environment.

However, one of the main challenges in implementing project-based learning is the top-down approach which is still dominant in Indonesia. In this approach, teachers often provide material directly to students, and opportunities for students to develop their creativity are limited (S Y Chen et al., 2019). As a result, students lack critical and independent thinking skills that are important in problem solving, especially in the context of increasingly complex global environmental changes. The PBL model itself has been proven to be an effective teaching method in improving students' critical and creative thinking skills. With PBL, students are invited to choose real problems that they are interested in and try to find solutions through group discussions, problem analysis, and presentation of results (Sari et al., 2021). In geography, PBL allows students to become more involved in the learning process and think more deeply about environmental issues such as climate change. It is hoped that the integration of the SCAMPER technique in PBL can further maximize students' potential in creative thinking. SCAMPER is a brainstorming technique that helps students see a problem from various points of view and generate innovative new ideas (Wu & Wu, 2020). In geography education, SCAMPER can be used to stimulate critical thinking and facilitate students in developing creative solutions to the environmental problems they face. SCAMPER consists of seven steps: *Substitute, Combine, Adapt, Modify, Put to Other Uses, Eliminate, and Rearrange.* These steps allow students to explore various alternative solutions to a problem and encourage them to think more flexibly (Suh, 2019). By using this technique, students are expected to be able to develop creative ideas that are more relevant and applicable in solving environmental problems.

Table 1. Seven Scamper thinking tools

S	*Substitute*	Are there any new functions or materials to replace or add?
C	*Combine*	• What functions can be integrated with the original? • How? • Integrate and use all functions?
A	*Adapt*	Are there any materials that can be customized for the original material, its function or appearance?

M	*Modify*	Is there anything that can be changed from the original material, its function or its appearance?
P	*Put to other uses*	Are there any other uses besides the existing functions?
E	*Eliminate*	What functions or materials can be eliminated
R	*Rearrange*	Is the order of functions reset or reversed

One of the advantages of SCAMPER is its ability to overcome the weaknesses of traditional PBL. In many cases, students have difficulty adapting to PBL because they are not used to working in groups or planning learning activities independently (Kolmos et al., 2020). SCAMPER helps students organize ideas and projects in a more structured way, making it easier for them to participate in the project-based learning process. The following is an explanation of SCAMPER in improving creative thinking skills and environmental awareness skills.

The first step is substitution. In this context, creative thinking occurs when students question whether there are materials that can be replaced with more environmentally friendly or cheaper ones, and how the substitution can improve the results of the project. This process facilitates divergent thinking skills, which allow students to generate many alternatives, and evaluative thinking, as they assess the impact of these changes on the goals and quality of the project (Michalko, 2006).

The second step is combination or combining ideas. The combination process requires students to combine previously separate ideas or elements into a new and more effective solution. In this context, students integrate various ideas or project elements, such as features from two different products or technologies, so as to create a superior innovation.

Creative thinking is involved here in several ways, namely flexibility in thinking. Students must be able to see the relationship between various ideas or elements that previously seemed unrelated. The combination of different elements produces new ideas that never existed before. When students combine two different things, they create a unique and innovative solution that improves the function of their project in preserving the environment, which reflects the ability of original creative thinking (Michalko, 2006).

The third step is adaptation or adjusting the product. This ability allows students to think openly and change their initial plans according to the situation at hand. In addition, by encouraging students to consider how their products can be more flexible and adaptive, they are encouraged to show originality in developing new solutions that have not been thought of before. The adaptation process also requires students to generate various ideas about how the product can work in various situations, which shows fluency of thinking.

The fourth step is modifying or changing the product. The step of modifying the product is closely related to the development of creative thinking skills, especially in terms of flexibility and elaboration. Students who are asked to identify specific parts of the prototype that can be modified practice the ability of flexible thinking, where they must consider various ways to change the design, size, shape, or function of the product. Overall, this modification step encourages students to think creatively by exploring and implementing new ideas in an effort to improve the quality of their products (Runco & Jaeger, 2012) (Amabile, 1983).

The fifth step is put to another use or other utilization. This activity encourages flexible thinking, where students are challenged to view product components not only in their original function, but also as potential solutions to other problems (Csikszentmihalyi, 2014). Originality is

also involved when students find new and innovative ways to utilize parts of a product that are designed for one purpose, but can be changed to serve another useful function (Zhou & George, 2001).

The sixth step is elimination or removing. The elimination step in this activity is closely related to the development of students' creative thinking skills. As students evaluate the elements of the product they have created, they are challenged to identify what is essential and what can be removed without compromising the core value of the project. (Amabile, 1983).

The seventh step is to reverse or reconfigure the product. In this step, the teacher supports students in experimenting with redesign ideas, giving them the freedom to find solutions that may be unconventional but effective (Runco & Jaeger, 2012). The reverse step involves transformational creativity, where students remodel something that already exists into a new form by reversing or deconstructing the design (Boden, 2004).

Apart from that, collaboration between PBL and SCAMPER can also help students face the final exam better. The use of PBL that is too focused on projects sometimes causes students to have difficulty mastering the material as a whole. With SCAMPER, students can more easily understand the subject matter because they are trained to think systematically and creatively in every learning step (Rosenfeld et al., 2001). In the end, combining PBL with SCAMPER not only aims to improve students' creative thinking abilities, but also to form a stronger attitude of caring for the environment. Through project activities, students learn to appreciate the surrounding environment and understand the importance of sustainable development. This is in line with geography learning objectives that support the achievement of Sustainable Development Goals (SDGs), especially those related to efforts to protect the environment and wise management of natural resources (Hawa et al., 2021).

Using SCAMPER also allows students to more freely explore various innovative solutions to real problems facing the world today, such as deforestation, environmental pollution and climate change. This process fosters a greater sense of responsibility towards nature and helps students understand the connection between the decisions they make and their impact on the environment. This is important considering that geography is not only a science that focuses on physical phenomena, but also on human aspects and how they manage natural resources sustainably.

Collaboration between students in project-based learning also trains them to work in teams, solve problems together, and develop interpersonal skills that are important in real life. Here, SCAMPER provides a clear framework to guide students in exploring various ideas systematically and structured, while still encouraging innovation and creative thinking (Risnani, 2019). In addition, PBL combined with SCAMPER also provides additional benefits in terms of developing communication skills. Students are encouraged to not only propose solutions but also present and defend their ideas before classmates and teachers. This process helps them build self-confidence, think logically, and communicate their ideas more clearly and effectively.

In the context of geography learning, the application of PBL and SCAMPER also supports action-oriented education. Students not only learn abstract concepts, but are also challenged to apply their knowledge in real-world contexts. For example, projects involving issues such as climate change mitigation or biodiversity conservation can motivate students to be more concerned and actively involved in efforts to preserve the environment around them. The research design was quasi-experimental by comparing three different treatments, namely the experimental group using

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the PBSL, PBL model, and the control group using the conventional model. This study used a randomized pre-test and post-test control group design. The experimental group and control group have the same characteristics as shown in the average value of the previous semester. The three groups were given the same pretest and posttest.

METHODE

1. Participants

The research subjects were grade 10 students of SMAN 1 Ngadiluwih for the 2023/2024 academic year. The geography subject taught is lithosphere and pedosphere phenomena in the second semester of the independent curriculum. Students were grouped into three groups, namely group A, group B, and group C with each group totaling 36 students. The method of determining the subject was carried out by purposive sampling, namely the subject was taken based on the characteristics of cognitive abilities that were almost the same based on the final semester assessment (PAS) of the odd academic year 2023/2024. Based on the average PAS value data in 10 classes. The level of environmental concern attitude was taken from the distribution of questionnaires at the 10th grade level. The experimental group and control group were selected using simple random sampling. It was found that group A was the PBSL experimental group, group B was the PBL experimental group and Group C was the control/conventional group. The research was carried out for 5 months in the second semester of the 2022/2023 academic year, from January 2 to May 17 2023. The topic discussed was soil conservation. The research variables are divided into two variables, namely 1) the independent variable is the PBSL, PBL and conventional models and 2) the dependent variable is creative thinking skills and environmental care attitudes.

2. Experiment Procedure

In the experimental procedure, we carried out project activities in 18 weeks, and class time was 180 minutes/week. Table 2 shows the procedure of this experiment.

Table 2. PBSL Model learning stages

No.	Step	Learning Activities	
		Teacher	Student
1.	Start with the essensial question	Introduce topics, examine relevant issues, and ask essential questions	Conveying opinions, ideas, ideas, formulating essential problems
2.	Designing a project plan	Directing students to work collaboratively to solve problems through project work	Students plan projects, select activities, determine material tools for project completion, choose a method or method of completion of the project
3.	Design a plan for the project with SCAMPER	Introduce scamper techniques to students and Direct students to work collaboratively to solve problems through project work with Scamper stages	Students change the project prototype with Scamper's stages, choose activities, determine material tools for project completion, choose a method or method of project completion
4.	Create a	Guiding students	Create a schedule to complete

	schedule	Developing a schedule of activities to complete the project	a project, timeline.
5.	Monitor the students and the progress of the project	Monitor student project work, provide resources and guidance, prepare rubrics to record all important activities	Work collaboratively in completing project work, conducting exploration and investigation by utilizing various learning resources, interviewing, and creating project products.
6.	assess the outcome	Assess the achievement of student project work, evaluate learning progress, and provide feedback	Each group presents project work outputs, written reports, and project output products
7.	Evaluate the experience	Guiding students to reflect on the activities and results of the project that has been carried out	Reflect on yourself by keeping a reflection journal on a series of project tasks carried out.

Source: (Wu & Wu, 2020)(Shih Yeh Chen et al., 2022)

3. Assesment Tools

1) Instrument and procedure

At the beginning of the semester, students are given a Torrance Test of Creative Thingking (TTCT) creativity test for about 30 minutes to determine the student's initial level of creativity. The TTCT was created by Paul Torrance for a creativity test to assess on four scales: fluency, flexibility, originality, and elaboration. And the environmental care attitude questionnaire consisting of 60 questions from 10 aspects of environmental care attitudes adapted from milfont (Milfont & Duckitt, 2010) Table 3 Creative thinking ability test instrument (Milfont & Duckitt, 2010).

Table 3 Creative thinking ability test instrument

No	Indicators of critical thinking ability	Thema	Question Item
1	Fluency	Characteristic of litosfer	1,2
2	Originality	Earthforms due to endogenous and exogenous energy	3,4
3	Elaboration	Soil formation process	5,6,7
4	Flexibility	Conservation of land	8,9,10

The validity of the research is required before the research instrument is tested. The validity test was tested on 36 students. The reliability test is carried out after the validity test. The validity and reliability test was carried out in class XI IPS 1 SMA Negeri 1 Ngadiluwih with a total of 36 students. This particular class is not a research sample. The validity test using Pearson's product moment correlation produced a value of 0.635-0.807 > table 0.361 which showed that the test instrument was said to be valid. The reliability test using Alpha Cronbach produced a value of 0.840 > 0.6 which indicates that the test instrument is said to be reliable

2) An instrument of environmental care.

At the beginning of the semester, students are given a Torrance Test of Creative Thingking (TTCT) creativity test for about 30 minutes to determine the student's initial level of creativity. The TTCT was created by Paul Torrance for a creativity test to assess on four scales: fluency, flexibility, originality, and elaboration. And the environmental care attitude questionnaire consisting of 60 questions from 10 aspects of environmental care attitudes adapted from milfont. There are 10 aspects of environmental care attitudes studied in this study which were adapted from Milfont (Milfont & Duckitt, 2010) which was previously used in a study to find the effect of the Project Based Learning Equipped with Mind Mapping (PJBL-MM) model on environmental care skills (Sukaesih, 2022). Ten aspects of environmental care attitudes are outlined in 60 attitude statements using the Likert scale. The statement of attitude consists of a statement of positive attitude and a negative attitude, then given a score according to the student's answers.

Table 4. Indicators of environmental care attitudes

No	Indicators of environmental care attitudes
1	Enjoyment of nature
2	Support for interventionist conservation policies
3	Environmental movement activism
4	Conservation motivated by anthropocentric concern
5	Confidence in science and technology
6	Environmental fragility
7	Altering nature
8	Personal conservation behaviour
9	Human dominance over nature
10	Ecocentric concern

Source: (Milfont & Duckitt, 2010)

In addition, validity control is also carried out to control external factors. Validity control includes: 1) determination of research subjects for the experimental and control groups based on the results of the pre-test with the closest/almost the same score, 2) the same teachers are assigned to conduct learning in the experimental and control groups, 3) students have not received information about the lithosphere topic.

3) Statistical *Analysis*

The effect of treatment on student grades was analyzed using one-way ANOVA to see significant differences. Tukey's test was performed to determine the significance of differences between means with a significance level of $p < 0.05$. All calculations were performed using IBM-SPSS statistical software version 2019 (1 New Orchard Road, Armonk, NY, USA).

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RESULT AND DISCUSSION

1. *The influence of the PBSL model on students' Creative Thinking Skills*

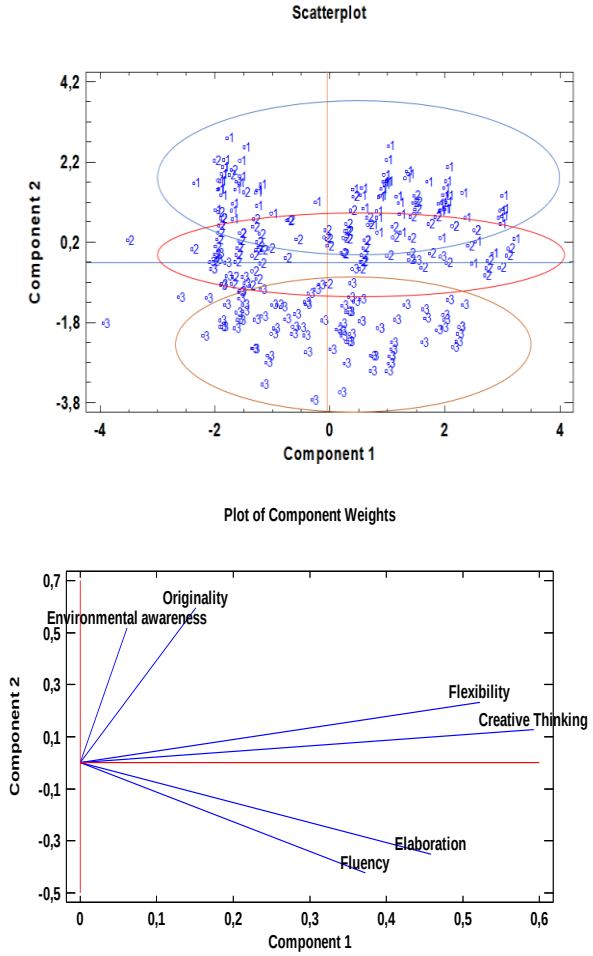

Figure 1. Scatter plot principal component analysis of the distribution of scores for PBSL, PBL and Conventional (A), and plot component weight for the relationship between groups of indications of student learning outcomes (B).

The statistical principal component analysis (PCA) test is applied to see the distribution of student learning outcomes and also the relationship between the indications of the measured scores. From the distribution of school student learning outcomes (Figure 1A.), it can be seen that there are 3 groups of value distributions explained from the variables component 1 and component 2. From the results of this test, it can be seen that there are different effects of PBSL, PBL, and conventional learning method treatments. Meanwhile, the plot component weight of PCA describes that there are groups of indication groups that may be related to each other, namely fluency with elaboration; flexibility with creative thinking and originality with environmental awareness. PBSL class learning begins with students identifying real environmental problems that occur around them, then formulating essential problems. The ability of students to generate a large number of ideas begins to be trained at this stage. This activity leads students to generate ideas, and choose a solution to the problem of the selected project. Through project activities students have the opportunity to

participate in real problem-solving, knowledge construction is carried out through authentic contexts (Efendi et al., 2020), (Halek et al., 2021).

In the design a plan for the project stage, students and their groups design a project plan by making a project proposal. Students Prepare a project proposal that contains a title, problem formulation, project description, product design of project results, methods, schedules and references. The activity of drafting a project proposal trains students to generate a large number of ideas, as well as develop the ability to solve problems with a variety of different solutions (Listiqowati et al., 2022). The problems chosen by each group are different, so students can learn from the experiences of other groups and gain broader knowledge. Project-based learning encourages students to be active, creative, problem-solving and innovate using its metacognises (Halek et al., 2021).

After they make a project plan, the scammer's steps are applied to improve the prototype of the project that has been made. At this stage find that students are better able to understand the concept of creativity, they can design surprising project sketches through the scamper's creative way of thinking. According to our findings, the characteristic of creative thinking, namely originality, increases significantly and consistently. It was also found that in experiments conducted in groups, students who had closed personalities could not participate in discussions easily. Therefore, experiments are needed for project activities that are carried out individually to see the effectiveness of creative thinking from scampers.

At the stage of compiling a schedule and monitoring project results, creative thinking skills are applied. Students formulate the stages of project work, choose the right method, compile instruments, and continue with investigation activities. Project work monitoring activities provide students with the opportunity to report on the progress of their projects. The project work report is given feedback by the teacher. Students also make works (products) from the results of the project. Product creation makes students have to think creatively and constructively. This is in line (Wijayanto & Utomo, 2023) which states that in project activities, students become creative and constructive through various projects, as well as make works from their project assignments.

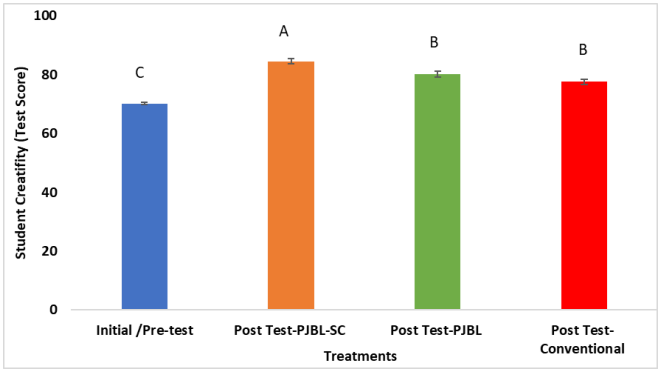

Figure 2. The effect of PBSL, PBL and conventional learning methods on students' creativity scores, the real difference between the mean measured using the tukey test and ($p < 0.005$).

Geography learning with the PBSL model has a positive impact on the growth of creative thinking skills. The average score of creative thinking skills of the PBSL experimental group of 86.48 was the highest from the average score of the PBL group of 81.32 and the control group of

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73.20. Thus, geography learning recommends the PBSL model to foster students' creative thinking skills.

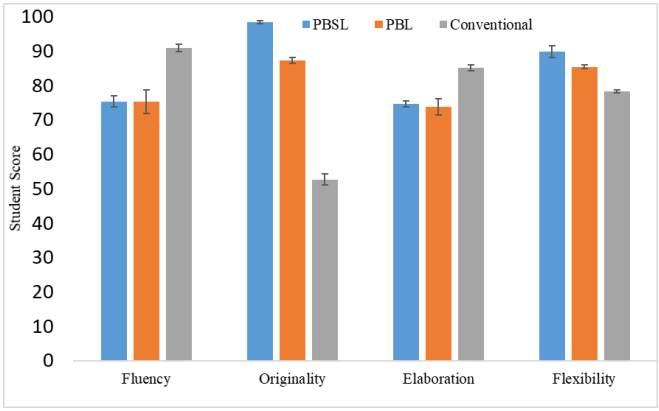

Figure 3. The influence of the learning model on the indicators of creative thinking skills. The real difference between the mean measured using the tukey test and ($p < 0.005$)

The PBSL model shows a higher originality value than other indicators, this is because in the project learning model with scammer steps that contain features that serve as a guide for students in developing new ideas that are different from before. The process of making products can train students to produce new original ideas, as well as train students' ability to organize ideas into one product or a more complete solution (elaboration), Products produced by students in geography classes in the form of posters, leaflets, and comics.

The results of the study show that there is an influence of the learning model on students' creative thinking skills. The PBSL model has a better influence on students' creative thinking skills. Students who get PBSL learning get higher creative thinking skills scores than students in PBL classes and conventional classes. In project-based learning, students' creative thinking skills are developed from the beginning to the end. Indicators of creative thinking skills are used during the learning process which include: fluency (the ability to generate a large number of ideas), flexibility (the ability to suggest different solutions to a problem), originality (the ability to generate new original ideas), and elaboration (the ability to organize various ideas into a single product or more complete solution) (TORRANCE, 1972).

In classes that apply conventional learning, the improvement of students' creative thinking skills is the lowest compared to PBL and PBSL classes. This is because not all students actively participate in learning. The role of teachers in conventional classroom learning is still large. Learning activities through discussions and assignments do not provide students with opportunities to explore, create new ideas, and opportunities to make works (products) are also still limited so that students' creative thinking skills are less developed. In contrast to PBL and PBSL class learning, students get a wide opportunity to generate ideas, make several alternative solutions to solve problems, and innovate to create project products. As stated (Efendi et al., 2020), Project-based learning facilitates students to build their knowledge (constructivism), while conventional classroom learning of teachers as a figure who dominates learning. Constructivism in project-based learning makes students have better creative thinking skills.

There are several learning principles that make the characteristics of the PBSL model. First, the principle of active learning in Scamper's project work and brainstorming. Second, investigation

in completing project work. Third, using social issues and contextual problems as the theme of the project. Fourth, collaboration to build knowledge.

The findings in this study are the determination of the influence of the PBSL model on creative thinking skills with the highest scamper activities producing originality indicators, the process of making products in soil conservation can train students to produce new original ideas, and train students' ability to organize ideas into one product with a more complete solution. The products produced by students in geography class are in the form of fertilizers that are published through students' social media accounts in the form of Youtube, TikTok and Facebook.

However, the PBSL model has little influence on elaboration because PBSL activities are carried out in groups so that it is possible that students with closed personalities are not able to participate in discussions well which makes the ability to organize and convey ideas lower, so further research is needed with PBSL individually. This is different from research (Rizal, 2022) which shows that the value of fluency is more significant than other indicators because the application of the SOLE model with the investigation process using the internet in the learning process has a positive impact on the growth of new ideas obtained from various sources of information on the internet.

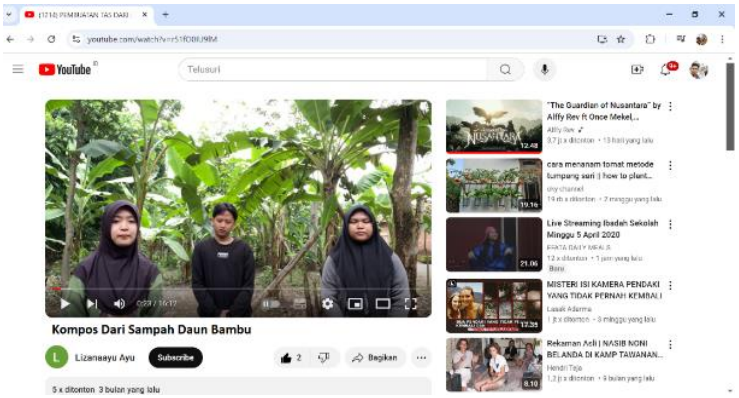

Figure 4. Project Activity Video Uploaded to Student Youtube

2. *The influence of the PBSL model on students' attitudes to care for the environment*

Geography learning activities using PBSL have an influence on students' environmental awareness attitudes. The mean value of environmental awareness attitudes in the PBSL group is 86.48, the value of environmental awareness attitudes in the PBL group is 81.32 while the mean value in the conventional group is 78.56.

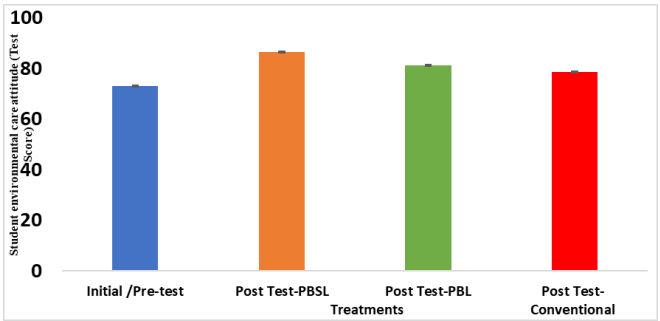

Figure 5. The influence of PBSL, PBL and Conventional models on the value of environmental care attitudes, the real difference between the mean measured using the tukey test and ($p < 0.005$).

The results of the study showed that there was a significant difference in students' attitudes of caring for the environment in learning with different learning models. The highest environmental care attitude score was achieved in PBSL class learning. The project-based learning process combined with scammers makes a positive contribution to developing an attitude of caring for the environment. In the first stage, students make observations by looking at phenomena, facts of environmental problems, social issues, followed by formulating problems. Students get a contextual learning experience. Contextual learning experiences in the environment have the potential to foster sensitivity, awareness and foster an attitude of caring for the environment. This happens because attitudes are built by previously acquired experience with the object of attitude (Van Giesen et al., 2015)(Wibowo et al., 2023).

Attitude will determine behavior or action (ajzen, 2012). Likewise, attitudes towards the environment determine behavior towards the environment. Environmental care attitudes are influenced by beliefs about the consequences of a behavior. During project work, students certainly have confidence in the project plan being worked on, confidence in the selection of the right strategy, and confidence in the chosen solution. This indirectly strengthens students' attitude of caring for the environment (Meliyev Muzaffar Saidakbarovich, 2022).

For example, in project activities with the theme "the impact of making red bricks and tiles on the environment and local communities". Students conduct on-site observations, and conduct interviews with local communities. The objects of attitudes found include the fact of digging land and felling trees, these activities damage the environment and disrupt the ecosystem, and the fact that public awareness to protect nature is still low. This is a meaningful learning experience and requires thinking to find the solution (Fatchan et al., 2016) (Ichsan et al., 2019).

The attitude of caring for the environment of conventional class students is still less developed than students who study with PBL and PBSL. This is because learning through discussions and assignments is still lacking in empowering students' environmental care attitudes. Learning is carried out by group presentations and discussions. In presentation and discussion activities, generally only a few students are actively involved. The opportunity for students to gain extensive experience, see authentic phenomena or problems as project-based learning does not take place in conventional classrooms. The experiences gained during the project contribute positively to the growth of a positive environmental care attitude. The learning experiences gained, as well as the beliefs built during the project, can develop students' attitudes (Ajzen, 2002)(Wibowo et al., 2023).

At the design stage, a plan for the project. Students determine and choose a variety of alternative strategies and methods to solve problems. The existence of problems encourages students to think, act, and make decisions to solve problems. Problem-based learning in daily life can provide a broad, actual learning experience, and can increase environmental awareness. At the design stage, a plan for the project. Students determine and choose a variety of alternative strategies and methods to solve problems. The existence of problems encourages students to think, act, and make decisions to solve problems. Problem-based learning in daily life can provide a broad, actual learning experience, and can increase environmental awareness (Selçuk, 2010) (Amin et al., 2020).

In the third stage, students formulate activities to solve project problems, make a list of necessary tools, materials, and instruments. Students collaboratively conduct investigations and explorations to collect data, solve project problems, and create work. At this stage, the scammer's creative way of thinking is given to direct students to understand the material well. Knowledge built

in the cognition structure is an important basis for the formation of an attitude of caring for the environment. This happens because an individual's awareness and attitude towards the environment is formed from his or her environmental knowledge (Wijayanto & Utomo, 2023). PBSL has the potential to empower environmentally caring attitudes because it involves students in the cognitive process, as well as giving students direct experience regarding the object of the attitude. This is supported by (Van Giesen et al., 2015) Which states that cognition has a high influence on the attitude object as a whole. The PBSL stages direct students to think flexibly in expressing creative ideas based on the learning experiences gained (Billah et al., 2019).

The next stage is for teachers to monitor the progress of the project through the project progress sheet reported by each group. Through projects, students are encouraged to be creative and constructive with an unlimited range of projects, as well as to create works from their project assignments (Luana et al., 2022).

In the final stage of a series of projects carried out, students present project work results in the form of reports and products at the assessment stage. PBSL learning is able to generate independence and motivate students to learn actively, as well as encourage the growth of an attitude of caring for the environment (Kristina Kasi, Sumarmi, 2018) (Sumarmi et al., 2021).

Figure 6. Student Activities when Making Compost from Vegetbale and Fruit Waste

CONCLUSIONS

Based on the results of hypothesis analysis and testing, as well as the results of the researcher's observations, it can be concluded that the PBSL model has an effect on creative thinking and environmental care. The findings in this study are the determination of the influence of the PBSL model on creative thinking skills, the highest PBSL activity is found in the originality indicator and the lowest is elaboration. The determination of the influence of the PBL model on creative thinking skills is highest in the originality indicator and the lowest is elaboration. The determination of the influence of conventional models on creative thinking skills is highest in the Fluency indicator and the lowest is originality. Students who have a closed personality cannot participate in discussions well. Therefore, experiments are needed for project activities that are carried out individually to see the effectiveness of PBSL's creative thinking. The results of the study showed that there was a significant difference in students' attitudes of caring for the environment in learning with different learning models. The highest score of environmental concern attitude was achieved in PBSL class learning and the lowest was conventional. The project-based learning process combined with scammers makes a positive contribution to developing an attitude of caring for the environment.

AUTHOR CONTRIBUTIONS

DNA, as a doctoral student, designed and initiated the initial idea for this research. He also developed the theoretical framework, performed analytical calculations, and drafted the research methodology. S, P, and YS, as supervisors, verified the accuracy of the analysis method, provided conceptual and technical input, and ensured the validity of the results obtained. DNA, under the guidance of the supervisor, encouraged FW to conduct field investigations to obtain empirical data that support the study findings, and supervised the overall implementation of the research. All authors played an active role in analyzing and discussing the research results, contributed to the interpretation of the data, and jointly drafted and revised the manuscript until it reached a final form that was suitable for publication.

REFERENCES

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology*, *32*(4), 665–683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x

Amin, S., Utaya, S., Bachri, S., Sumarmi, & Susilo, S. (2020). Effect of problem-based learning on critical thinking skills and environmental attitude. *Journal for the Education of Gifted Young Scientists*, *8*(2), 743–755. https://doi.org/10.17478/jegys.650344

Andrews, D., & Townsend, B. (2017). A tale from the tropics: Education for sustainability and the value of project-Based learning. *Proceedings of the 19th International Conference on Engineering and Product Design Education: Building Community: Design Education for a Sustainable Future, E and PDE 2017, September*, 340–345.

Arikunto, S. (2021). *dasar-dasar Evaluasi Pendidikan*. Bumi Aksara.

Billah, A., Khasanah, U., & Widoretno, S. (2019). *Empowering Higher-Order Thinking through Project-Based*. *020011*.

Chen, S Y, Lai, C. F., Lai, Y. H., & Su, Y. S. (2019). Effect of project-based learning on development of students' creative thinking. *The International Journal …*. https://doi.org/10.1177/0020720919846808

Chen, Shih Yeh, Lai, C. F., Lai, Y. H., & Su, Y. S. (2022). Effect of project-based learning on development of students' creative thinking. *International Journal of Electrical Engineering and Education*, *59*(3), 232–250. https://doi.org/10.1177/0020720919846808

Chien, Y. C., Liu, M. C., & Wu, T. T. (2020). Discussion-record-based prediction model for creativity education using clustering methods. *Thinking Skills and Creativity*. https://www.sciencedirect.com/science/article/pii/S1871187119303360

Denuga, D. D., & Nkengbeza, D. (2022). Pre-Service Teachers Experience in Project-Based Learning Approach: A Case Study of Two Campuses of the University of A (UNA). *Open Journal of Social Sciences*, *10*(04), 121–132. https://doi.org/10.4236/jss.2022.104009

Efendi, D., Sumarmi, S., & Utomo, D. H. (2020). The effect of PjBL plus 4Cs learning model on critical thinking skills. *Journal for the Education of Gifted Young Scientists*, *8*(4), 1509–1521. https://doi.org/10.17478/jegys.768134

Farid Fakhry Tharwa, F. (2019). Using the SCAMPER Model to DevelopTranslation Skills for Major Students in the Faculty of Education, Majmaah University, Saudi Arabia. *Arab World English Journal For Translation and Literary Studies*, *3*(2), 91–113. https://doi.org/10.24093/awejtls/vol3no2.9

Fatchan, A., Soekamto, H., Sumarmi, ., & Utaya, S. (2016). Effect of Learning "Outdoor Study" Ability to Communicate in Writing and Social-Geography Student Learning Outcomes at

"Mataraman" East Java-The Republic of Indonesia*. *Mediterranean Journal of Social Sciences*, *7*(3), 429–435. https://doi.org/10.5901/mjss.2016.v7n3p429

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*(April), 101586. https://doi.org/10.1016/j.ijer.2020.101586

Halek, D. H., Sumarmi, Budijanto, & Utomo, D. H. (2021). Examination Improving Character towards Environment Care Through Their Creativity and Innovation at School (A Case Study at the Senior High School 3 Ternate City)*. *Eurasian Journal of Educational Research*, *96*(96), 82–101. https://doi.org/10.14689/ejer.2021.96.6

Hawa, N. N., Zakaria, S. Z. S., Razman, M. R., & Majid, N. A. (2021). Geography education for promoting sustainability in Indonesia. *Sustainability (Switzerland)*, *13*(8), 1–15. https://doi.org/10.3390/su13084340

Hwang, R. H., Hsiung, P. A., Chen, Y. J., & Lai, C. F. (2017). Innovative project-based learning. *International Symposium on …*. https://doi.org/10.1007/978-3-319-71084-6_21

Ichsan, I. Z., Sigit, D. V., Miarsyah, M., Ali, A., Arif, W. P., & Prayitno, T. A. (2019). HOTS-AEP: Higher order thinking skills from elementary to master students in environmental learning. *European Journal of Educational Research*, *8*(4), 935–942. https://doi.org/10.12973/eu-jer.8.4.935

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Project-based learning: A review of the literature. *Improving Schools*, *19*(3), 267–277. https://doi.org/10.1177/1365480216659733

Kolmos, A., Holgaard, J. E., & Clausen, N. R. (2020). Progression of student self-assessed learning outcomes in systemic PBL. *European Journal of Engineering Education*, *0*(0), 1–23. https://doi.org/10.1080/03043797.2020.1789070

Kristina Kasi, Sumarmi, and K. A. (2018). Pengaruh Model Pembelajaran Service Learning Terhadap Sikap Peduli Lingkungan Dan Kemampuan Menulis Karya Ilmiah Siswa SMA. *Jurnal Pendidikan:Teori, Penelitian, Dan Pengembangan*, *4*(3), 437–440.

Landau, B., Smith, L. B., & Jones, S. S. (1988). The importance of shape in early lexical learning. *Cognitive Development*, *3*(3), 299–321. https://doi.org/10.1016/0885-2014(88)90014-7

Listiqowati, I., Budijanto, Sumarmi, & Ruja, I. N. (2022). The Impact of Project-Based Flipped Classroom (PjBFC) on Critical Thinking Skills. *International Journal of Instruction*, *15*(3), 853–868. https://doi.org/10.29333/iji.2022.15346a

Luana, P., Syaibana, D., Putra, A. K., & Suharto, Y. (2022). *Collaborative Creativity Learning : Analyzing Scientific Creativity and Problem Solving Watershed Conservation Studies in Learning* (Vol. 1). Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-63-3

Meliyev Muzaffar Saidakbarovich. (2022). *FORMATION OF ECOLOGICAL CULTURE IN THE TEACHING OF FLORA AND FAUNA*. *3*(12), 115–118.

Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, *30*(1), 80–94. https://doi.org/10.1016/j.jenvp.2009.09.001

Nagel, P. (2008). The essential skill for 21st century. *Social Education*, *72*(7), 354–358.

Nation, M. L. (2008). Project-based learning for sustainable development. *Journal of Geography*, *107*(3), 102–111. https://doi.org/10.1080/00221340802470685

Özyaprak, M. (2016). The effectiveness of SCAMPER technique on creative thinking skills. *Journal for the Education of Gifted Young Scientists*, *4*(1), 31–40. https://doi.org/10.17478/JEGYS.2016116348

Purwanto. (2009). *Evaluasi Hasil Belajar*. Pustaka Pelajar.

Risnani, L. Y. (2019). Teknik SCAMPER : Stimulasi Kreativitas Mahasiswa Calon Guru Biologi pada Aktivitas Laboratorium SCAMPER Technique : Stimulation of Student Creativity for Pre-service Biology Teacher in Laboratory Activities. *BIOEDUKASI: Jurnal Pendidikan*

Biologi, *12*(1), 35–40.

Rizal, S. (2022). CREATIVE THINKING AND PROCESS SCIENCE SKILL: SELF-ORGANIZED LEARNING ENVIRONMENT ON WATERSHED CONSERVATION MATERIAL. *Jurnal Pendidikan IPA Indonesia SELF-ORGANIZED LEARNING ENVIRONMENT ON*, *11*(4), 578–587. https://doi.org/10.15294/jpii.v11i4.39571

Rosenfeld, Sherman; Benhur, Y. (2001). Project-Based Learning (PBL) in Science and Technology: A Case Study of Professional Development. *Journal of Action Research and Professional Development*, *II*(1), 460–480.

Sari, Y. I., Sumarmi, Utomo, D. H., & Astina, I. K. (2021). The Effect of Problem Based Learning on Problem Solving and Scientific Writing Skills. *International Journal of Instruction*, *14*(2), 11–26. https://doi.org/10.29333/iji.2021.1422a

Scoffham, S. (2003). Thinking creatively. *Primary Geographer*, 50, pp. 4–6. 0956-277x

Selçuk, G. S. (2010). The effects of problem-based learning on pre-service teachers' achievement, approaches and attitudes towards learning physics. *International Journal of Physical Sciences*, *5*(6), 711–723.

Stoltman, J. P., Lidstone, J., & Kidman, G. (2017). *2016 International Charter on Geographical Education The Purpose of the Charter on Geographical Education*. 1–8.

Suh, S. (2019). A Study on the Application of SCAMPER Techniques for the Development of Fashion Design -Focusing on the Development of the SCAMPER Questions-. *Journal of Fashion Business*, *23*(3), 1–9.

Sukaesih, S. 2022. Pengaruh Project Based Learning Dilengkapi Mind Mapping (PJBL-MM) Dan Gender Terhadap Pemahaman Hakikat Sains, Kesadaran Metakognisi, Keterampilan Berpikir Kreatif Dan Sikap Lingkungan Mahasiswa. Dissertation. Malang: Universitas Negeri Malang.

Sumarmi. (2012). Model-model Pembelajaran Geografi. In *Aditya Media Publishing*.

Sumarmi, Aliman, M., & Mutia, T. (2021). The Effect Of Digital Eco-Learning In Student Worksheet Flipbook To Environmental Project Literacy And Pedagogic Competency. *Journal of Technology and Science Education*, *11*(2), 357–370. https://doi.org/10.3926/jotse.1175

TORRANCE, E. P. (1972). Predictive Validity of the Torrance Tests of Creative Thinking. *The Journal of Creative Behavior*, *6*(4), 236–262. https://doi.org/10.1002/j.2162-6057.1972.tb00936.x

Usher, J. (2021). Powerful primary geography: a toolkit for 21st century Learning. *Irish Educational Studies*, *40*(4), 689–691. https://doi.org/10.1080/03323315.2021.1899032

Van Giesen, R. I., Fischer, A. R. H., Van Dijk, H., & Van Trijp, H. C. M. (2015). Affect and cognition in attitude formation toward familiar and unfamiliar attitude objects. *PLoS ONE*, *10*(10), 1–14. https://doi.org/10.1371/journal.pone.0141790

Wibowo, N. A., Sumarmi, S., Utaya, S., & Bachri, S. (2023). *Students ' Environmental Care Attitude : A Study at Adiwiyata Public High School Based on the New Ecological Paradigm (NEP)*.

Wu, T. T., & Wu, Y. T. (2020). Applying project-based learning and SCAMPER teaching strategies in engineering education to explore the influence of creativity on cognition, personal motivation, and personality traits. *Thinking Skills and Creativity*, *35*, 100631. https://doi.org/10.1016/j.tsc.2020.100631

Yli-Panula, E., Jeronen, E., & Lemmetty, P. (2020). Teaching and Learning Methods in Geography Promoting Sustainability. *Education Sciences*, *10*(1).