Journal of Community Empowerment 4 (1) (2024): 16-24 p-ISSN 2798-5997 | e-ISSN 2807-1115
Sekolah Pascasarjana Universitas Negeri Semarang https://journal.unnes.ac.id/journals/index.php/jce

Improving Science Teachers' Creative Thinking Skills Using PjBL-STEAM Assisted by Canva

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Abstract. The 4Cs are the main skills emphasized to face challenges in the 21st century. One of the skills of the 4Cs is creative thinking skills. Creative thinking skills are important for students to have to solve problems with creative solutions. In addition to students, teachers as educators are also required to have these skills so that learning becomes more innovative, solution, and meaningful. The purpose of this service is to improve the creative thinking skills of science teachers in designing lessons with the PjBL-STEAM model in science learning and increase the knowledge of science teachers in utilizing Canva digital software that can be used in STEAM-based learning in science learning. The methods used in this service activity are material presentation, practice of designing posters and assembling STEAM products related to energy materials, as well as discussion and question and answer sessions. The results of the study show that PjBL-STEAM learning training assisted by Canva can improve the creative thinking skills of science teachers at Semarang City Junior High School. Participants also gave a positive response to the feasibility of the material and the presentation of the training. This means that the implementation of training to improve creative thinking skills with PjBL-STEAM, assisted by Canva Telang, was carried out very well.

Keywords: creative thinking, canva, PjBL-STEAM, science teacher

How to Cite: Widiyatmoko, A., Fibriana, F., Aji, S., Mayanti, A. N. R., Darmawan, M.S., Hidayat, L. (2024). Improving Science Teachers' Creative Thinking Skills Using PjBL-STEAM Assisted by Canva. *Journal of Community Empowerment*, 4 (1), 16-24.

INTRODUCTION

The development of science and technology in the era of the Industrial Revolution 4.0 and the 21st century has made it an inseparable unit (Fadli, 2021). This results in a challenge for students to have the 4C abilities and skills in the 21st century. These abilities and skills include critical thinking (critical thinking and problem solving), collaboration (collaboration), communication (communication), and creativity (creativity and innovation) (Wardani & Budiadnya, 2023). These skills are fundamental skills that students and teachers must have as educators in the current era (Lavi et al., 2021).

Therefore, these skills are important to implement in the learning process so that students can face the challenges of the 21st century in the future (Fitriyah & Ramadani et al., 2021). One of the essential 21st-century skills to teach in education is creative thinking (Zakaria, 2021). Creative thinking involves creating solutions and ideas from different perspectives (Darwanto, 2019; Nurhanifah, 2022; Rati & Deddy, 2022). With creative thinking skills, students can solve problems using innovative solutions (Rati & Deddy, 2022; Handayani et al., 2022).).

However, teachers as educators still do not optimize their creative thinking skills in developing learning media in the classroom (Saragih & Zaki, 2023). Thus, science learning becomes less interesting because it is only monotonous for educators to explain and students to listen (Saragih & Zaki, 2023). Therefore, training is needed to improve teachers' creative thinking skills so that learning is more meaningful, one of which is through STEAM (Fitriyah & Ramadani, 2023; Ero et al. 2023; Zhan et al., 2023).

STEAM is an approach that integrates 5 components in learning, namely science, technology engineering, art, and mathematics. The implementation of STEAM in learning can encourage students and teachers to produce creative ideas and solutions in solving problems (Lubis, 2018). Project-based learning (PjBL) can also be integrated with the STEAM approach, which is then expected to be able to improve the creative thinking skills of students and teachers in facing the challenges of the 21st century (Rosdiana et al., 2022). On the other

hand, Canva media is a platform that can be used to develop science learning media according to the era of the Industrial Revolution 4.0 and the 21st century (Indahwati et al., 2023).

The results of interviews as initial observations show that Semarang City Science Teachers still have difficulty implementing creative learning, still rarely develop media using Canva, and have never implemented the PjBL-STEAM learning model explicitly. Therefore, training on improving creative thinking skills with PjBL-STEAM assisted by Canva for Semarang City Middle School science teachers is important so that it is hoped that science learning will become more up-to-date according to the industrial revolution 4.0 and the 21st century, more interesting and more meaningful due to optimization creative thinking skills of teachers as educators.

The problems found are that science teachers still have difficulty implementing creative learning, rarely develop media using canva, and have never implemented the PjBL-STEAM learning model explicitly. The appropriate solution that has been mutually agreed upon with partners is training and mentoring activities to improve the creative thinking skills of science teachers with PjBL-STEAM assisted by Canva in the Semarang City middle school science teacher group. PjBL-STEAM learning innovation has developed rapidly in the last decade (Indahwati et al, 2023; Permana et al., 2023; Ayuningsih et al., 2022). STEAM in the education sector can prepare students to face increasingly complex real-world problems (Mang et al., 2023; Fitria et al., 2023; Erol et al., 2023).

This training activity aims to provide training and assistance in learning activities with a PjBL-STEAM model design for science teachers through activities with a facilitation-based action learning model. The specific objectives are (1) improving science teachers' creative thinking skills in designing learning activities using the PjBL-STEAM model in science learning, and (2) increasing science teachers' knowledge in utilizing Canva digital software which can be used in STEAM-based learning in science learning.

METHODS

Training and mentoring activities are carried out face-to-face at SMP Negeri 41 Semarang. This community service design refers to the facilitation-based action learning model by Rusilowati (2021). The activities were carried out with the participation of Semarang City Science teacher partners and carried out in participatory collaboration with the service team and partners, both in the preparation, implementation, and evaluation stages.

Preparation phase

The preparation stages are carried out through the stages of coordinating the team of community service lecturers with the administrators of the Semarang City Middle School Science, sending invitation letters to partner teachers by the chairman of the Semarang City Middle School Science as well as partner members, preparing a schedule for mentoring carried out with partners, compiling materials and determining topics. training on STEAM-based science learning to be offered to partner teachers, and preparing materials related to PjBL-STEAM assisted by Canva for training and mentoring activities with partners.

Implementation stage

The implementation stage was held in the form of training on the use of Canva media in integrating the PjBL-STEAM project into science learning. Activities are carried out with the active participation of participants (partners) in the form of questions and answers and discussions, assistance in preparing PjBL-STEAM projects by partners, assistance in implementing the learning process by utilizing Canva digital software to design PjBL-STEAM projects in science learning in groups of Semarang City Middle School science teachers.

Assistance in project creation in the form of PjBL-STEAM products in the form of (1) wind generator, (2) science car, (3) traffic light science, (4) sweeping robot, (5) solar panel car. This product can be applied to STEAM-based science learning to overcome the energy crisis problem, assist in making STEAM posters as a

form of implementation of Art elements, target teachers (partners) accompanied by a team of service members practicing the PjBL-STEAM products that have been made, documenting activities by making videos of the implementation of PjBL training -STEAM assisted by Canva.

Evaluation Stages

The results of the PjBL-STEAM learning training assisted by Canva for Semarang City Middle School Science Teachers show that teachers' creative thinking skills to package interesting and innovative learning have increased. Partner teachers are also skilled in creating and analyzing STEAM products and creating STEAM posters to be applied in science learning.

RESULTS AND DISCUSSION

The service team from Science Education Study Program, Universitas Negeri Semarang has held PjBL-STEAM training assisted by Canva for Semarang City middle school science teachers. Activities were carried out effectively on Tuesday, June 11, 2024, at SMP Negeri 41 Semarang. The service team has made thorough preparations before carrying out the activity. Preparations are made 2 months before the training. The service team coordinated with the chairman of the Semarang City Science and teacher representatives. After coordinating, the service team then discussed the division of job desks and prepared all the requirements for carrying out training activities.

The training was attended by 35 Semarang City Middle School science teachers. Participants were very enthusiastic about taking part in this training activity. Exactly at 09.00 WIB on June 11, 2024, the activities began. The activity opened with the singing of the national anthem Indonesia Raya. Then continued with the welcoming speech. The first speech was made by the Head of SMP N 41 Semarang Ina Istiana S.Pd., M.Pd., then continued with the speech by the Head of Science Teacher Association Semarang City Sukimin S.Pd., M.Pd., the last speech was made by the Head of the service team Arif Widiyatmoko Ph.D., as well as the opening mark of training activities. The FMIPA UNNES service team that provided the training consisted of Arif Widiyatmoko, Ph.D., Fidia Fibriana, Ph.D., and Septiko Aji, M.Pd. Apart from that, the students involved consisted of Alfiana Nur Rosita Mayanti S.Pd., Melissa Salma Darmawan S.Pd., and Luky Hidayat.

In this training, participants received material about implementing the PjBL learning model in learning, using Canva media to help design more interesting learning, and implementing the STEAM approach in science learning to implement learning that is innovative, contextual, and supports 21st-

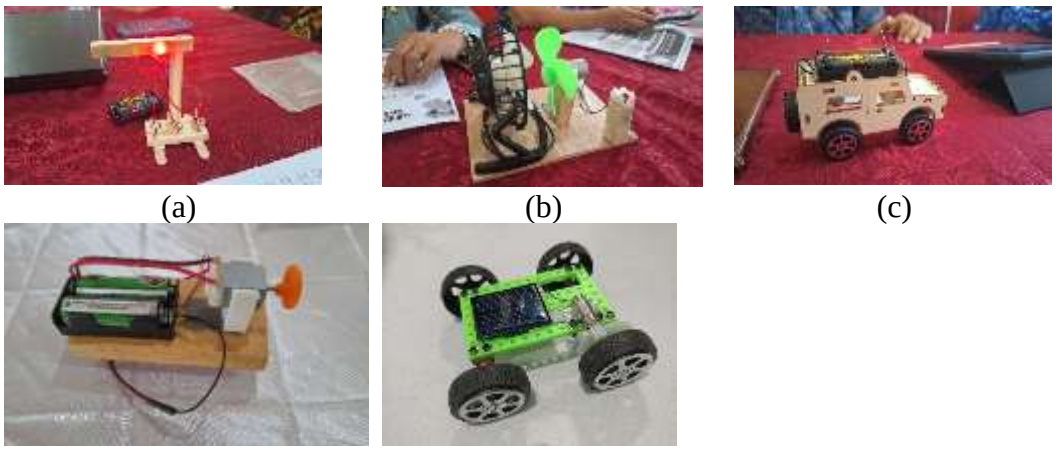

Figure 1. PjBL-STEAM Energy Material Products: (a) Traffic Light Science, (b) Wind Generator, (c) Science Car, (d) Sweeping Robot, (e) Solar Panel Car

(a) (b) (c)

Figure 2. Poster products for PjBL-STEAM teaching aids on science material: (a) car with fan, (b) motorboat sponge, (c) water purification

century skills. there are practical activities for making STEAM analysis posters and assembling STEAM products related to energy materials.

After the speech, participants completed a pretest questionnaire to determine the teacher's initial creative thinking skills in designing innovative learning and implementing PjBL-STEAM assisted by Canva in learning. The session then continued with the delivery of the first material about the PjBL learning model by Septiko Aji M.Pd. The resource person provided a good explanation regarding the benefits of implementing the PjBL learning model, PjBL features, potential, and PjBL simulations for 21st century competencies as well as showing examples of PjBL-STEAM products that can be used in science learning. Fidia Fibriana, Ph.D, delivered the second presentation of material. The resource person delivered material about Canva features, creating science learning media through Canva, as well as the advantages and disadvantages of Canva.

The next session delivered STEAM material to support 21st-century skills by Arif Widiyatmoko, Ph.D. The speakers conveyed digital transformation in the era of the Industrial Revolution, the vision of STEM to face the era of society 5.0, the challenges of the era of technological disruption where the role of humans will largely be replaced by robots/machines/AI, the importance of implementing STEAM, the development of a STEM Center, and competitions related to posters and STEM. Next, the resource person presented a meter related to energy problems as a trigger. Then the service team divided the science teachers into 8 groups to practice designing and assembling STEAM products

Table 1. Results of Analysis of Improving Science Teachers' Creative Thinking Skills

Indicator	Mean score (%)		Criteria		N-Gain	N-Gain criteria
	Pretest	Posttest	Pretest	Posttest		
Fluency	68.19	98	Creative	Very Creative	0.94	High
Flexibility	69.52	97.9	Creative	Very Creative	0.93	High
Elaboration	61.71	98.57	Creative	Very Creative	0.96	High
Originality	61.14	97.71	Creative	Very Creative	0.94	High

Table 2. Participants' responses to the implementation of the training

Aspect	%	Criteria
Aspects of the suitability of training materials		
Training materials according to teacher needs in the 21st century learning era and industrial revolution 4.0.	98.2	Very good
Training materials according to students' needs in the 21st-century learning era and Industrial Revolution 4.0.	98.8	Very good
The training material can increase teachers' understanding of PjBL-STEAM learning assisted by Canva in science learning.	97.7	Very good
The complete coverage of training materials is useful for providing teachers with guidance for implementing PjBL-STEAM learning assisted by Canva in science learning.	94.8	Very good
Aspects of Training Presentation		
The objectives to be achieved in the training are conveyed to participants.	98.2	Very good
The accuracy of the sequence of training presentations according to the agreed schedule.	97.7	Very good
The training material was presented interestingly by the resource persons.	97.7	Very good
The presentation of the material makes it easier for teachers to implement PjBL-STEAM learning assisted by Canva in science learning.	96	Very good
The presentation of training materials encourages teachers to actively look for sources and materials to implement PjBL-STEAM learning in science learning.	97.1	Very good

about the energy crisis guided by the steps in the PjBL-STEAM worksheets that had been distributed.

The STEAM products provided include traffic light science, wind generator, science car, sweeping robot, and solar science car. Each group assembles a different product. The first step is carried out by analyzing problems related to energy materials that have been provided in the worksheet, then the teacher designs the product design and analyzes the STEAM elements in the product by packaging it in the form of a poster. The teacher and his group colleagues assemble and test the STEAM product and answer questions on the PjBL-STEAM worksheets. The teachers were very enthusiastic about working on the STEAM project. The FMIPA service team is ready to help teachers if they experience problems when assembling the project. The session continued with the presentation of each group presenting the STEAM elements in the products that had been made and analyzing their relationship to the concept of energy and the problem of the energy crisis. The products from the PjBL-STEAM energy material project that the teacher has created are presented in Figure 1.

After all groups presented their products, a question and answer session continued. Participants openly discussed the real implementation of PjBL-STEAM assisted by Canva in science learning. Teachers are very happy with the introduction of innovative, interesting, and contextual learning. Apart from that, discussions were also continued regarding challenges and innovations that could be developed in implementing learning with PjBL-STEAM assisted by Canva. Teachers were asked to discuss the problem of the energy crisis and explain innovations that might be possible by implementing PjBL-STEAM in science learning and linking it to the use of alternative energy. Teachers who successfully answered received appreciation in the form of a solar panel car kit.

Apart from face-to-face activities, there is training carried out outside of offline activities, namely through PjBL-STEAM assignments. The assignment consists of designing STEAM

teaching aids in science learning and making STEAM posters regarding the teaching aids that have been made. The assignments given can train teachers to develop creative thinking skills in designing innovative science learning. The PjBL-STEAM teaching aid poster product that the teacher has made is presented in Figure 2.

The training session to improve creative thinking skills with PjBL-STEAM, assisted by Canva, was then continued with filling out a posttest questionnaire for creative thinking skills and response instruments for implementing the training that had been held by the service team. The results of the analysis of the creative thinking skills of Semarang City science teachers during the PjBL-STEAM learning training assisted by Canva are presented in Table 1.

The N-Gain score in Table 2 shows that teachers' creative thinking skills have improved rapidly after the PjBL-STEAM learning training assisted by Canva. The results of the analysis for each indicator of creative thinking skills can be described as follows. On the fluency indicator, the pretest percentage score was 68.19%, and the post-test was 98%. The percentage results show an increase in creative thinking skills from the previous criteria of being creative to being very creative. The average N-Gain is 0.94, so it is in the high category. The fluency indicator can be observed that during the implementation of the activity the teacher can answer with several answers if there are questions during the PjBL-STEAM learning training activities assisted by Canva, the teacher also fluently expresses ideas during the implementation of the PjBL-STEAM learning training activities assisted by Canva.

Apart from that, teachers can also quickly understand problems related to the energy crisis. This is in line with research by Kartina et al. (2021) which states that creative thinking skills on the fluency indicator are directly proportional to skills in providing many answers for problem solving. Apart from that, during the presentation, the teacher was fluent in expressing his ideas and was able to answer questions given by the service team and other group colleagues.

In the flexibility indicator, the pretest percentage score was 69.52%, and the posttest was 97.9%. The percentage results show an increase in creative thinking skills from the previous criteria of being creative to being very creative. The average N-Gain is 0.93, so it is in the high category. The flexibility indicator can be observed that during the training, the teacher can explain the STEAM-based props project; if there are problems during the implementation of the PjBL-STEAM learning training assisted by Canva, the teacher has other ways to overcome them. Apart from that, teachers can also group types of energy when implementing learning training. Flexibility can be seen by providing varied interpretations and diversity of problem-solving (Cahyani, 2023). This flexibility ability was proven during the training, every time there was a problem the teacher was able to think flexibly, able to see from various points of view in solving the problem. Teachers are also able to respond flexibly to questions raised by the service team and other groups.

In the elaboration indicator, the pretest percentage score was 61.14%, and the posttest was 97.71%. The percentage results show an increase in creative thinking skills from the previous criteria of being creative to being very creative. The average N-Gain is 0.96, so it is in the high category. Elaboration indicators can be observed. During the training, the teacher was able to design a PjBL-STEAM learning design with the help of Canva. Apart from that, teachers can also develop or enrich the ideas presented by the presenters regarding PjBL-STEAM with the help of Canva by implementing them in making PjBL-STEAM products during training on energy topics. The elaboration aspect shows how detailed or detailed the answer is to solve the problem posed (Yulianti, 2017).

Creative thinking skills on elaboration indicators during training were demonstrated in detail by the teacher and group colleagues designing project designs and posters and analyzing STEAM elements in products related to energy materials. The teacher and his group colleagues also made a presentation and

explained in detail the application of STEAM to the product. In the originality indicator, the pretest percentage score was 68.19%, and the posttest was 98%. The percentage results show an increase in creative thinking skills from the previous criteria of being creative to being very creative. The average N-Gain is 0.94, so it is in the high category. Indicators of originality can be observed that during the training, teachers were able to be creative in making STEAM products using Canva media to overcome problems related to the energy crisis.

Furthermore, teachers are also able to test STEAM products that have been made by group colleagues. The originality aspect shows that the teacher not only answers correctly but can provide innovations in solving problems (Qomariyah & Subekti 2021). This was proven during the discussion session; the teacher was able to provide ideas and ideas innovatively to develop and implement the application of PjBL-STEAM assisted by Canva on other science topics to solve various problems in everyday life.

Participants showed enthusiasm and very good responses to the training to improve creative thinking skills with PjBL-STEAM assisted by Canva. The results of the analysis of training implementation instruments prove this. This service assessment instrument focuses on assessments regarding the appropriateness of the training material and presentation. The results of participants' responses to the PjBL-STEAM training assisted by Canva are presented in Table 2.

Table 2 shows that the average percentage of participants' responses to service was 97.4%, with detailed responses regarding the appropriateness aspect of the material being 97.6% and the training presentation being 97.4%. These results indicate that the training that took place was presented very well. A description of the suitability aspects of training materials can be described as follows. In terms of the training material delivered by the needs of teachers in the 21st Century learning era and Industrial Revolution 4.0, the average percentage obtained was 98.2%.

Aspects of the training material are 98.8% in line with students' needs in the 21st century learning era and industrial revolution 4.0. Aspects of the training material were able to increase teachers' understanding of PjBL-STEAM learning assisted by Canva in science learning by 97.7%. The completeness of the training material coverage is useful in guiding teachers to implement PjBL-STEAM learning assisted by Canva in science learning at 94.8% and in aspects of the training material by the objectives of the independent curriculum at 98.2%.

Another aspect is the training presentation. The description of the aspects of the training presentation includes the aspect that the objectives to be achieved by the training are conveyed clearly to students, obtaining a score of 98.2%. The accuracy of the sequence of training presentations according to the agreed schedule was 97.7%. The training material was presented interestingly by 97.7% of the speakers. The presentation of the material makes it easier for teachers to implement PjBL-STEAM learning assisted by Canva in science learning by 96%. Finally, the aspect of presenting training materials encourages teachers to actively look for sources and materials to implement PjBL-STEAM learning in science learning at 97.1%.

CONCLUSION

Training to improve creative thinking skills with PjBL-STEAM assisted by Canva for Semarang City science teachers was welcomed well and enthusiastically by participants. This training has been proven to be able to improve teachers' creative thinking skills in designing PjBL-STEAM-based learning. This is proven by the N-Gain score for each indicator of creative thinking skills being in the high category. Participants also showed a positive response to the delivery of training material and presentation.

Participants considered the training presented to be very interesting and innovative and added real knowledge and experience to be applied in science learning. The researcher's suggestions for further service activities can be carried out with a wider reach, not limited to Semarang City but can reach other areas, especially areas that are still lagging in the

development of science and technology. Apart from that, you can also vary the media used as an example of implementing AI in training. So that we can prepare teachers who can package interesting, innovative, creative, and contextual learning with 21st-century skills.

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