

Research Article

Does Problem-Based Learning Enhance Student Creativity?

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Abstract

This study aims to examine the impact of the problem-based learning (PBL) model in archival subjects on improving the creativity of vocational school students majoring in logistics management. The study employed an experimental method with a quasi-experimental approach using a non-equivalent control group design. Participants comprised 68 students, with 34 assigned to the experimental group and 34 to the control group. Data were gathered through achievement tests, semi-structured interviews, and document analysis to provide both quantitative evidence and contextual insights. Prior to hypothesis testing, the data were assessed for normality and homogeneity to ensure that statistical assumptions were met. The analysis included hypothesis testing and n-gain score calculation to evaluate the magnitude of learning improvement. The findings show a significant enhancement in students' creativity skills among those who learned through PBL. In addition, comparisons of pre-test and post-test results between the experimental and control groups demonstrate meaningful differences, supporting acceptance of the alternative hypothesis. These results suggest that implementing PBL in archival instruction can effectively foster students' creative thinking and problem-solving capabilities in vocational education contexts.

Keywords: problem-based learning, student creativity, classroom experiment

INTRODUCTION

Creativity plays an important role in the learning process because it enables students to think divergently, generate new ideas, and develop alternative solutions to various problems (Oci, 2016). Previous studies have shown that student creativity can be improved through the implementation of problem-based learning (PBL). A prior study by Simangunsong et al. (2023) reported that PBL significantly contributes to the enhancement of creativity, conceptual understanding, and problem-solving skills. Similar findings were reported by Elizabeth and Sigahitong (2018), who found that PBL positively affects students' creative thinking abilities, as well as by Maulidia et al. (2020), who demonstrated that PBL improves students' creativity by actively engaging them in problem-solving activities. In addition, Birgili (2015) emphasized that learning environments based on PBL are effective in fostering both creative and critical thinking skills.

Creativity is defined as the ability to produce new and different ideas (Rukhmana, 2022). Creative students demonstrate curiosity, confidence, and persistence in learning, which positively affects their academic performance. This is reinforced by Salsabila and Ramdhini (2020), who stated that creativity is linked to learning satisfaction and overall

student achievement. Beyond cognitive aspects, creativity also influences motivation, student engagement, and the ability to internalize concepts meaningfully. Thus, creativity becomes an essential skill required in 21st-century learning to equip students for future challenges (Isabirye et al., 2025).

However, in practice, learning in schools including archiving subjects still to emphasize theoretical content and teacher-centered instruction. Such conditions often cause students to feel bored, less active, and unable to develop their creative and critical thinking skills. Ramadhani and Khairuna (2022) explained that monotonous learning models limit creativity and reduce the effectiveness of learning outcomes. In archiving subjects, students often complete tasks based solely on instructions, without opportunities to explore problem-solving or engage in meaningful discussions. Archiving is an essential competency in the logistics management department because it prepares students to meet workplace expectations. However, learning activities at vocational school is still dominated by the direct instruction, which limits opportunities for developing creativity and critical thinking skills (Yanti, 2019).

Practical activities such as organizing documents based on the five filing systems (alphabetical, subject, region, date, and number) are often carried out procedurally and repeatedly. Learning activities that are routine and procedural can hinder the development of students' creativity because students only follow instructions without being encouraged to explore ideas or alternative solutions (Ahmad & Mawarni, 2021). As a result, the creative skills expected to emerge from archiving practices do not develop optimally. This condition is reflected in students' mistakes when organizing documents, such as inaccurately arranging letters in snelhecter folders, which indicates a lack of deeper understanding and creativity in applying archiving concepts. Creativity develops when students are actively involved in learning and given opportunities to think, explore, and solve problems independently (Ahmad, Tambak & Nasution, 2017).

The direct Instruction model is considered less effective in developing students' creativity because learning is teacher-centered, causing students to be passive and limiting their involvement in problem-solving and collaboration. Therefore, a learning model that actively engages students is needed. PBL is an appropriate alternative because it focuses on real-world problems and encourages students to think creatively, share ideas, and find solutions. The direct Instruction model emphasizes teacher dominance in the learning process, which results in limited student participation and interaction during classroom activities (Sidik & Winata, 2016). Learning models that involve students actively in solving problems and collaborating with peers are proven to be more effective in enhancing creativity compared to conventional instruction. (Rais & Suswanto, 2017).

Previous studies (Hidayati et al., 2024; Nolowala, 2024; Maryanti et al., 2023) have shown that PBL has a significant positive effect on students' creativity and critical thinking skills. However, most of these studies were conducted at the general secondary education level, focused on subjects other than archiving, and often integrated PBL with specific learning media. Meanwhile, research examining the direct application of the PBL model in archiving subjects within vocational education, particularly in Logistics Management programs at vocational high schools remains limited. Therefore, this study was conducted to address this research gap by investigating the effect of the PBL on students' creativity in vocational schools.

METHOD

Research Design

This research employed an experimental method with a quasi-experimental approach using non-equivalent control group design. Class XI ML 1 served as the experimental class receiving the problem-based learning (PBL) treatment, while Class XI ML 2 acted as the control class using the direct instruction model. The design involved pre-test for both groups before treatment, treatment only in the experimental class, and post-test afterward. This research design was used to determine the effect of instructional treatment by systematically comparing the outcomes of the experimental and control groups (Arikunto, 2021). An experimental approach in educational research enables researchers to obtain objective and measurable data based on predetermined research procedures (Hartono, 2019).

Population and Sample

The research population comprised all 68 students in Class XI Logistics Management at SMK Negeri 1 Surabaya from two classes (XI ML 1 and XI ML 2). The sample was selected via purposive sampling based on similar academic performance, consisting of 34 students from XI ML 1 as the experimental class and 34 students from XI ML 2 as the control class.

Instruments

The research instruments used to collect the data consisted of a student creativity test in the form of essay questions that had been validated and tested for reliability using SPSS 22.0 and further analyzed using Microsoft Excel 2019, unstructured interview guidelines with subject teachers, and documentation sheets covering student scores, research activities, and instructional materials for the Archiving subject on filing system elements.

Procedures

The procedures of this research consisted of several stages. First, a pre-test was administered to both the experimental and control classes to measure students' initial creativity levels. Next, the learning treatment was implemented, in which the experimental class was taught using the PBL model, while the control class applied the direct instruction model. After the treatment, a post-test was conducted to measure students' final creativity levels. Additional data were collected through unstructured interviews with subject teachers and documentation of student scores, research activities, and instructional materials for the Archiving subject on filing system elements. Finally, the collected data were analyzed to draw research conclusions.

Data Analysis

Data analysis included normality test, homogeneity test, hypothesis testing via independent sample t-test confirming significant differences, and N-Gain Score test showing greater improvement in the experimental group. All analyses were processed using SPSS 22.0 and spreadsheets.

RESULT

Pre-test Results of the Experimental Class and Control Class

Prior to receiving any treatment, both classes were first administered a pretest to assess students' initial abilities on the topic of Filing System elements. The pretest results indicated that the starting abilities of the experimental and control groups were relatively comparable. The lowest and highest scores in both classes were not significantly different, and the average score remained below the minimum passing grade of 75. These findings imply that both groups still had basic abilities that needed improvement and had equal opportunities to receive the learning intervention, as shown in Table 1. The pre-test results in the experimental class indicate that students' initial abilities were generally in the low to moderate range. The control class showed similar initial abilities, with only a slight advantage seen in the experimental class.

Table 1

Pre-test results of the experimental class and control class

Class	Lowest Score	Highest Score	Average	Number of Student
Experimental Class	33.9	69.6	52.73	34
Control Class	33.9	69.6	51.11	34

Post-test Results for the Experimental Class and Control Class

After the learning process was completed, both classes were given a posttest to determine the change in student creativity after the learning treatment was given. The posttest results revealed an improvement in scores for both classes; however, the increase was noticeably greater in the experimental class that was taught using the PBL, as shown in Table 2.

Table 2

Posttest results for the experimental class and control class

Class	Lowest Score	Highest Score	Average	Number of Student
Experimental Class	62.5	98.2	83.04	34
Control Class	35.7	80.3	62.24	34

Based on the data in the table, the post-test results in the experimental class show that most students exceeded the minimum competency level. This demonstrates that the PBL effectively improves student understanding through investigative activities, group work, and evaluation of the problem-solving process. Meanwhile, the control class also showed some improvement, but not as significantly as the experimental class. This indicates that the direct instruction model used in the control class was less effective in enhancing student learning outcomes.

Validity

The validity test of these questions was conducted using IBM SPSS 22.0 to compare the r calculated and r table values. In this study, the r table for 30 students with a significance level of 0.05 was 0.361. A question is considered valid if r calculated is greater than r table. The following are the results of the validity test for the pre-test and post-test questions (see Table 3).

Table 3
Validity test results

Question No.	R calculated	R table	Description
Question 1	0.330	0.3610	Invalid
Question 2	0.379	0.3610	Valid
Question 3	0.537	0.3610	Valid
Question 4	0.372	0.3610	Valid
Question 5	0.088	0.3610	Invalid
Question 6	0.454	0.3610	Valid
Question 7	0.590	0.3610	Valid
Question 8	0.387	0.3610	Valid
Question 9	0.636	0.3610	Valid
Question 10	0.653	0.3610	Valid
Question 11	0.503	0.3610	Valid
Question 12	0.642	0.3610	Valid
Question 13	0.740	0.3610	Valid
Question 14	0.523	0.3610	Valid
Question 15	0.552	0.3610	Valid
Question 16	0.766	0.3610	Valid
Question 17	0.619	0.3610	Valid
Question 18	0.651	0.3610	Valid
Question 19	0.646	0.3610	Valid
Question 20	0.547	0.3610	Valid

Based on 20 questions tested on 34 students, 18 valid questions were obtained (numbers 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20) with r calculated $>$ r table) while the other 2 items were invalid. Thus, only 18 valid questions were used for the pre-test and post-test instruments in the study.

Reliability

After the validity test, the valid items were then tested for reliability using the SPSS 22.0 program, with the following results (see Table 4). Based on the reliability test results, the 20 pre-test and post-test items obtained a Cronbach's Alpha value greater than 0.60, specifically 0.861. Therefore, it can be concluded that the pre-test and post-test items are reliable.

Table 4
Reliability test results

Type of Test	Cronbach's Alpha	Decision
Test Results	0.861	Reliable

Question Difficulty Level

The difficulty level of the items was calculated using a difficulty index, with categories of difficult (≤ 0.30), moderate (0.31–0.70), and easy (≥ 0.71). An item is considered good if it is in the moderate category. The calculation of the difficulty level of the pre-test and post-test was performed using Microsoft Office Excel 2019, which provided in Table 5. Based Referring to the analysis results in Table 5, out of the 20 pre-test and post-test items evaluated, 11 questions were categorized as having a moderate difficulty level and 9 questions were classified as easy.

Table 5
Test of difficulty level of pre-test and post-test items

Category	Difficulty Index Range	Number of Question	Percentage
Easy	0.72 – 0.85	9	45%
Moderate	0.53 – 0.67	11	55%
Difficult	-	0	0%

Item Discrimination

The item discrimination power was analyzed using Microsoft Office Excel 2019 with the categories poor (0.00–0.20), fair (0.21–0.40), good (0.41–0.70), and very good (0.71–1.00). The calculation results are presented in Table 6.

Table 6
Item discrimination test for pre-test and post-test

Category	Number of Question	Percentage
Good	5	25%
Fair	9	45%
Poor	6	30%

As shown in Table 6, which shows the results of the discrimination test for the 20 questions analyzed, there were 5 questions categorized as good, 9 as fair, and 6 as poor. Poor-quality questions were not used in the data analysis because during the normality test, the data became abnormal, so that when testing the hypothesis, it did not affect student creativity. Only 14 questions with adequate or good discrimination were used as research instruments.

Normality Test

The normality test was carried out using the Shapiro–Wilk method in SPSS 22.0 with a significance level of 0.05. The data is considered normally distributed if the significance value is greater than 0.05. The results of the normality test are shown as follows:

Table 7
Normality test results

Student Creativity	Shapiro-Wilk
Experimental Class Pre-test	0.525
Experimental Class Post-test	0.335
Control Class Pre-test	0.151
Control Class Post-test	0.237

Based on the results of the Shapiro–Wilk normality test presented in the table above, the significance values for the experimental class pre-test and post-test were 0.525 and 0.335, respectively, while the control class obtained significance values of 0.151 and 0.237. Since all significance values exceed the 0.05 significance level, it can be concluded that the pre-test and post-test data in both classes are normally distributed.

Homogeneity Test

The homogeneity test was carried out using SPSS 22.0 to examine whether the variances of the post-test data in the experimental and control classes were equivalent.

The data is classified as homogeneous if the significance value exceeds 0.05. The results of the test are shown in Table 8. Based on the results of the homogeneity test on the post-test values, a significance value of 0.094 was obtained. Because this value is greater than 0.05, the variance of the two groups is declared homogeneous, thus fulfilling the assumption for the t-test.

Table 8*Homogeneity test results*

Group	Significance	Description
Posttest Experimental Class & Control Class	0.094	Homogenous (Sig > 0.05)

Hypothesis Test

Hypothesis testing was conducted using the Independent Sample T-test. The results of the analysis indicated a significance value of 0.000, meaning the hypothesis was accepted because the sig value was < 0.05. Therefore, there is a significant difference in student creativity between the class that implemented the Problem Based Learning model and the control class.

Table 9*Hypothesis Test*

Group	T calculated	Significance	Description
Posttest of Experimental Class dan Control Class	7.966	0.000	Significant (Ha accepted)

Based on Table 9, the t-test results indicate a significance value of 0.000, meaning that the research hypothesis is accepted. This implies that the application of the Problem-Based Learning model has been proven to significantly influence students' creativity compared to the conventional learning model used in the control class.

N-Gain Score Test

The results of the n-gain score analysis indicate that student creativity improved in both groups; however, the increase in the experimental class was greater than in the control class. Therefore, the implementation of the PBL model is proven to be more effective in enhancing student creativity (see Table 10).

Table 10*Gain Score Test*

Group	Pretest Average	Posttest Average	N-Gain Score	Description
Experimental Class	52.73	83.04	30.30	Higher improvement
Control Class	51.11	62.24	12.20	Lower improvement

Based on Table 10, the n-gain score test results show an increase in learning outcomes in both groups, but the increase in the experimental class is greater than in the

control class. Thus, the PBL model is proven to be more effective in encouraging an increase in student creativity.

DISCUSSION

The results of this study show that students in the experimental class, which implemented the Problem-Based Learning (PBL) model, experienced a significantly greater increase in creativity compared to those in the control class using the Direct Instruction model. This improvement is reflected in students' ability to generate diverse ideas, produce original responses, and elaborate solutions more effectively throughout the learning process. These findings indicate that PBL successfully creates a learning environment that encourages students to think independently, actively, and creatively.

This result is consistent with previous studies that reported the effectiveness of PBL in enhancing students' creative thinking skills. For instance, Elizabeth and Sigahitong (2018) found that the PBL model has a positive effect on students' creative thinking abilities, while Ersoy and Başer (2014) concluded that PBL significantly improves creative thinking in higher education settings. Similar findings were also reported by Birgili (2015), who emphasized that PBL learning environments effectively foster creative and critical thinking skills. In the vocational education context, Ratnasari, Supriyanti and Rosbiono (2017) demonstrated that the implementation of PBL can enhance students' creativity by engaging them in problem-oriented learning activities.

In terms of mechanism, PBL works more effectively because students are directly confronted with real problems related to the archival filing system. Through activities such as group discussions, investigations, case analysis, and presentations, students engage deeply with the learning process. They are required to evaluate information, search for alternative solutions, formulate ideas, and construct knowledge based on their own exploration. This process strengthens key aspects of creativity, including fluency, flexibility, originality, and elaboration.

On the other hand, the direct instruction model does not provide sufficient opportunities for students to explore ideas independently. Learning in the control class focused heavily on teacher explanations followed by routine practice tasks. As a result, students tend to follow predetermined steps without engaging in creative thinking, which explains why the improvement in creativity was not as substantial as in the experimental class. These findings align with previous studies, such as Hidayati et al. (2024) who reported that PBL enhances student participation and understanding by placing learners at the center of instruction. Similarly, Nolowala et al. (2024) found that PBL significantly improves critical thinking and creativity among high school students. Maryanti et al. (2023) further demonstrated that multimedia-based PBL strengthens students' mathematical creativity and higher-order thinking skills. Thus, the present study reinforces prior research, confirming that PBL is highly effective in improving creativity across various subjects, including Archival Studies.

PBL shows a strong positive effect on creativity development because it requires students to learn through direct experience, problem-solving, and collaborative interaction. In contrast, traditional teacher-centered methods such as Direct Instruction are less capable of stimulating higher-order creative thinking. The findings of this study offer practical implications, especially for teachers of Archival subjects. Educators are encouraged to adopt PBL as an alternative instructional model to enhance student creativity, particularly for topics requiring analytical and problem-solving skills, such as

the filing system. PBL can also foster a more engaging and student-centered classroom atmosphere while increasing students' confidence in expressing ideas. Moreover, the implementation of PBL prepares students to meet workplace expectations that demand creativity, collaboration, and critical thinking abilities.

CONCLUSION

This study concludes that the pre-test and post-test results demonstrate a considerable improvement in the experimental class that applied the problem-based learning (PBL) model compared to the control class that used the direct instruction approach. The average post-test score in the experimental group rose markedly from the pre-test, whereas the control group showed only a slight improvement due to the one-way learning process that did not engage students actively. The findings of this study offer significant implications for instructional practice, particularly in Archival subjects within vocational education. The evidence that PBL enhances students' creativity underscores the need for educators to shift from teacher-centered instruction toward more interactive, problem-oriented learning approaches. PBL can serve as an essential strategy to encourage students to explore concepts more deeply, collaborate actively, and develop creative solutions to real-world problems relevant to their future professional roles.

This study was conducted to the best of our ability, but we realize that it still has several limitations. The limitations of this study are events that are difficult for researchers to control. Some of the events that are difficult to control include students who are noisy during class, causing them to pay less attention and not focus on learning, and students who are not very involved in group discussions. These are things that cannot be controlled by researchers. Based on the research findings, the researcher recommends that the PBL model be implemented as an innovative alternative learning approach that emphasizes active student participation. Finally, future research is expected to improve the description of questions when the test of question discrimination does not have poor criteria in the questions and has a good average criterion so that it does not affect the data during the normality test.

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Not applicable

Competing interests

The author has declared that there are no conflicts of interest

Data availability

The data were provided upon request to corresponding author

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