Jurnal Ilmu Sosial dan Pendidikan (JISIP)
Vol. 9 No. 3 Juli 2025
e-ISSN : 2656-6753, p-ISSN: 2598-9944
DOI: *10.36312/jisip.v9i3.8663/http://ejournal.mandalanursa.org/index.php/JISIP/index*

Optimization of Flowchart Material in Programming Using Problem Based Learning Model Class X SMKN 1 Cerme

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Article Info
Article history:
Received: 30 April 2025
Publish: 1 Juky 2025

Keywords:
PBL;
Flowchart;
Learning Outcomes;
Learning Interest;
Learning Motivation.

Abstract
This study aims to analyze the optimization of flowchart material in programming through the application of the PBL model in class X of SMKN 1 Cerme. The method used is Classroom Action Research with two cycles, involving 36 students of class X Visual Communication Design (DKV) 1. Data collection was carried out through cognitive tests, learning interest questionnaires, and learning motivation questionnaires. The results of the study showed a significant increase in the cognitive learning outcome aspect, with the average pretest score increasing from 67.5 to 74.9 and the posttest score from 80.9 to 89.9. The results of the paired t-test showed that the implementation of PBL had a positive impact on students' academic achievement. The increase was also seen in students' learning interest, indicated by an increase in the percentage of learning completion from 81% to 97%. In addition, students' learning motivation increased, with the highest score in cycle I of 4.53 in the aspect of facility availability, and increasing to 4.69 in cycle II in the aspect of belief in the relevance of flowchart learning to the world of technology. The conclusion of this study shows that the PBL model is effective in improving student learning outcomes, interests, and motivation. The implication is that teachers are advised to implement problem-based learning that is contextual and relevant to the needs of students and the world of work.

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1. INTRODUCTION

National education continues to undergo updates as time goes by, one of which is through the implementation of the Independent Curriculum which focuses on strengthening 21st century competencies. This curriculum provides space for teachers to adapt learning models to the needs and characteristics of students, as suggested by Asyafah (2019), that variations in learning models are needed so that students do not experience boredom and remain enthusiastic about learning. One approach that is in line with the spirit of the Independent Curriculum is PBL, which places students as active subjects through contextual problem solving (Adistana, 2016). This model is also believed to be able to increase student responsibility for learning, critical thinking and independence (Sanjaya in Tyas, 2017). Apart from that, this approach also trains students to become independent and responsible learners, who are able to reflect on their learning process and are ready to face real challenges in society and the world of work.

PBL is considered very appropriate to apply in informatics learning, especially in the topics of algorithms and flowcharts. Flowcharts are diagrammatic representations of problem solving flows that are useful in programming (Rosaly et al., 2020; Tominanto & Subinarto, 2018). In fact, many students still experience problems in understanding the material due to a lack of connection between learning methods and the reality they face. This also happened at SMKN 1 Cerme, where students' interest and motivation towards learning flowcharts was relatively low.

This phenomenon also occurred at SMKN 1 Cerme, where students found low interest and motivation in learning flowcharts. Marti'in (2019) stated that interest in learning arises from feelings of liking that develop through learning experiences, and this is an important driver in the learning process. Unfortunately, low interest in learning is often caused by unattractive teaching methods, students' lack of understanding of the relevance of the material to the world of work, and limited learning facilities such as software and computers. Adnyana and Yudaparmita (2023) added that students' enjoyment and emotional involvement have a central role in forming interest and value in the material being studied.

Learning motivation is also an important factor in achieving learning outcomes. Without strong enough encouragement, students tend to experience a decrease in enthusiasm for learning which has an impact on academic achievement (Novianti, 2020). Fernando (2024) differentiates motivation into two types, namely intrinsic motivation which comes from internal drives such as personal ideals, and extrinsic motivation which is influenced by external factors such as support from teachers and parents. The lack of these two types of motivation is reflected in the low learning outcomes of students and their inability to apply flowcharts in the context of real problem solving.

Therefore, contextual, interactive and applicable learning strategies are needed, one of which is adopting the Problem-Based Learning model. Presenting real cases such as the development of a queuing system and online registration flow makes learning more meaningful, increases student engagement, and strengthens understanding of the material. Furthermore, this model supports the development of systematic thinking skills which are much needed in the industrial world.

Based on this background, researchers made strategic efforts to apply the PBL model in flowchart learning. It is hoped that the contextual problems raised in learning can trigger curiosity, increase active involvement, and help students understand concepts more deeply. Therefore, this research was conducted with the title *"Optimizing Flowchart Material in Programming Using the Problem-Based Learning Model in Class X SMKN 1 Cerme"* which aims to examine the extent to which this model can significantly increase student interest, motivation and learning outcomes.

2. RESEARCH METHOD

Research using the PTK method of qualitative and quantitative approaches was carried out in two cycles. The research location is at SMK Negeri 1 Cerme, Gresik Regency, in the even semester of the 2024/2025 academic year. X DKV 1 student, totaling 36 people, were the sample determined purposely, namely students who obtained scores below the Assessment Completeness Criteria (KKTP).

The independent variable is the PBL model, while the dependent variable includes student learning outcomes, interests and motivation. The instruments used include multiple choice tests prepared based on competency indicators and Bloom's taxonomy to measure student learning outcomes and questionnaires to measure student interest and motivation to learn, with a Likert scale that refers to Maslow and Herzberg's theory.

Data collection in this research was carried out through administering pre-tests and post-tests to measure learning outcomes, as well as distributing questionnaires to obtain non-

test information related to students' learning interests and motivation. The collected data was analyzed quantitatively descriptively using percentages and simple statistical techniques. Assessment of learning outcomes is based on the level of achievement of the Assessment Completeness Criteria (KKTP), while analysis of interest and motivation uses interpretive categories based on a range of scales. To ensure the accuracy and suitability of the instruments used, validity, reliability, level of difficulty of questions and distinguishing power were tested.

3. RESEARCH RESULTS AND DISCUSSION

3.1.Research result

3.1.1. Test the Efficacy of Test Instruments

a. Validity Test

Content validity for instruments in the form of tests is carried out by comparing the suitability of the question items to the learning material that has been taught. The results of the analysis show that all 30 items tested meet the validity criteria. This is proven through the results of the correlation coefficient calculation, where all values *r*_{count} are greater than compared *r*_{table}. Some of the questions with the highest level of validity include questions number 2 (0.820), 4 (0.778), 5 (0.752), 3 (0.738), 17 (0.721), and 10 (0.718). Apart from that, a number of other questions also showed strong validity values, such as questions number 1 (0.681), 6 (0.680), 7 (0.678), 9 (0.657), 15 (0.665), 18 (0.643), 19 (0.631), and 13 (0.609). Based on these results, it can be concluded that all the questions used have met the validity criteria and are suitable for use as measurement instruments in this research.

b. Reliability Test

The Cronbach's Alpha coefficient of 0.931 shows that the test instrument with 30 questions has very good reliability. This value exceeds 0.6, which is the minimum limit to declare an instrument valid. Thus, the data collected through this instrument is stable and reliable for further analysis.

Table 1. Reliability Test Results

Reliability Statistics	
Cronbach's Alpha	N of Items
.931	30

(Source: Personal Documents, 2025)

c. Difficulty Level

It can be seen that all the items in the test are distributed in the easy to medium category, as shown by the calculation results using SPSS version 26. The results of the difficulty level test show that all the items in this test are classified as easy to medium, with some variations in the level of ease. Some items provide a bit of a challenge, but overall, the test needs to be evaluated to have a more balanced distribution of difficulty levels.

d. Difference Power Test

The results of the analysis show that these questions are effective in differentiating students based on their ability level. Questions with good differential power can still be maintained, but need to be evaluated further to improve their quality. Overall, this test can be said to have good quality in measuring students' abilities objectively and fairly.

3.1.2. Improving Student Learning Outcomes

a. Cycle I Learning Results

Measurement of students' cognitive learning outcomes is carried out through tests consisting of a pretest and posttest. Learning completeness is determined if students get a score equal to or exceeding the threshold for the Assessment Completeness Criteria (KKTP), which is 75. The following diagram presents the level of completeness of students' pretest and posttest scores on the learning material. *Flowchart* in Programming.

Figure 1. Cycle I Learning Results
(Source: Personal Documents, 2025)

Based on the analysis of cycle 1 learning results in Figure 4.5, it can be seen that the scores of 36 students in the pretest were 3 students who completed and 33 students who did not complete with an average score of 67.5. Then during the implementation of the posttest there was an increase and 33 students completed the score with an average of 80.9, so from this data it can be seen that there was an increase in student learning outcomes.

b. Cycle II Learning Results

In the second cycle, the increase in learning outcomes was measured using the test method by carrying out pretest and posttest activities

Figure 2. Cycle II Learning Results
(Source: Personal Documents, 2025)

Based on Figure 2, it is known that 52% of students completed the pretest and 100% of students completed the posttest. After learning using the PBL model, the posttest results showed that all students succeeded in achieving

completeness with a mean score of 89.9. These results are in line with the findings of Ruli and Indarini (2022), who stated that the PBL model makes a major contribution to the development of students' critical thinking in learning mathematics. Parwata (2021) also found the same thing, stating that the application of the PBL model significantly improved student learning outcomes in physical education, sports and health subjects. This happens because students are actively involved during learning. In addition, Maulidya and colleagues (2021) explained that the learning steps in the PBL model, such as problem orientation, independent and collaborative investigation, to process analysis and evaluation, play a role in developing students' analytical abilities in secondary level biology learning.

3.1.3. Students' Learning Interests

a. Results of Cycle I Learning Interest

Data on students' interest in learning activities was obtained from the results of filling out a questionnaire that was completed by 36 students of class X DKV 1 which is presented in the following diagram:

Figure 3. Results of Cycle I Learning Interest
(Source: Personal Documents, 2025)

Based on the results of the questionnaire data analysis obtained in cycle I, it can be concluded that the students' responses were very good. In cycle 1, it was obtained that 81% was categorized as very good in indicators 2,4 and 5, which means that 31 out of 36 students had feelings of liking, had positive feelings towards learning, felt connected, fascinated and experienced increased learning outcomes in learning flowcharts in programming.

b. Results of Cycle II Learning Interest

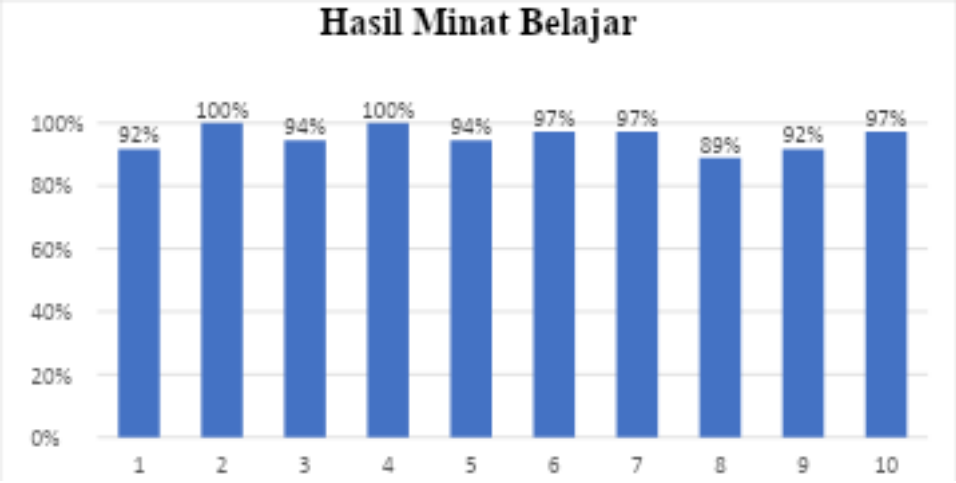

Figure 4. Results of Cycle II Learning Interest
(Source: Personal Documents, 2025)

In cycle II, the results of data analysis explained that students' responses to learning flowcharts in programming experienced a very positive increase. The highest response, namely 100%, was recorded in indicators 2 and 4, which indicated that students began to show interest in the material being studied, felt emotional involvement, and showed an increase in understanding the flowchart concept. These findings confirm that the application of the PBL model in optimizing flowchart learning makes a significant contribution to improving learning outcomes and student interest. This can be seen from the increase in the percentage of learning completeness, which was initially 81% in cycle I, increasing to 97% in cycle II.

This finding is in line with the research results of Farisi (2023), which revealed that there is a strong correlation between interest in learning and motivation to learn, as well as a quite significant relationship between interest in learning and students' career planning. Additional support is provided by the findings of Yudhiarti (2020), which shows that interest in vocational fields and students' academic potential contribute significantly to learning achievement. Siti Nur Isnaini's research (2023) shows that the use of interestingly designed learning media can encourage student involvement and interest in the learning process. Furthermore, Selviana (2025) found that the implementation of group counseling services proved effective in helping to foster students' interest in learning. Meanwhile, findings from Setiawan and colleagues (2022) confirm the existence of an interplay between the level of interest in learning and student achievement of learning outcomes.

Based on these various findings, it can be concluded that the application of the PBL model not only improves students' academic results, but also strengthens their interest and motivation to learn. These factors collectively contribute to supporting the achievement of more optimal academic achievement in the educational environment.

3.1.4. Student Learning Motivation

a. Results of Cycle I Learning Motivation

Data on student motivation for learning activities was obtained from the results of filling out a questionnaire that was completed by 36 class X DKV 1 students which is presented in the following diagram:

Figure 5. Results of Cycle I Learning Motivation
(Source: Personal Documents, 2025)

The highest average learning motivation in cycle I of 4.53 was recorded in the aspect of the availability of adequate learning facilities, such as software, computers and practice rooms, which support the learning process of making flowcharts.

b. Results of Cycle II Learning Motivation

Figure 6. Results of Cycle II Learning Motivation
(Source: Personal Documents, 2025)

The highest average motivation for learning outcomes in cycle II was 4.69 obtained in aspect 6. Students' motivation also increased with the application of the PBL model, especially in aspect 6, namely students believed that studying programming flowcharts helped me hone my skills and supported me in achieving my goals in the world of technology. This increase shows that factors such as the availability of adequate learning facilities, teacher support through guidance and constructive feedback, and recognition of students' work results play an important role in increasing learning motivation. Apart from that, students' belief in the benefits of learning flowcharts in developing skills and achieving goals in the field of technology also encourages increased motivation.

Overall, these results indicate that efforts to improve the quality of learning, both through providing adequate facilities and emotional and academic support from teachers, can effectively increase students' learning motivation in compiling programming flowcharts.

3.2.Discussion

Based on analysis of pretest and posttest data followed by hypothesis testing, it can be concluded that the application of the PBL model significantly contributes to improving student learning outcomes. This is reflected in the increase in the average pretest score from 67.5 in cycle I to 74.9 in cycle II. Likewise, the average posttest score increased from 80.9 to 89.9 in the same cycle.

This increase in cognitive aspects is reinforced by the results of statistical tests using the method *paired t-test* via the SPSS version 26 application, as shown in Tables 4.2 and 4.4. A significance value (Sig. 2-tailed) of 0.000 (< 0.05) indicates that there is a significant difference before and after implementing PBL. Thus, these findings confirm that the PBL model is effective in improving conceptual understanding and overall student learning outcomes.

The results of this research are in line with various previous studies which confirm the effectiveness of the PBL model in improving the quality of learning. Maya Sari and Ani Rosidah (2023) found that the application of the PBL model was able to encourage active student participation, foster enthusiasm for learning, and have a positive impact on student learning outcomes at the elementary school level. This is reinforced by the findings of Ipah Budi Minarti and colleagues (2023), who stated that the PBL approach not only improves students' critical thinking skills in temperature and heat material, but also encourages active involvement and provides effective alternative learning methods to increase learning outcomes.

The effectiveness of PBL in developing high-level thinking skills was also proven by Efrianus Ruli and Endang Indarini (2022), who noted the significant influence of this

model in improving students' critical thinking skills in learning mathematics. Similar findings were presented by I Made Yoga Parwata (2021), who showed that the use of PBL can actually improve learning outcomes in physical education, sports and health subjects. Furthermore, Maulidya and colleagues (2021) emphasized that each stage in the PBL model syntax—from problem orientation to process evaluation—can encourage students' analytical abilities, especially in biology learning at the secondary school level.

In the context of this research, the application of the PBL model to flowchart material has been proven to be able to improve student learning outcomes significantly, as seen from the increase in average scores and test results. *paired t-test*. These results also reflect the close relationship between students' interests, motivation and academic achievements. Farisi (2023) revealed that interest in learning has a strong relationship with learning motivation and is moderately related to students' career planning. This opinion is reinforced by Yudhiarti (2020), who found a significant relationship between vocational interests, learning potential, and students' academic achievement.

Furthermore, the research results show that increasing students' interest in learning is also influenced by media and a supportive learning environment. Isnaini and colleagues (2023) stated that the use of interesting learning media can increase students' interest in the material, thereby supporting a more effective learning process. In addition, Selviana (2025) proves that group counseling services can also be used to arouse students' previously low interest in learning. This finding was confirmed by Angga Setiawan and team (2022), who showed that there was a positive relationship between interest and student learning outcomes.

In terms of motivation, questionnaire data collected during cycles I and II showed significant improvements in various indicators. Increasing learning motivation in the aspect of availability of learning facilities and belief in the benefits of flowchart learning shows that internal and external factors both play an important role. This is supported by Acep Roni Hamdani and colleagues (2021), who stated that the PBL model is effective in increasing students' learning motivation in elementary schools. Adetyas (2021) also emphasized that the availability of adequate learning facilities can provide a big boost to student motivation. Apart from that, Amelia and colleagues (2021) said that choosing the right learning model, coupled with the use of interactive media, can significantly strengthen students' learning motivation.

Strong motivation is proven to be one of the determining factors for student learning success. Loviyan and the research team (2023) stated that high enthusiasm for learning has a positive correlation with students' academic success. This is also reinforced by the research results of Zamsir and colleagues (2021), who through regression analysis found that learning motivation has a significant effect on student learning outcomes. Thus, it can be concluded that the application of the PBL model not only has a positive impact on learning outcomes, but also simultaneously increases student interest and motivation, which ultimately contributes to more optimal academic achievement.

4. CONCLUSION

Based on the research results, it can be concluded that the application of the model *Problem-Based Learning* (PBL) is effective in improving learning outcomes, interest and motivation of class X DKV 1 SMKN 1 Cerme students on flowchart material in programming. This effectiveness is demonstrated by an increase in the average pretest score from 67.5 in Cycle I to 74.9 in Cycle II, as well as the average posttest score from 80.9 to 89.9. Test results *paired t-test* show a significance value (Sig. 2-tailed) of 0.000 (<0.05), which indicates there is a significant difference after implementing the PBL model. Apart from that, the level of learning completeness also increased from 81% in Cycle I to 97% in Cycle II. Analysis of the motivation questionnaire showed an increase in the average score

from the aspects of availability of learning facilities and students' belief in the benefits of flowchart learning, respectively from 4.53 to 4.69. These findings prove that the PBL model not only increases conceptual understanding, but also significantly grows students' interest and motivation to learn.

5. THANK-YOU NOTE

The author expresses deep appreciation and gratitude to the entire extended family of SMKN 1 Cerme, especially to the Pamong Teacher, as well as the students of class X DKV 2 for all their extraordinary support, cooperation and involvement during the implementation of this research. The author would also like to express his thanks to Surabaya State University, especially to the field supervisors who have provided very meaningful guidance, direction and academic support. Not to forget, the author appreciates the enthusiasm and assistance of PPG colleagues who contributed to this research process, as well as all parties who have helped directly or indirectly so that this research can be completed well.

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