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Research Article

The Effect of PBL Learning Model Visual Mapping Method Based on Analysis on Learning Outcomes of Labor Material in Class XI at SMA Negeri 1 Pasuruan

Muhammad Ridwan[1*], Licha Inabah[2], Dies Nur Hayati[3]
[1-3]Universitas PGRI Wiranegara Pasuruan, Indonesia
Email: [1)] mridwan.y17@gmail.com, [2)] lichainabah123@gmail.com

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Abstract
The objective of this study is to examine how the Problem-Based Learning (PBL) approach, combined with visual mapping techniques, impacts the academic performance of students studying employment material in class XI at SMAN 1 Pasuruan. Through a quantitative method and linear regression analysis, the research findings reveal that this teaching model has a notable and beneficial impact on student learning outcomes, accounting for 29.3% of the variation observed. Although effective, challenges were encountered such as non-normal residual distribution and heteroscedasticity. In conclusion, the PBL-visual mapping model proves to be a valuable tool for enhancing students' understanding of complex labor-related material, fostering critical thinking, and improving academic performance. Nonetheless, the study highlights the importance of addressing methodological limitations and exploring additional variables to further optimize the model's effectiveness. Future research should focus on refining the analytical approach and integrating complementary teaching strategies to maximize the potential of this innovative learning model.

Keywords: Problem-Based Learning, Visual Mapping, Learning Outcomes, Analytical Skills, Employment Education, Teaching Innovation, Critical Thinking, Secondary Education

1. Introduction

Education has a very important role in shaping human resources that are qualified, competent, and ready to face global challenges. The learning process at school does not only aim to transfer knowledge, but also to build students' analytical, creativity, and problem-solving skills (Fauziyah et al., 2024). Therefore, an effective learning model is needed to support the achievement of these goals (Arahmat, 2017).

Problem-Based Learning (PBL) has shown to be a successful educational approach in enhancing students' critical thinking abilities and academic achievements (Lukman et al., 2015). This model places students at the centre of learning by presenting real problems as the starting point of the learning process (Hmelo-Silver, 2004; Tarihoran & Adriadi, 2016). In its application, PBL allows students to develop analytical skills and systematic thinking through independent and group problem solving (Setiarani et al., 2022).

However, the implementation of PBL requires an innovative approach to make it more interesting and in accordance with student characteristics (Lumbantungkup et al., 2022). The analysis-based Visual Mapping method is one of the relevant alternatives to be integrated in the PBL model (Virgiana & Wasitohadi, 2016). Visual Mapping utilizes diagrams, concept maps, or other visual representations to help students understand relationships between concepts, organize ideas in a structured manner, and critically evaluate information (Crunkilton & Finch, 1999; Gao et al., 2021). This method enhances students' grasp of concepts and fosters greater engagement and creativity in their educational activities.

This visual mapping method is also able to make students understand the material more easily, because the method is able to encourage students to summarize all the material (Anisa et al., 2021).

This study seeks to examine how the use of the PBL learning model with Visual Mapping technique can impact the learning outcomes of students in XI SMAN 1 Pasuruan. The primary focus of this research is on enhancing the academic performance of students in subjects that demand strong analytical abilities. It is anticipated that the implementation of this teaching approach will help enhance the overall quality of learning, particularly by fostering students' critical thinking and analytical skills.

2. Methods

This research utilises quantitative techniques, specifically simple linear regression analysis, to investigate how independent factors impact the dependent variable. The reason for choosing this form of analysis is to explore the direct relationship between the variables of the PBL learning model using visual mapping method as the independent variable and student learning outcomes as the dependent variable.

Information was gathered using questionnaires and tests assessing learning outcomes. Before conducting regression analysis, the data underwent classical assumption tests, such as normality and linearity tests, to confirm the suitability of the regression model employed. Statistical software was utilised for data analysis to evaluate the impact of the independent variable on the dependent variable.

Validity and reliability tests were conducted before data analysis to ensure the quality of the tools used. The purpose of the validity test is to confirm that each item in the instrument can accurately measure the intended aspects. Validity criteria are determined based on the correlation between item score and total score, where the r-value should be greater than r-table or significance value should be less than 0.05. The results of the validity test indicate that all items, for both the independent variable (X) and the dependent variable (Y), have an r value higher than the r table (0.2227 at df = 76, α = 0.05). Therefore, it can be concluded that all items are deemed valid.

Table 1. Validity test result

Item Number	r_{value}	r_{table}	Significance 0,05	Description
X1	0,531	0,2227	0,000	Valid
X2	0,682	0,2227	0,000	Valid
X3	0,638	0,2227	0,000	Valid
X4	0,617	0,2227	0,000	Valid
X5	0,630	0,2227	0,000	Valid
X6	0,546	0,2227	0,000	Valid
Item Number	r_{value}	r_{table}	**Significance 0,05**	**Description**
Y1	0,633	0,2227	0,000	Valid
Y2	0,642	0,2227	0,000	Valid
Y3	0,694	0,2227	0,000	Valid
Y4	0,603	0,2227	0,000	Valid
Y5	0,704	0,2227	0,000	Valid
Y6	0,594	0,2227	0,000	Valid

The purpose of the reliability test is to assess the stability of the instrument's measurement outcomes. The level of reliability is evaluated through the application of Cronbach's Alpha, where a value exceeding 0.60 signifies a dependable instrument. After conducting the reliability analysis, it was determined that the Cronbach's Alpha value for variable X is 0.658 and for variable Y it is 0.719, both of which surpass the threshold for reliability.

Table 2. Reliability test result

Variable	Cronbach Alpha value	Cronbach Alpha Standard Value	Description
X	0,658	0,600	Reliable
Y	0,719	0,600	Reliable

With these results, the research instruments were declared valid and reliable, making them suitable for data collection. This ensures that the data generated is of good quality and can support further analysis.

3. Results and Discussion

3.1. Research Results

This research seeks to examine how the Visual Mapping Method, based on the PBL Learning Model Analysis, impacts the academic performance of students studying employment materials in class XI at SMAN 1 Pasuruan. The data analysis using simple linear regression and classical assumption tests revealed the following findings.

3.1.1. Classical Assumption Test Results

A) Normality Test (Kolmogorov-Smirnov)

The normality test is conducted to verify whether the residuals in the regression model are normally distributed, which is one of the basic assumptions in linear regression analysis.

Table 3. Normality test result

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		78
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	2.21864728
Most Extreme Differences	Absolute	.123
	Positive	.078
	Negative	-.123
Test Statistic		.123
Asymp. Sig. (2-tailed)		.005[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

The p-value obtained from the Kolmogorov-Smirnov test is 0.005, indicating statistical significance at a level below 0.05. Therefore, the null hypothesis (H_0) suggesting that the residual data conforms to a normal distribution is deemed invalid. Consequently, it can be inferred that the residual data does not exhibit a normal distribution. It is crucial to highlight the failure to meet this assumption of normality as it could impact the precision of parameter estimation in the regression analysis employed. Nevertheless, although the residual data is not normal, the effect of the PBL learning model of visual mapping method based on analysis on student learning outcomes can still be analysed, although with consideration of the use of methods that are more robust to violations of the normality assumption. This also shows that although this model has an effect on learning outcomes, the non-normal distribution of residuals can affect the validity of the model's predictions in explaining the variability of student learning outcomes on labour materials.

B) Heteroscedasticity Test (Glejser Test)

A heteroscedasticity test is then performed to determine if there is an issue with inconsistent residual variance at different predictor values, which is referred to as heteroscedasticity.

Table 4. Heteroscedasticity test result

Variable	Coefficient	p-value	Conclusion
ABS_RES	-0.538	0.004	Significant (Heteroscedasticity)

According to the results of the Glejser test, the ABS_RES variable has a coefficient of -0.538 and a p-value of 0.004, which is less than 0.05. This indicates a heteroscedasticity problem in the model, which means that the residual variance is not constant across predictor values. Although PBL learning with visual mapping method based on analysis shows a significant effect on student learning outcomes, this heteroscedasticity problem indicates that the model may not be fully optimal in predicting student learning outcomes consistently. To overcome this problem, remedial measures such as the use of regression methods that are more resistant to heteroscedasticity or data transformation can be considered so that this learning model can provide more accurate and reliable results. This suggests that although PBL learning is effective in improving learning outcomes, instability factors in residual variance still need to be corrected to improve the accuracy of the model.

C) Autocorrelation Test (Durbin-Watson)

The purpose of the autocorrelation test is to determine if the residuals in the regression model are independent of each other, a key aspect in conducting linear regression analysis.

Table 5. Autocorrelation test result

Test	Durbin-Watson value	Conclusion
Durbin-Watson	1.727	No autocorrelation

The Durbin-Watson test results show a value of 1.727, which is within the expected range of 1.5 to 2.5, indicating that there is no significant autocorrelation in the residuals of the regression model. This means that the residuals in this model are independent of each other, which fulfils the basic regression assumption of freedom from autocorrelation.

Thus, the PBL learning model of visual mapping method based on analysis can be considered valid to be used in explaining the effect of this model on students' learning outcomes, especially in labour material, because there is no systematic pattern among the residuals that can affect the analysis results. This confirms that this model can be used without any bias derived from excessive residual interrelationships, so the validity of the effect of this learning model on learning outcomes can be relied upon.

3.1.2. Simple Linear Regression Test Results

A) Coefficient of Determination (R^2)

Table 6. Coefficient of determination test result

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.542[a]	.293	.284	2.233	1.727

a. Predictors: (Constant), PBL Learning Visual Mapping Method Analysis
b. Dependent Variable: Learning Outcomes of Labour Materials

The results from the coefficient of determination test reveal an R^2 value of 0.293, suggesting that 29.3% of the variability in student learning outcomes can be accounted for by the PBL learning model using the visual mapping method through analysis. This suggests that while the model plays a significant role in student learning outcomes, the majority of the variation (70.7%) is influenced by factors beyond the model. The Adjusted R^2 value of 0.284 provides a more cautious estimate, taking into account the number of independent variables and sample size.

This result indicates that although PBL learning based on visual mapping is effective in improving students' understanding, there is room to improve the explanatory power of the model by adding other factors that can also affect learning outcomes. This finding underlines the importance of digging deeper into additional variables that can improve the quality of learning in the future.

B) Partial T Test

The partial t test was conducted to test whether the PBL learning variable of visual mapping method based on analysis has a significant influence on student learning outcomes.

Table 7. Partial t test result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.879	2.543		4.672	.000
	PBL Learning Visual Mapping Method Based on Analysis	.556	.099	.542	5.617	.000

a. Dependent Variable: Learning Outcomes of Labour Materials

The results of the t-test indicate that an increase of one unit in the learning model results in a 0.556 unit increase in student learning outcomes. Having a t-value of 5.617 and a p-value of 0.000, less than 0.05, suggests that the PBL learning model using visual mapping analysis has a notable impact on student learning outcomes.

This result shows that this learning model is effective in improving students' understanding of employment material, which proves that a problem-based approach and visualisation can significantly improve learning outcomes.

C) Simple Linear Regression Coefficient

The findings from the basic linear regression analysis indicate that a strong and positive correlation exists between the use of Problem-Based Learning (PBL) with visual mapping techniques and the academic performance in labour material.

Table 8. Simple linear regression coefficient result

Model	Unstandardized Coefficients (B)	t	Sig.
Constant	11.879	5.617	0.000
PBL Learning	0.556	5.617	0.00

The regression coefficient of 0.556 suggests that implementing this learning model will enhance student learning outcomes by 0.556 units for each unit increase. The value of t is 5.617 and the p-value is 0.000, indicating rejection of the null hypothesis. Therefore, it can be inferred that using problem-based learning with visual mapping analysis greatly benefits student learning, particularly in understanding material related to labour.

3.2. Discussion

The findings of this study demonstrate that the integration of the Problem-Based Learning (PBL) model with visual mapping techniques has a significant and positive impact on the learning outcomes of Class XI students at SMA Negeri 1 Pasuruan, particularly in labor-related material. The simple linear regression analysis revealed that the PBL-visual mapping model accounts for 29.3% of the variance in student learning outcomes, indicating its effectiveness in enhancing academic performance. This aligns with previous research highlighting the benefits of PBL in fostering critical thinking, problem-solving skills, and deeper conceptual understanding (Lukman et al., 2015; Setiarani et al., 2022). The visual mapping component further supports these outcomes by providing students with a structured and visually engaging way to organize information, analyze relationships between concepts, and synthesize knowledge (Virgiana & Wasitohadi, 2016; Anisa et al., 2021).

The partial t-test results, with a regression coefficient of 0.556 and a p-value of 0.000, underscore the strong influence of the PBL-visual mapping model on student learning outcomes. This suggests that each unit increase in the application of this model corresponds to a 0.556-unit improvement in student performance. Such findings highlight the potential of this approach to transform traditional teaching methods, particularly in subjects requiring analytical and critical thinking skills.

However, the study also identified several limitations that warrant attention. The normality test revealed that the residuals were not normally distributed ($p = 0.005$), which may affect the precision of the regression model's predictions. Additionally, the heteroscedasticity test indicated inconsistent residual variance across predictor values ($p = 0.004$), suggesting that the model's predictive accuracy may be compromised. These issues point to the need for methodological refinements, such as data transformation or the use of robust regression techniques, to address these statistical challenges and improve the reliability of the model.

Despite these limitations, the absence of autocorrelation (Durbin-Watson value = 1.727) confirms the independence of residuals, reinforcing the validity of the regression analysis. This finding supports the conclusion that the PBL-visual mapping model is a viable and effective approach for enhancing student learning outcomes, particularly in complex subjects like labor education.

The study's results have important implications for educational practice. By integrating PBL with visual mapping, educators can create a more engaging and interactive learning environment that encourages students to actively participate in the learning process. This approach not only improves academic performance but also equips students with essential skills such as critical thinking, problem-solving, and the ability to analyze and synthesize information such as skills that are crucial for success in the 21st century.

4. Conclusion

The study concludes that the Problem-Based Learning (PBL) model integrated with visual mapping techniques significantly improves the learning outcomes of Class XI students at SMA Negeri 1 Pasuruan, particularly in labor-related material. The model accounts for 29.3% of the variance in student performance, demonstrating its effectiveness in enhancing critical thinking, analytical skills, and conceptual understanding. However, challenges such as non-normal residual distribution and heteroscedasticity highlight the need for methodological refinements to improve the model's predictive accuracy.

Integrating Problem-Based Learning with visual mapping techniques significantly boosts student learning outcomes in labor-related curriculum quite remarkably nowadays. Nearly 30% of performance variance explained by model with 0.556-unit gains in academic results per unit implementation increase. Methodological refinements will be needed in future research due largely to statistical limitations surrounding residual distribution and pretty severe heteroscedasticity. Crucial 21st-century skills like critical thinking and problem analysis are developed through this educational approach which enhances content mastery pretty significantly.

5. References

Anisa, A. R., Ipungkarti, A. A., & Saffanah, K. N. (2021). Pengaruh kurangnya literasi serta kemampuan dalam berpikir kritis yang masih rendah dalam pendidikan di Indonesia. *Current Research in Education: Conference Series Journal*, *1*(1), 1–12.

Arahmat, Y. (2017). *Pengaruh model pembelajaran berbasis masalah (problem based learning) dengan teknik mind mapping terhadap metakognisi dan hasil belajar biologi*. University of Jember.

Crunkilton, J. R., & Finch, C. R. (1999). Curriculum development in vocational and technical education. *Planning, Content And Implementation. Fifth Edition. Virgina Polytechnic Institute And State University: Ally and Bacon Publisher*.

Fauziyah, L. F., Yulisma, L., & Maladona, A. (2024). Implementasi Model Pembelajaran Problem Based Learning Berbantuan Mind Mapping Terhadap Kemampuan Berpikir Kreatif Siswa di MA Sabilurrosyad. *J-KIP (Jurnal Keguruan Dan Ilmu Pendidikan)*, *5*(1).

Gao, S., Meng, F., Gu, Z., Liu, Z., & Farrukh, M. (2021). Mapping and clustering analysis on environmental, social and governance field a bibliometric analysis using scopus. *Sustainability (Switzerland)*, *13*(13). https://doi.org/10.3390/su13137304

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, *16*(3), 235–266.

Lukman, L. A., Martini, K. S., & Utami, B. (2015). Efektivitas metode pembelajaran Project Based Learning (PJBL) disertai media Mind Mapping terhadap prestasi belajar siswa pada materi pokok sistem koloid di kelas XI IPA SMA Al Islam 1 Surakarta tahun ajaran 2013/2014. *Jurnal Pendidikan Kimia*, *4*(1), 113–119.

Lumbantungkup, A., Sitorus, M. A., Siahaan, C. O., & Hutabarat, L. C. (2022). Students Problems of Reading Skill in Narrative Text at Tenth Grade of SMA Kartika Pematangsiantar. *Journal of Humanities, Social Sciences and Business (JHSSB)*, *1*(2), 65–72. https://doi.org/https://doi.org/10.55047/jhssb.v1i2.102

Setiarani, S., Alpian, Y., & Anwar, A. S. (2022). Penerapan Model PBL Dalam Meningkatkan Hasil Belajar Siswa Kelas III SD. *BUANA ILMU*, *7*(1), 246–257.

Tarihoran, N., & Adriadi, A. (2016). Pembelajaran Problem Based Learning (PBL) dan Motivasi Siswa Terhadap Hasil Belajar PAI DI SMP Negeri I Ciruas Serang. *Saintifika Islamica: Jurnal Kajian Keislaman*, *3*, 15–38.

Virgiana, A., & Wasitohadi, W. (2016). Efektivitas Model Problem Based Learning Berbantuan Media Audio Visual Ditinjau Dari Hasil Belajar Ipa Siswa Kelas 5 Sdn 1 Gadu Sambong-Blora Semester 2 Tahun 2014/2015. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *6*(2), 100–118.