

Original Article

Enhancing the Quality of Mathematics Learning through Strengthening Pedagogical Competencies, Effectiveness of Project Based Learning (Pjbl), Creativity and Achievement Motivation

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Abstract: *Quality of learning is defined as the degree to which teachers, students, curriculum and learning materials, media, facilities, and learning systems work together to produce the best possible learning processes and results in line with curriculum requirements. A key component of accomplishing educational objectives is the caliber of learning. It is known from a number of educational development reports that the quality of mathematics instruction at Bogor Regency's private vocational schools falls short of expectations for both educational objectives and competency requirements. Research is therefore required to gather data on factors linked to raising the standard of learning. By investigating the effects of pedagogical competency, project-based learning (PjBL) effectiveness, creativity, accomplishment motivation, and learning quality, this study aims to implement strategies and methods to enhance the quality of learning. This study uses the SITOREM approach for indicator analysis to identify strategies and methods to enhance the quality of learning and the route analysis method to ascertain the influence between the variables examined.*

Keywords: *Quality of Learning, Pedagogical Competency, Effectiveness of Project Based Learning (PjBL), Creativity, Achievement Motivation, SITOREM Analysis.*

I. INTRODUCTION

In the 21st century, the keyword used to be able to take part in life in this century is competence. This competency means more than just knowledge and skills (Rychen & Salganik, 2003). Rychen & Salganik (2003) further explained that this competency involves the ability to meet complex needs using various psychosocial resources, including attitudes, knowledge, and skills in a particular area, such as communication and language skills.

Analytical competence consists of the ability to think critically (critical thinking), solve problems (problem-solving), formulate a decision (decision-making), and research and discovery (research and inquiry). Critical thinking includes analyzing arguments, making inferences, inductive or deductive reasoning, assessing or evaluating, and making decisions (Lai, 2011).

Interpersonal competencies (interpersonal skills) include communication, collaboration, leadership, and responsibility. These interpersonal skills are related to the ability of a person to receive and convey ideas or messages either verbally or in writing and how a person can collaborate with other people in social life.

The ability to carry out action (ability to execute) consists of initiative (initiative) and independence (self-direction), as well as productivity (productivity). To be able to carry out an action of renewal or change that changes something or something that is not good for the better, initiative is needed. Independence, which includes phases of thinking, action control, and reflection, is part of a strategy to improve self-quality, while productivity refers to the ability to always produce useful work.

The ability to process information (information processing) includes processing related information involving data/information representation; organization, classification, extraction, filtering, summarization, visualization of information; decryption and interpretation of information; translation and comprehension from and to foreign languages; information evaluation; and distinguishing information that is not useful (Wu, 2013). These abilities include information literacy, media literacy, digital society, information technology operations, and concepts.

The ability to change (capacity for change) turns out to be a century-old competency 21st. This competency includes creativity/innovation, adaptive learning (learning to learn), and flexibility. With creativity/innovation, someone can do work more efficiently. This efficiency can also be applied to learning by always adapting and carrying out lessons on how to learn



better. These competencies are trained through mathematics subjects. The problem is, what kind of mathematics subjects train these competencies? This is related to the statement that competencies can be learned in a favorable learning environment (OECD, 2003).

It is necessary to choose several appropriate learning strategies to meet these standards. Learning that meets these principles and standards, for example, problem-based learning (Apino & Retnawati, 2018; Bukhari & Retnawati, 2018), project-based learning, and discovery-based learning, which has been proven through research to improve various competencies. The learning carried out should not only emphasize lower-order thinking but also the need to teach higher-order thinking (HOTS). This learning is carried out by emphasizing active student participation and is designed starting from determining learning objectives. Learning flow (learning trajectory) also needs to be taken into consideration when formulating learning objectives (Retnawati, 2017).

Learning objectives are not only used for the learning activities themselves but also for assessment purposes. Considering that the role of assessment is large and has various benefits, including capturing students' abilities to assess the success of the learning carried out, obtaining input on students' learning strategies (Retnawati, Hadi, Nugraha, Sulistyaningsih, 2017), assessment also needs to receive attention. The components measured are not only lower-order thinking but also measure higher-order thinking. This will motivate students to learn many things, including various competencies needed in the 21st century.

Apart from the principles and standards mentioned above, what is very urgent and very important is integrating character education into mathematics education. This integration is important, considering that in this life, there are various values that must be maintained, implemented, and/or preserved in social life; even though some values include incompetence, such as responsibility and independence, other values need to be taken into consideration, for example, religious values, humanity, politeness, and others.

Even though there are principles and standards for implementing learning, various challenges are faced in implementing mathematics learning. From a curriculum perspective, Even though it has been socialized since 2013, it turns out that its implementation has not been evenly distributed at all levels of education (Retnawati, 2015). From the educator's perspective, the content of the material in the curriculum is too dense, so teachers are more focused on completing the material. This makes it difficult to implement student-centered learning because it requires a lot of time (Retnawati, Munadi, Arlin Wibowo, Wulandari, 2017). Teachers' understanding of active learning and learning that trains HOTS (Jailani & Retnawati), as well as the use of information technology-based media, is also still varied and partial, so it is a challenge to achieve the expected competencies.

From the student side, students are not yet accustomed to carrying out learning using various strategies and learning approaches. Students are also not used to working on HOTS questions involving several stages of work (complex questions), let alone looking for alternative ways to do it. Regarding problem-solving, students also experience problems with long reading questions (Retnawati, Kartowagiran, Arlinwibowo, Sulistyaningsih, 2017).

In terms of facilities and infrastructure, teachers and students still have difficulty finding books for learning and also learning media that train various competencies, HOTS, for example (Jailani & Retnawati, 2016). Likewise, with assessments, there need to be examples of assessment models and examples of questions that measure mathematical abilities that are integrated with various required competencies.

Various efforts can be made by several related parties to answer these challenges. Related research, both learning, media, and its integration with values that train various 21st-century competencies in order to equip students to face the challenges of the next decade. The results of this research need to be disseminated widely to society, not only in academic circles. Teacher support for implementing literacy learning in general and also specific literacy, for example, mathematical literacy, scientific literacy, financial literacy, and media literacy, and integration with character education through various practices, is very necessary. Likewise, coaching prospective teachers and continuous teacher professional development emphasizes continuous competency development. Community support is also needed to work together to improve the quality of human resources.

A) Quality of Learning

Based on the opinions and theories presented by Dundon & Wilkinson (2020), Kaizen et al. (2012), Rabiah (2019), Poornima M. Charantimath (2020), Tribus (2010), Jayawardana (2017), Nurtanto et al., (2020), Darma et al., (2021), it can be synthesized that the quality of learning is the Quality of Learning is the intensity of the systemic and synergistic relationship between teachers, students, curriculum and learning materials, media, facilities and learning systems in producing optimal learning processes and outcomes in accordance with curricular demands. The indicators of learning quality are as follows: 1). Teacher Activities, 2). Learning Facilities, 3). Classroom Climate, 4). Student Attitudes, and 5). Student's motivation to study

B) Pedagogical Competency

Based on the opinions and theories presented by Sudargini & Purwanto (2020), Jason A. Colquitt et al. (2019), Laura M. Desimone and Daniel Stuckey (2018), Piasta et al. (2008), Sailors and Price (2010), Christopher Winch and John Gingell (2010), Mulyasa (2006), Suparian (2011), Suprihatiningrum (2013), Rohman (2009), Ramayulis (2013), and Saryati (2014), In order to fulfill a specific function in the teaching profession, pedagogical competence can be defined as the teacher's ability to manage student learning throughout the teaching and learning process, from planning to evaluation. The following are indications of the quality of learning: 1. Understanding student traits, 2) being able to control learning, 3) using learning technology, 4) putting learning outcome evaluation into practice, and 5) helping students reach their full potential.

C) Effectiveness of Project-Based Learning (PjBL)

Based on the opinions and theories presented by Daryanto and Raharjo (2012: 162), Fathurrohman (2016:119), Saefudin (2014:58), Mulyasa (2014:145), Satoto Endar Nayono et al., (2013:341), and Isriani (2015: 5), it can be synthesized that Project Based Learning or abbreviated as PJBL is a learning model that has the aim of guiding students through a collaborative project that integrates various subjects or curriculum material and gives students the opportunity to explore the material using various means that are meaningful to them. Himself, and conduct experiments collaboratively. The indicators of learning quality are as follows: 1). Provides complex problems, 2). Designing a way to create a product/project, 3). Develop a product/project manufacturing schedule, 4). Product/project investigation, 5). Monitor product/project progress, 6). Presentation of final product/project results, and 7). Documentation of the final product/project results

D) Creativity

Based on the opinions and theories presented by McShane and Von Glinov (2018), Makhrus et al. (2022), Sang Hoon Bae et al. (2013), Cropley et al. (2011), Hellriegel and Slocum (2011), AJ Starko (2013), Sawyer, R. K. (2012), Shalley (2015), Trevor Davies (2006), Gillian Bramwell, et al. (2010), Gibson et al. (2012: 78), Tang, Min (2017), and Rais et al., (2022), it can be synthesized that creativity is the action of a person or group to produce and develop new original ideas so that they can increase their imagination differently from before. The indicators of learning quality are as follows: 1). Exploring curiosity, 2). Generate new ideas, 3). Develop ideas persistently, 4). Combining ideas into something new, and 5). Take a risk

E) Achievement Motivation

Based on the opinions and theories presented by Atmoko and Hidayah (2014), Purwanto (2014: 219), Susanto (2018: 35), Mangkunegara (2010: 19-20), Yunus (2005), Tucker, Zayco and Herman, (2007), Awan, Nouren and Naz (2011), and Woolfolk, (2004), it can be synthesized that achievement motivation is motivation that has a goal direction to pursue achievement and develop or demonstrate the high ability of each individual to get grades. And maximum results and have commendable value. The indicators of learning quality are as follows: 1). Self-encouragement in achieving goals, 2). Desire to excel in competition, 3). Orientation towards high professional performance, and 4). Strong passion for getting performance feedback

F) SITOREM

"Scientific Identification Theory to Conduct Operation Research in Education Management" is what SITOREM stands for, and it can be broadly understood as a scientific approach to finding variables (theory) to carry out "Operation Research" in the field of education management (Soewarto Hardhienata, 2017).

SITOREM is a technique used in the context of Correlation and Path Analysis study to perform: 1. Determine how strongly the independent and dependent variables are related, 2) Examine the value of the research findings for each indicator of the research variable, and 3) Examine the relative importance of each indicator for each research variable using the "Cost, Benefit, Urgency, and Importance" criteria.

A priority order of indicators that must be maintained and those that must be improved right away can be established based on the strength of the relationship between the research variables and the weight of each independent variable indicator that contributes the most. Organized. The average score of each indicator for each research variable is used to calculate the analysis of the worth of the research results for each indicator. From the perspective of the research subject, the average score for each indication represents the real state of these indicators.

II. METHODS

As explained above, this research aims to find strategies and ways to improve the quality of learning through research on the strength of influence between Quality of Mathematics Learning as the dependent variable and pedagogical competence, effectiveness of project-based learning (PjBL), creativity, and achievement motivation as independent variables. The research method used is a survey method with a path analysis test approach to test statistical hypotheses and the SITOREM method for indicator analysis to determine optimal solutions for improving the quality of mathematics learning.

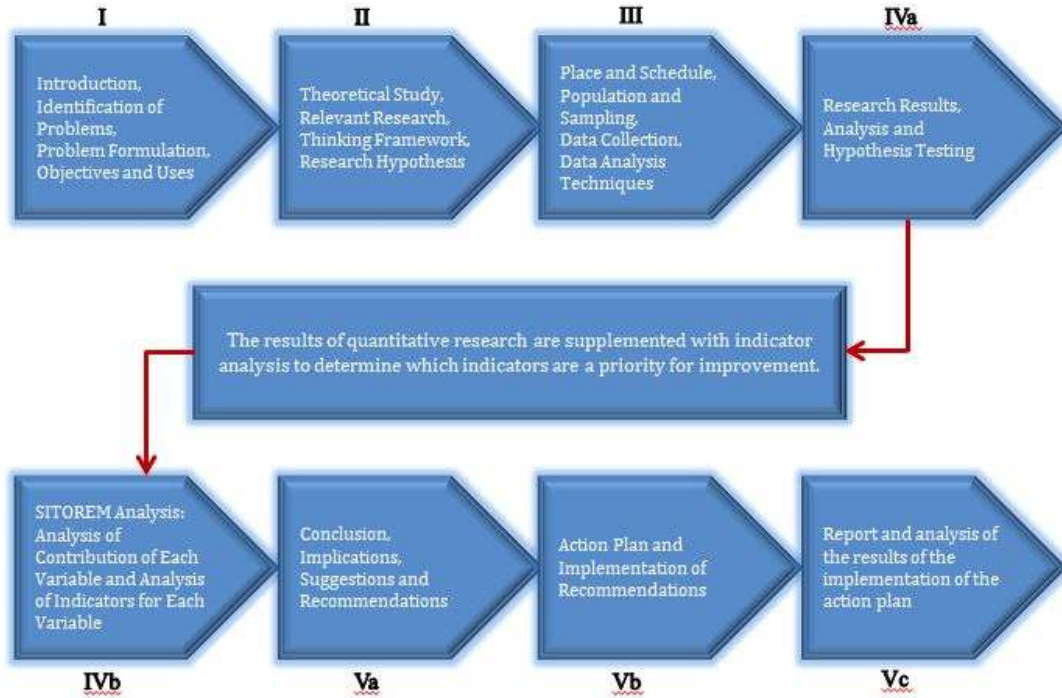


Figure 1. Quantitative and SITOREM Step

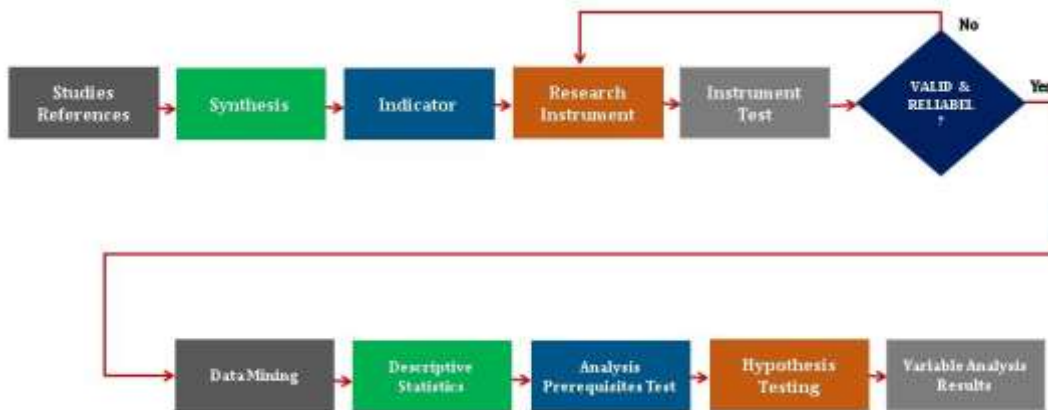


Figure 2. Quantitative Research Step

Using the Slovin formula derived from Umar, a sample of 168 teachers was selected from among the 289 teachers who were foundation permanent teachers (GTY) at Bogor Regency Private Vocational High Schools (SMK).

Teachers who participated in the study were given a questionnaire, which served as the research instrument for data collection. The research indicators whose conditions will be examined are the source of the research instrument items. Before being distributed to respondents, the research instrument was first tested to determine its validity and reliability.

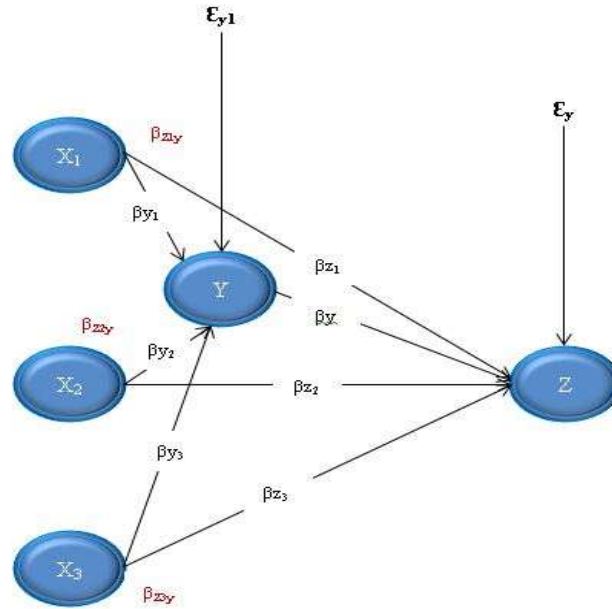


Figure 3. Research Constellation

III. RESULT AND DISCUSSION

A) Convergent Validity Test

Convergent validity is calculated in order to evaluate construct validity. The loading factor and Average Variance Extracted (AVE) values are used to determine convergent validity. If an instrument's loading factor and Average Variance Extracted (AVE) are both more than 0.5, it is said to pass the convergent validity test. The following table displays the findings of the convergent validity test:

Table 1. Convergent Validity Test Results

Variable	Indicator	Loading Faktor	AVE
Pedagogical Competency (X_1)	Mastering the characteristics of students	0.846	0.723
	Ability to manage learning	0.868	
	Utilization of learning technology	0.806	
	Implementation of learning outcomes evaluation	0.904	
	Developing students to actualize their various potentials	0.824	
Effectiveness of Project-Based Learning (PjBL) (X_2)	Provides complex problems	0.889	0.771
	Design a way to create a product/project	0.900	
	Prepare a product/project creation schedule	0.775	
	Product/project investigation	0.901	
	Monitor product/project progress	0.919	
	Presentation of final product/project results	0.863	
	Documentation of the final product/project results	0.892	
Creativity (X_3)	Exploring curiosity	0.916	0.824
	Generate new ideas	0.910	
	Develop ideas persistently	0.939	
	Combining ideas into something new	0.894	
	Take a risk	0.880	
Achievement Motivation (Y)	Self-encouragement in achieving goals	0.853	0.742
	Desire to excel in competition	0.906	
	Orientation to high professional performance	0.869	
	Strong passion for getting performance feedback	0.815	
Learning Quality (Z)	Teacher Activities	0.854	0.785
	Learning Facilities	0.919	
	Class Climate	0.920	
	Student Attitude	0.856	
	Student's motivation to study	0.878	

B) Discriminant Validity Test

Cross-loading is used to calculate discriminant validity, and if the indication's cross-loading value in one variable is higher than its correlation value in other variables, the indicator is deemed valid to gauge that variable. The following table displays the cross-loading calculation's findings:

Table 2. Results of Cross-Loading Discriminant Validity Testing

Indikator	Pedagogical Competency (X ₁)	Effectiveness of Project-Based Learning (PjBL) (X ₂)	Creativity (X ₃)	Achievement Motivation (Y)	Learning Quality (Z)
X1.1	0.846	0.366	0.307	0.498	0.417
X1.2	0.868	0.383	0.357	0.453	0.528
X1.3	0.806	0.369	0.275	0.398	0.462
X1.4	0.904	0.340	0.322	0.483	0.442
X1.5	0.824	0.386	0.330	0.422	0.372
X2.1	0.387	0.889	0.515	0.554	0.580
X2.2	0.390	0.900	0.565	0.536	0.520
X2.3	0.390	0.775	0.449	0.518	0.460
X2.4	0.417	0.901	0.563	0.552	0.578
X2.5	0.341	0.919	0.565	0.494	0.503
X2.6	0.367	0.863	0.477	0.466	0.509
X2.7	0.361	0.892	0.513	0.484	0.497
X3.1	0.385	0.567	0.916	0.564	0.538
X3.2	0.369	0.565	0.910	0.509	0.508
X3.3	0.357	0.548	0.939	0.541	0.521
X3.4	0.307	0.546	0.894	0.522	0.571
X3.5	0.279	0.469	0.880	0.491	0.481
Y.1	0.409	0.505	0.621	0.853	0.536
Y.2	0.460	0.566	0.574	0.906	0.560
Y.3	0.491	0.465	0.444	0.869	0.564
Y.4	0.474	0.486	0.340	0.815	0.518
Z.1	0.445	0.554	0.610	0.621	0.854
Z.2	0.484	0.553	0.537	0.608	0.919
Z.3	0.504	0.547	0.476	0.563	0.920
Z.4	0.455	0.473	0.458	0.448	0.856
Z.5	0.435	0.502	0.462	0.539	0.878

C) Construct Reliability

Cronbach alpha and composite reliability are two calculations that can be used to measure construct reliability. According to the test criteria, the construct is deemed trustworthy if the Cronbach alpha is better than 0.6 and the composite reliability is greater than 0.7. The following table provides a summary of the findings from the Cronbach alpha and composite reliability calculations:

Table 3. Construct Reliability Testing Results

Variable	Cronbach's Alpha	Composite Reliability
Pedagogical Competency (X ₁)	0.904	0.929
Effectiveness of Project-Based Learning (PjBL) (X ₂)	0.950	0.959
Creativity (X ₃)	0.947	0.959
Achievement Motivation (Y)	0.884	0.920
Learning Quality (Z)	0.931	0.948

D) Coefficient of Determination (R²)

The magnitude of the contribution of exogenous variables to endogenous variables, or the extent to which endogenous variables may explain the diversity of exogenous variables, is ascertained using the Determination Coefficient (R²). The following table displays the R² results.

Table 4. Results of the Coefficient of Determination (R²)

Variabel Dependent	R Square	R Square Adjusted
Achievement Motivation (Y)	0.498	0.487
Learning Quality (Z)	0.533	0.520

E) Predictive Relevance (Q^2)

The model's accuracy and the estimated parameters' ability to produce the observed values can be gauged by the Q^2 value. A model is considered adequate if its Q^2 value is greater than 0 (zero), while it is considered to be predictively irrelevant if its Q^2 value is less than 0 (zero). The Predictive Relevance (Q^2) test yielded the following findings:

Table 5. Results of Predictive Relevance Testing (Q^2)

Variabel Dependent	SSO	SSE	$Q^2 (=1-SSE/SSO)$
Achievement Motivation (Y)	596.000	384.018	0.356
Learning Quality (Z)	745.000	446.677	0.400

The results in Table 5 show that all variables produce Predictive Relevance (Q^2) values greater than 0 (zero), which indicates that the model is said to be good enough.

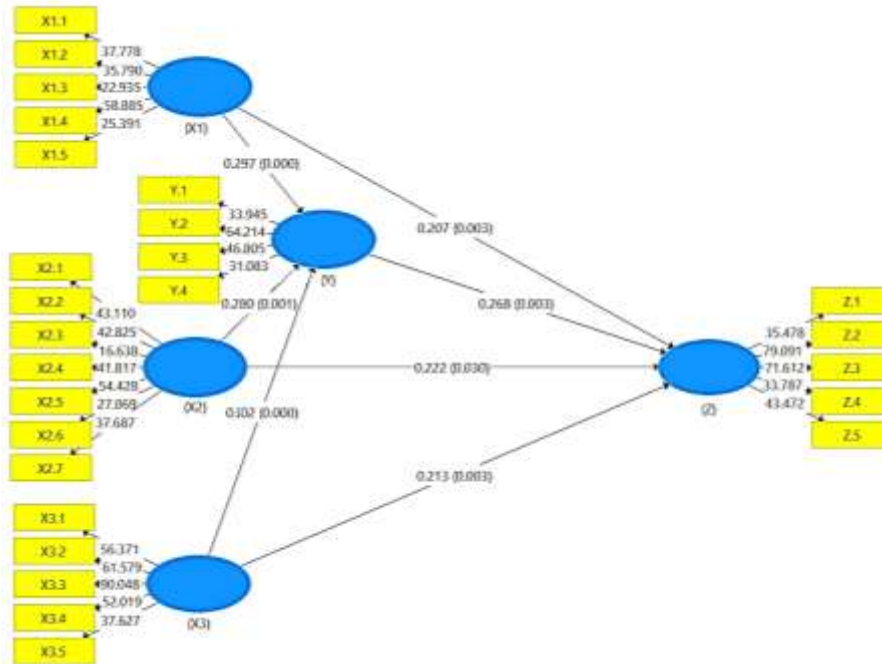


Figure 4. Research Constellation

F) Hypothesis test

Significance testing is utilized to determine if exogenous variables have an impact on endogenous variables. According to the test criteria, there is a substantial influence of exogenous factors on endogenous variables if the P-value is less than the significant alpha 5% or 0.05 or if the T-statistics value is $\geq$ T-table (1.96). The following tables and figures show the outcomes of the models and significance tests.

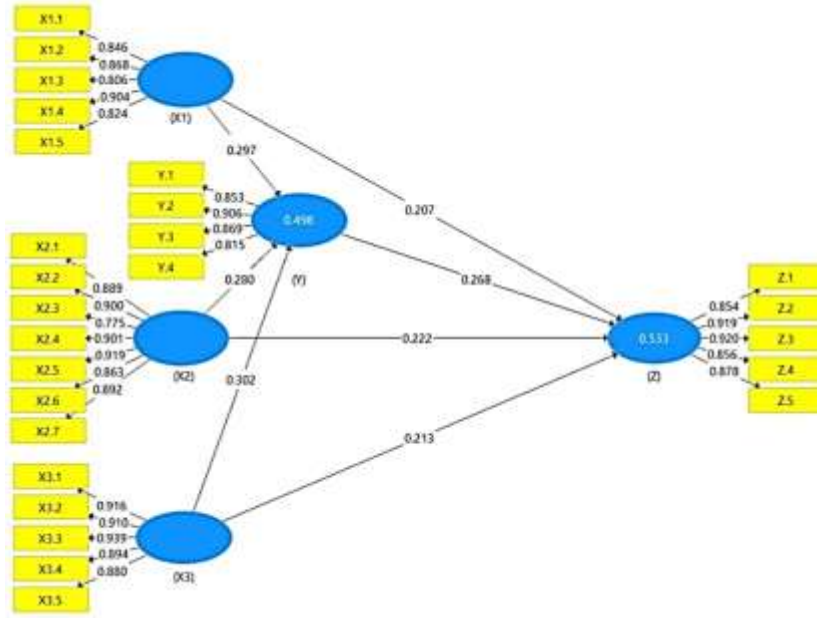


Figure 5. Path analysis results

Complete hypothesis testing is presented in the following table:

Table 6. Hypothesis Testing Results

No.	Path	Coefisien	T Statistics (O/STDEV)	P Values
1.	Pedagogical Competency (X ₁) -> Achievement Motivation (Y)	0.297	3.948	0.000
2.	Pedagogical Competency (X ₁) -> Quality of learning (Z)	0.207	2.957	0.003
3.	Effectiveness of Project-Based Learning (PjBL) (X ₂) -> Achievement Motivation (Y)	0.280	3.310	0.001
4.	Effectiveness of Project Based Learning (PjBL) (X ₂) -> Quality of learning (Z)	0.222	2.174	0.030
5.	Creativity (X ₃) -> Achievement Motivation (Y)	0.302	3.818	0.000
6.	Creativity (X ₃) -> Quality of learning (Z)	0.213	2.985	0.003
7.	Achievement Motivation (Y) -> Quality of learning (Z)	0.268	2.986	0.003

The Influence of Pedagogical Competency (X₁) on Achievement Motivation (Y)

Testing the influence of Pedagogical Competency (X₁) on Achievement Motivation (Y) produces a T statistics value of 3,948 with a p-value of 0.000. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that Pedagogical Competency (X₁) has a significant influence on Achievement Motivation (Y). The resulting coefficient value is positive, namely 0.297. Thus, it can be interpreted that the higher the Pedagogical Competency (X₁), the greater the Achievement Motivation (Y).

Influence of Pedagogical Competency (X₁) on Learning Quality (Z)

Testing the influence of Pedagogical Competency (X₁) on Learning Quality (Z) produces a T statistics value of 2.957 with a p-value of 0.003. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that Pedagogical Competency (X₁) has a significant influence on Learning Quality (Z). The resulting coefficient value is positive, namely 0.207. Thus, it can be interpreted that the higher the Pedagogical Competency (X₁), the more likely it is to increase the Quality of Learning (Z).

The Effect of Project-Based Learning (PjBL) Effectiveness (X₂) on Achievement Motivation (Y)

Testing the effect of Project Learning (PjBL) Effectiveness (X₂) on Achievement Motivation (Y) produces a T statistics value of 3.310 with a p-value of 0.001. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that Project Based Learning (PjBL) Effectiveness (X₂) has a significant influence on Achievement Motivation (Y). The resulting coefficient value is positive, namely 0.280. Thus, it can be interpreted that the better the effectiveness of Project Based Learning (PjBL) (X₂), the more likely it is to increase Achievement Motivation (Y).

Effect of Project-Based Learning (PjBL) Effectiveness (X₂) on Learning Quality (Z)

Testing the effect of Project Learning (PjBL) Effectiveness (X₂) on Learning Quality (Z) produces a T statistics value of 2.174 with a p-value of 0.030. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that there is a significant influence on the effectiveness of Project Based Learning (PjBL) (X₂) on the Quality of Learning (Z). The resulting coefficient value is positive, namely 0.222. Thus, it can be interpreted that the better the effectiveness of Project Based Learning (PjBL) (X₂), the more likely it is to improve the Quality of Learning (Z).

Influence of Creativity (X₃) on Achievement Motivation (Y)

Testing the influence of Creativity (X₃) on Achievement Motivation (Y) produces a T statistics value of 3,818 with a p-value of 0.000. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that there is a significant influence of Creativity (X₃) on Achievement Motivation (Y). The resulting coefficient value is positive, namely 0.302. Thus, it can be interpreted that better Creativity (X₃) tends to increase Achievement Motivation (Y).

Influence of Personality (X₃) on Learning Quality (Z)

Testing the effect of Creativity (X₃) on Learning Quality (Z) produces a T statistics value of 2.986 with a p-value of 0.003. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that there is a significant influence of Creativity (X₃) on Learning Quality (Z). The resulting coefficient value is positive, namely 0.213. Thus, it can be interpreted that the better the Creativity (X₃), the more likely it is to improve the Quality of Learning (Z).

Influence of Achievement Motivation (Y) on Learning Quality (Z)

Testing the effect of Achievement Motivation (Y) on Learning Quality (Z) produces a T statistics value of 2.986 with a p-value of 0.003. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that Achievement Motivation (Y) has a significant influence on Learning Quality (Z). The resulting coefficient value is positive, namely 0.268. Thus, it can be interpreted that the higher the Achievement Motivation (Y), the more likely it is to increase the Quality of Learning (Z).

Table 7. Indirect Effect Hypothesis Testing

No	Variabel Indirect	Coefisien	T Statistics (O/STDEV)	P Values
1.	Pedagogical Competency (X ₁) -> Achievement Motivation (Y) -> Quality of learning (Z)	0.080	2.250	0.025
2.	Effectiveness of Project Based Learning (PjBL) (X ₂) -> Achievement Motivation (Y) -> Quality of learning (Z)	0.075	2.203	0.028
3.	Creativity (X ₃) -> Achievement Motivation (Y) -> Quality of learning (Z)	0.081	2.442	0.015

The Influence of Pedagogical Competency (X₁) on Learning Quality (Z) Through Achievement Motivation (Y)

Testing the influence of Pedagogical Competency (X₁) on Learning Quality (Z) through Achievement Motivation (Y) produces a T statistics value of 2.250 with a p-value of 0.025. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that Pedagogical Competency (X₁) has a significant influence on learning quality (Z) through achievement motivation (Y). Thus, it can be stated that Achievement Motivation (Y) is able to mediate the influence of Pedagogical Competency (X₁) on Learning Quality (Z).

The Effect of Project-Based Learning (PjBL) Effectiveness (X₂) on Learning Quality (Z) Through Achievement Motivation (Y)

Testing the effect of the Effectiveness of Project Learning (PjBL) (X₂) on the Quality of Learning (Z) through Achievement Motivation (Y) produces a T statistics value of 2.203 with a p-value of 0.028. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that there is a significant influence on the effectiveness of Project Based Learning (PjBL) (X₂) on the Quality of Learning (Z) through Achievement Motivation (Y). Thus, it can be stated that Achievement Motivation (Y) is able to mediate the influence of Project Based Learning (PjBL) Effectiveness (X₂) on Learning Quality (Z).

The Influence of Creativity (X₃) on Learning Quality (Z) Through Achievement Motivation (Y)

Testing the influence of Creativity (X₃) on Learning Quality (Z) through Achievement Motivation (Y) produces a T statistics value of 2.442 with a p-value of 0.015. The test results show that the T statistics value is > 1.96, and the p-value is < 0.05. This means that there is a significant influence of Creativity (X₃) on Learning Quality (Z) through Achievement Motivation (Y). Thus, it can be stated that Achievement Motivation (Y) mediates the influence of Creativity (X₃) on Learning Quality (Z).

Optimal Solution for Improving Learning Quality

A summary of research findings that identifies the best course of action for raising the Quality of Learning can be constructed using the findings of statistical hypothesis testing, indicator priority, and indicator value calculations as previously mentioned:

Table 8. SITOREM Analysis

Pedagogical Competency ($\beta z1 = 0,207$) (rank.IV)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Mastering the characteristics of students	1 st	Mastering student characteristics (21.17)	3.88
2	Ability to manage learning	2 nd	Implementation of learning outcomes evaluation (21.13)	4.10
3	Utilization of Learning Technology	3 rd	Utilization of Learning Technology (20.16)	4.00
4	Implementation of learning outcomes evaluation	4 th	Ability to manage learning (20.17)	3.61
5	Developing students to actualize their various potentials	5 th	Development of students to actualize their various potentials (17.37)	3.60
Effectiveness of Project-Based Learning (PjBL) ($\beta z2 = 0,222$) (rank.II)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Provides complex problems	1 st	Designing a way to create a product/project (16.18)	3.57
2	Design a way to create a product/project	2 nd	Develop a product/project creation schedule (16.13)	4.02
3	Prepare a product/project creation schedule	3 rd	Presentation of final product/project results (15.16)	3.68
4	Product/project investigation	4 th	Monitor product/project progress (15.04)	4.04
5	Monitor product/project progress	5 th	Product/project investigation (13.16)	4.12
6	Presentation of final product/project results	6 th	Provides complex problems (13.12)	4.08
7	Documentation of the final product/project results	7 th	Documentation of final product/project results (11.21)	3.74
Creativity ($\beta z3 = 0,213$) (rank.III)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Exploring curiosity	1 st	Taking risks (20.38)	3.82
2	Generate new ideas	2 nd	Combining ideas into something new (20.16)	3.84
3	Develop ideas persistently	3 rd	Developing ideas persistently (20.13)	3.78
4	Combining ideas into something new	4 th	Generating new ideas (20.12)	4.14
5	Take a risk	5 th	Exploring curiosity (19.21)	4.02
Achievement Motivation ($\beta y1 = 0,268$) (rank. I)				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Self-encouragement in achieving goals	1 st	Desire to excel in competition (26.37)	3.85
2	Desire to excel in competition	2 nd	Self-encouragement in achieving goals (25.43)	4.11
3	Orientation to high professional performance	3 rd	Orientation to high professional performance (24.56)	3.65
4	Strong passion for getting performance feedback	4 th	Strong passion for getting performance feedback (23.64)	4.03
Quality Learning				
Indicator in Initial State		Indicator after Weighting by Expert		Indicator Value
1	Teacher Activities	1 st	Classroom Climate (21.17)	3.78
2	Learning Facilities	2 nd	Learning Facilities (21.13)	3.65
3	Class Climate	3 rd	Student Attitude (20.16)	4.15
4	Student Attitude	4 th	Student Learning Motivation (19.12)	3.86
5	Student's motivation to study	5 th	Teacher Activities (18.42)	4.16
SITOREM ANALYSIS RESULT				
Priority order of indicator to be Strengthened			Indicators remain to be maintained	
1 st	Desire to excel in competition		1. Self-encouragement in achieving goals	
2 nd	Orientation to high professional performance		2. Strong passion for performance feedback	
3 rd	Design a way to create a product/project		3. Develop a product/project creation schedule	
4 th	Presentation of final product/project results		4. Monitor product/project progress	
5 th	Documentation of the final product/project results		5. Product/project investigation	

6 th	Take a risk	6. Provide complex problems
7 th	Combining ideas into something new	7. Generate new ideas
8 th	Develop ideas persistently	8. Explore curiosity
9 th	Mastering the characteristics of students	9. Implementation of learning outcomes evaluation
10 th	Ability to manage learning	10. Use of Learning Technology
11 th	Developing students to actualize their various potentials	11. Student Attitude
12 th	Class Climate	12. Teacher Activities
13 th	Learning Facilities	
14 th	Student's motivation to study	

IV. CONCLUSIONS, IMPLICATIONS, AND SUGGESTIONS

Based on the results of the analysis, discussion of research results, and hypotheses that have been tested, it can be concluded as follows:

1. Improving the Quality of Learning can be done by using strategies to strengthen variables that have a positive influence on the Quality of Learning.
2. Variables that have a positive influence on the quality of learning are pedagogical competency, effectiveness of Project-Based Learning (PjBL), creativity, and achievement motivation. This is proven by the results of variable analysis using the SEM PLS method.
3. The way to improve the quality of learning is to improve weak indicators and maintain good indicators for each research variable.

Based on the research conclusions above, the following implications can be drawn from this research:

1. In order to improve the quality of learning, it is necessary to strengthen Pedagogical Competency, Effectiveness of Project Based Learning (PjBL), and Creativity, as exogenous variables with Achievement Motivation as an intervening variable.
2. If Pedagogical Competency is to be developed, it is necessary to improve the indicators that are still weak, namely Mastering the characteristics of students, Ability to manage learning, and Development of students to actualize the various potentials they have and maintain or develop indicators: Implementation of evaluation of learning outcomes and Utilization of Learning Technology.
3. If the effectiveness of Project Learning (PjBL) is to be developed, it is necessary to improve the indicators that are still weak, namely, Designing ways to create products/projects, Presentation of final product/project results, and Documentation of final product/project results, as well as maintaining or developing indicators: Developing product/project manufacturing schedules, Monitoring product/project progress, Investigating products/projects, and Providing complex problems.
4. If creativity is to be developed, it is necessary to improve the indicators that are still weak, namely Taking risks, Combining ideas into something new, and Developing ideas persistently, as well as maintaining or developing the indicators: Generating new ideas and Exploring curiosity.
5. With an increase in Achievement Motivation, it is necessary to improve indicators that are still weak, namely the desire to excel in competition and orientation towards high professional performance, as well as maintaining or developing indicators such as self-drive in achieving goals and a strong passion for performance feedback.

Suggestions or recommendations that can be given to related parties are as follows:

1. Principals need to improve the quality of learning by strengthening Pedagogical Competency, Effectiveness of Project Learning (PjBL), Creativity, and Achievement Motivation by improving Class Climate, Learning Facilities, and Student Learning Motivation, as well as maintaining or developing Student Attitudes and Teacher Activities
2. The Ministry of Education, Culture, Research, and Technology (Kemdikbudristek) and school organizing institutions need to develop teachers to improve the Quality of Learning by providing appropriate direction to strengthen the Pedagogical Competency, Effectiveness of Project Learning (PjBL), Creativity, and Achievement Motivation in accordance with the results of this research.

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