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Exploring the Relationship Between Academic Supervision and Pedagogical Competence in Secondary Education: A Quantitative Study in Cilegon

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ABSTRACT

Teachers' pedagogical competence is a key determinant of instructional quality and student-centered learning. Academic supervision is widely recognized as a professional support mechanism to enhance teachers' instructional practices; however, empirical evidence from localized secondary school contexts in Indonesia remains limited. This study examines the relationship between academic supervision and pedagogical competence among senior high school teachers in Cilegon City. A quantitative correlational design was employed involving 30 senior high school teachers selected through simple random sampling. Data were collected using validated and reliable questionnaires measuring academic supervision and pedagogical competence. Pearson product–moment correlation analysis was conducted using SPSS after confirming the assumptions of normality and linearity. The findings reveal a strong and statistically significant positive relationship between academic supervision and teachers' pedagogical competence ($r = 0.836$, $p = 0.001$), indicating that teachers who perceive supervision as structured and developmental tend to report higher levels of pedagogical competence. The results suggest that academic supervision plays an important role in supporting teachers' pedagogical development, particularly when implemented systematically and reflectively. These findings align with the objectives of *Kurikulum Merdeka* and current national education policies emphasizing teacher professionalism and continuous improvement. Despite limitations related to sample size and self-reported data, this study provides contextualized evidence supporting the strengthening of academic supervision practices. Future research should employ longitudinal and mixed-method approaches to further explore the mechanisms through which supervision contributes to sustained pedagogical improvement.

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1. INTRODUCTION

Improving the quality of education remains a central priority in national development agendas, particularly in developing countries where human capital is a key driver of social and economic progress. Teachers play a pivotal role in determining educational quality, as they are directly responsible for planning, implementing, and evaluating learning processes in the classroom. Consequently, strengthening teachers' professional competencies—especially pedagogical competence—is essential for achieving effective, student-centered learning and improving overall educational outcomes (Sujanto, 2018).

Pedagogical competence refers to teachers' ability to understand learners' characteristics, design and implement appropriate instructional strategies, manage classroom dynamics, utilize learning resources and technology, and evaluate learning outcomes systematically (Hamdayama, 2016; Rifma, 2016). In the Indonesian context, pedagogical competence is formally recognized as one of the four core competencies mandated for teachers under Law No. 14 of 2005 on Teachers and Lecturers. More recently, the implementation of Kurikulum Merdeka and Permendikbudristek No. 2626 of 2023 has further emphasized reflective teaching practices, differentiated instruction, and student-centered learning as essential indicators of pedagogical competence. Despite these policy frameworks, variations in teachers' pedagogical competence persist across regions and school levels, indicating the need for sustained professional support mechanisms.

One institutional mechanism designed to support teachers' professional growth is academic supervision. Academic supervision is commonly understood as a structured and systematic process of professional assistance aimed at improving instructional practices through observation, feedback, coaching, and reflective dialogue (Glickman et al., 2014; Sahertian, 2010). Rather than functioning as an evaluative or administrative procedure, contemporary perspectives emphasize supervision as a collaborative and developmental process that empowers teachers to reflect on their instructional practices and continuously improve their pedagogical skills (Mainuddin et al., 2021).

Previous studies have consistently reported a positive relationship between academic supervision and teachers' pedagogical competence. For example, Angelicha and Sanoto (2021) found a strong correlation between academic supervision and pedagogical competence among teachers, suggesting that effective supervision contributes to improved instructional practices. Similarly, Maslihah et al. (2024) reported that academic supervision significantly accounted for variance in teachers' pedagogical competence in early childhood education settings. These findings reinforce the theoretical assumption that supervision plays a critical role in enhancing teacher professionalism.

However, despite the growing body of empirical research, several gaps remain. First, many existing studies focus on general or broad educational contexts without sufficiently considering localized challenges that may shape how supervision is implemented and experienced by teachers. Second, prior research often treats academic supervision as a uniform practice, paying limited attention to contextual factors such as school support systems, availability of professional learning communities, and regional disparities in educational resources. Third, empirical evidence from senior high school settings in industrial or semi-urban regions, such as Cilegon City, remains limited, even though such contexts present unique institutional and organizational characteristics.

Cilegon City represents an important case for examining academic supervision and pedagogical competence. Despite its strategic economic position, educational quality indicators in the region have not consistently reflected this potential. Preliminary observations and informal reports from teachers indicate challenges related to limited professional development opportunities, insufficient instructional facilities, and supervision practices that are often perceived as procedural rather than developmental. In such contexts, academic supervision may not function optimally as a mechanism for enhancing pedagogical competence, highlighting the need for empirical investigation that is sensitive to local educational realities.

Building on these gaps, the novelty of this study lies in its contextualized examination of the relationship between academic supervision and teachers' pedagogical competence within senior high

schools in Cilegon City. Unlike previous studies that predominantly emphasize generalized educational settings, this research situates academic supervision within schools that have begun implementing professional learning communities (komunitas belajar), thereby providing insight into supervision practices in an evolving professional development environment. Furthermore, this study contributes empirical evidence from a region that has received limited scholarly attention, offering a localized perspective on how academic supervision relates to pedagogical competence under current national education reforms.

Accordingly, this study aims to analyze the relationship between academic supervision and the pedagogical competence of senior high school teachers in Cilegon City. By empirically examining this relationship, the study seeks to inform school leaders and policymakers about the importance of strengthening supervision practices that are not merely administrative but genuinely developmental. The findings are expected to contribute to the refinement of academic supervision strategies that support teacher professionalism and align with the goals of Kurikulum Merdeka and contemporary educational policy directions.

2. METHODS

2.1 Research Design

This study adopted a quantitative correlational research design to examine the relationship between academic supervision and teachers' pedagogical competence. A correlational approach was selected because the study aimed to identify the magnitude and direction of association between variables as they naturally occur in school settings, rather than to establish causal relationships through experimental manipulation. Such a design is widely used in educational research to explore professional practices and teacher competencies within authentic institutional contexts (Creswell & Creswell, 2018).

2.2 Participants and Sampling

The target population comprised senior high school teachers in Cilegon City, Indonesia. A total of 30 teachers participated in the study and were selected using simple random sampling to reduce selection bias and ensure equal probability of participation. While the sample size may be considered modest, it was deemed adequate for correlational analysis based on established statistical guidelines.

Specifically, according to Cohen's (1988) power analysis framework, a minimum sample size of 26 participants is sufficient to detect a large effect size ($r \geq .50$) with a statistical power of .80 at an alpha level of .05 in a bivariate correlation. Given that previous studies in similar contexts have reported strong correlations between academic supervision and pedagogical competence (e.g., Angelicha & Sanoto, 2021), the sample size in the present study was considered sufficient to detect meaningful associations while acknowledging limitations in generalizability.

Participants were drawn from senior high schools that had implemented professional learning communities (*komunitas belajar*). This criterion ensured that respondents had prior exposure to structured supervision and collaborative professional development practices, thereby enhancing the contextual relevance of the data.

2.3 Research Instruments

Data were collected using a self-administered questionnaire consisting of two scales: academic supervision and pedagogical competence. Instrument development was guided by established theoretical and empirical literature on instructional supervision and teacher competence (Glickman et al., 2014; Hamdayama, 2016).

The academic supervision scale measured teachers' perceptions of supervision practices, including supervision planning, classroom observation, feedback quality, and follow-up support. The pedagogical competence scale assessed teachers' self-perceived ability to understand learners, design

instructional strategies, implement student-centered learning, manage classrooms, and evaluate learning outcomes. Responses were recorded using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Prior to the main data collection, the instrument underwent psychometric evaluation. Item validity was assessed using Pearson product–moment correlation, with all items exceeding the recommended threshold of r > .30. Internal consistency reliability was examined using Cronbach's alpha, yielding coefficients of .87 for academic supervision and .89 for pedagogical competence, both of which indicate strong reliability (Nunnally & Bernstein, 1994).

2.4 Data Collection Procedure

Data collection was conducted during the second semester of the 2024/2025 academic year, in the first week of March 2025. Ethical approval was obtained from relevant institutional authorities, and informed consent was secured from all participants prior to participation. Teachers were informed that their participation was voluntary, their responses would remain anonymous, and the data would be used solely for research purposes.

The questionnaires were distributed directly to participants and collected upon completion. To mitigate common method bias, respondents were assured that there were no right or wrong answers and that their responses would not be linked to administrative evaluations.

2.5 Data Analysis

Data analysis was performed using SPSS software. Descriptive statistics were first computed to summarize the characteristics of the sample and the distribution of variables. Assumptions for parametric analysis were evaluated, including normality and linearity of the relationship between variables. These assumptions were met, allowing the use of Pearson product–moment correlation.

Pearson correlation analysis was then conducted to examine the strength and direction of the relationship between academic supervision and pedagogical competence. Statistical significance was evaluated at the .05 level. Effect size interpretation followed Cohen's (1988) guidelines, where correlation coefficients of .10, .30, and .50 represent small, medium, and large effects, respectively.

Given the cross-sectional and self-reported nature of the data, findings were interpreted as associative rather than causal. The analysis aimed to provide empirical evidence of the relationship between academic supervision and pedagogical competence within the studied context, while acknowledging the methodological limitations related to sample size and research design.

3. FINDINGS AND DISCUSSION

3.1 Finding

This study was conducted to examine the dependent variable in relation to the independent variable using a questionnaire instrument structured in the form of operational indicators. A total of 30 teachers participated as respondents. The collected data had to meet prerequisites before being processed in the subsequent stages. The data collected through questionnaires for each variable, measured on an ordinal scale, were input into Microsoft Excel with scores of 5, 4, 3, 2, and 1, corresponding to the respondents' answers.

3.1.1 Prerequisite Tests

a. Normality Test

The normality test was conducted using the Kolmogorov-Smirnov (K-S) test, as the study involved 30 respondents, meeting the minimum requirement for the K-S test. The purpose of this test was to

assess the distribution of residual data for variables X and Y and determine whether the data were normally distributed.

Based on the calculations, the significance value (Sig.) obtained was as follows:

Table 1. Result of Normality Test

One-Sample Kolmogorov-Smirnov Test			
			Unstandardized Residual
N			30
Normal Parameters[a,b]	Mean		.0000000
	Std. Deviation		5.33552112
Most Extreme Differences	Absolute		.123
	Positive		.090
	Negative		-.123
Test Statistic			.123
Asymp. Sig. (2-tailed)[c]			.200[d]
Monte Carlo Sig. (2-tailed)[e]	Sig.		.280
	99% Confidence Interval	Lower Bound	.268
		Upper Bound	.291

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.
e. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 299883525.

From the table above, it can be observed that the unstandardized (residual) Asymp. Sig (2-tailed) value is 0.200, which is greater than the significance level of 0.05. This indicates that the research data follow a normal distribution, fulfilling one of the key assumptions required for parametric statistical analysis. Normality is an essential criterion in statistical testing, as it ensures that the results derived from inferential analysis, such as correlation and regression, are valid and reliable. When data are normally distributed, it allows for more accurate hypothesis testing and enhances the interpretability of statistical outcomes. This finding is further supported by the histogram and p-plot residual graphs presented below:

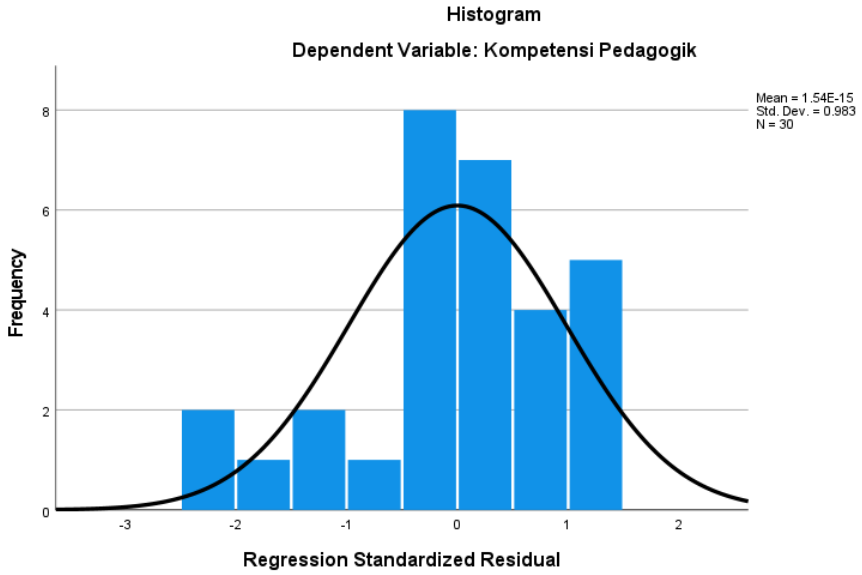

Figure 1. Histogram of Standardized Residual

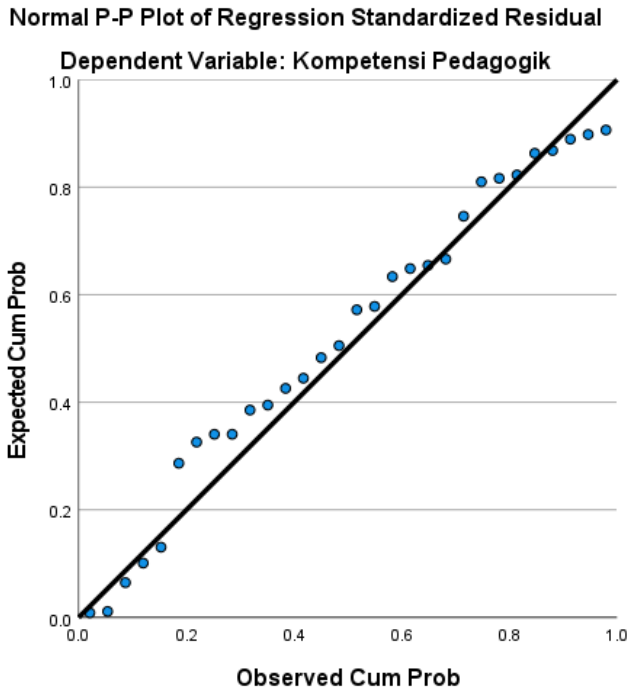

Figure 2. P-Plot of Regression Standarized Residual

This conclusion is further reinforced by the visual representations of data distribution, namely the histogram and p-plot residual graphs. The histogram provides a graphical summary of the data's frequency distribution, where a bell-shaped curve suggests normality. Meanwhile, the p-plot residual graph compares the observed data against the expected normal distribution, with data points closely aligning along the diagonal line indicating a normal pattern. These graphical representations serve as complementary evidence to the statistical test, strengthening the validity of the normality assumption.

The confirmation of normally distributed data is crucial for subsequent stages of analysis, as it ensures that parametric statistical methods, such as Pearson correlation and regression analysis, can be

applied appropriately. If the data were not normally distributed, alternative non-parametric methods would have been required, which could impact the sensitivity and interpretability of the results. By meeting this assumption, the study can proceed with further statistical testing, providing robust insights into the relationship between academic supervision and pedagogical competence among senior high school teachers in Cilegon City.

b. Linearity Test

The linearity test aims to determine the nature of the relationship between the independent and dependent variables. In this case, a linear relationship means that the relationship follows a straightn-line pattern. Based on the linearity test conducted using SPSS, the results are shown in the table below:

Table 2. Result of Linearity Test

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Pedagogical Competence * Academic Supervision	Between Groups	(Combined)	2370.467	17	139.439	4.534	.005
		Linearity	1913.934	1	1913.934	62.236	.000
		Deviation from Linearity	456.532	16	28.533	.928	.565
	Within Groups		369.033	12	30.753		
	Total		2739.500	29			

From the table above, the relationship between the Academic Supervision variable and the Pedagogical Competence variable shows a significant deviation from linearity (0.565), which exceeds the 0.05 threshold. This indicates that the relationship between these two variables follows a linear pattern. In other words, as academic supervision improves, there is a consistent and proportional change in pedagogical competence. A linear relationship suggests that variations in academic supervision directly correspond to variations in teachers' pedagogical competence, making it possible to predict one variable based on the other with a reasonable degree of accuracy.

Establishing linearity is essential in correlational and regression analyses, as it ensures that the assumptions underlying these statistical methods are met. When a relationship is linear, statistical models such as Pearson correlation and linear regression can be applied effectively to quantify the strength and direction of the relationship. The confirmation of linearity in this study means that any observed correlation between academic supervision and pedagogical competence is likely to be meaningful rather than resulting from random fluctuations. This finding strengthens the study's validity, allowing for more precise interpretations and practical implications regarding the role of academic supervision in enhancing teachers' pedagogical competence.

3.1.2 Homogeneity Test

The homogeneity test is used to determine whether two or more distributions in the study have the same variance. The decision-making criteria are as follows:

1. If the significance value > 0.05, the data distribution is homogeneous.
2. If the significance value < 0.05, the data distribution is not homogeneous.

Based on the homogeneity test using SPSS, the results are presented in the table below:

Table 3. Result of Homogenity Test

Tests of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.032	1	58	.859
	Based on Median	.025	1	58	.874
	Based on Median and with adjusted df	.025	1	55.526	.874
	Based on trimmed mean	.036	1	58	.850

ANOVA					
Result					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.400	1	5.400	.053	.818
Within Groups	5864.200	58	101.107		
Total	5869.600	59			

Based on the homogeneity test conducted using SPSS, the significance value for the Academic Supervision and Pedagogical Competence variables was found to be 0.859. Since this value exceeds the 0.05 threshold, it indicates that the data distribution for both variables is homogeneous. In other words, the variance across the groups is relatively uniform, confirming the absence of heteroscedasticity in this study. Ensuring homogeneity of variance is crucial for obtaining valid and reliable statistical analyses. When data exhibit homogeneity, comparisons between groups become more equitable, as no substantial differences in data dispersion could skew the interpretation of results. Consequently, the relationship between Academic Supervision and Pedagogical Competence can be analyzed more objectively, free from bias due to significant variance discrepancies.

With the confirmation of data homogeneity, the study can proceed to the next stage of analysis without concerns regarding substantial variance differences. Homogeneous data ensure that any observed differences in the study are not attributed to uneven variability within the sample but genuinely reflect the relationship between the examined variables. This enhances confidence in the validity of the research findings, as uniform variance across groups suggests that uncontrolled external factors do not significantly influence the data. As a result, the subsequent analyses will yield more accurate insights into the correlation between Academic Supervision and Pedagogical Competence among high school teachers in Cilegon. Given the assurance of data homogeneity, more advanced statistical techniques, such as linear regression or path analysis, can be applied to further explore the extent to which Academic Supervision influences teachers' Pedagogical Competence.

3.1.3 Correlation Test (Relationship between X and Y)

The hypothesis test was conducted to analyze the relationship between Academic Supervision (X) and Pedagogical Competence (Y). The data obtained from the correlation test using SPSS are as follows:

Table 4. Result of Correlation test

Correlations			
		Academic Supervision	Pedagogical Competence
Academic Supervision	Pearson Correlation	1	.836**
	Sig. (2-tailed)		.000
	N	30	30
Pedagogical Competence	Pearson Correlation	.836**	1
	Sig. (2-tailed)	.000	
	N	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

From the output table above, the obtained significance value is 0.001 < 0.05, indicating a correlation between Academic Supervision and Pedagogical Competence. In other words, the relationship between these two variables is statistically significant, meaning that changes in Academic Supervision will have an impact on changes in Pedagogical Competence.

The Pearson Correlation analysis shows a positive correlation with an r-value of 0.836 > r-table 0.463 (1%). This value indicates that the relationship between Academic Supervision and Pedagogical Competence is not only present but also quite strong. This means that the better the implementation of Academic Supervision, the higher the level of teachers' Pedagogical Competence.

Thus, it can be concluded that the correlation between Academic Supervision and Pedagogical Competence is positive and strongly related. This finding highlights the importance of effectively implementing Academic Supervision to enhance teachers' Pedagogical Competence, which ultimately contributes to the overall improvement of learning quality.

3.1.4 Significance Test

The significance or probability test is a crucial statistical method used in research to determine the reliability of the obtained results. The significance/probability test provides an indication of the likelihood that the research results are accurate. In this study, the researcher selected a significance level of 0.05, implying a 95% probability that the findings are valid and a 5% chance of error. By establishing this threshold, the analysis gains a solid statistical foundation, ensuring that the conclusions drawn from the data are not merely coincidental but supported by empirical evidence.

To examine the relationship between Academic Supervision and Pedagogical Competence, the researcher utilized SPSS, a powerful statistical software for data analysis. The researcher selected a significance level of 0.05, meaning there is a 95% chance that the findings are correct and a 5% chance of error. This predetermined significance level serves as a benchmark for assessing whether the observed relationship between variables is statistically meaningful. Through SPSS, the researcher can systematically analyze the data, reducing potential biases and enhancing the objectivity of the findings.

The correlation test results yielded a significance value of 0.001, indicating a strong statistical association between the two variables. Using SPSS, the significance or probability of the data can be described as follows: The analysis of the relationship between Academic Supervision and Pedagogical Competence, based on the correlation test results above, shows a significance value of 0.001. This figure is considerably lower than the 0.05 threshold, suggesting that the correlation is highly significant. Consequently, this finding implies that improvements in Academic Supervision are likely to positively influence teachers' Pedagogical Competence, reinforcing the importance of effective supervision in educational settings.

According to the standard decision-making criteria in significance testing, when the significance value is less than 0.05, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This value is smaller than 0.05. According to the decision-making criteria, if the significance

value is < 0.05, it indicates a significant correlation between Academic Supervision and Pedagogical Competence. As a result, this study substantiates the hypothesis that Academic Supervision plays a pivotal role in shaping teachers' pedagogical abilities. Consequently, enhancing the quality of academic supervision could serve as a strategic approach to fostering educators' professional development and improving overall instructional effectiveness.

3.2 Discussion

The findings of this study reveal a strong and statistically significant positive relationship between academic supervision and teachers' pedagogical competence among senior high school teachers in Cilegon City. The magnitude of the correlation indicates that teachers who perceive academic supervision as structured, supportive, and development-oriented also report higher levels of pedagogical competence. This result supports theoretical perspectives that conceptualize academic supervision not merely as an administrative function but as a professional learning process that facilitates instructional reflection and continuous improvement (Glickman et al., 2014; Sahertian, 2010). From a professional development standpoint, supervision serves as a mechanism through which teachers receive feedback, clarify instructional goals, and refine pedagogical practices in alignment with student-centered learning principles.

The strong correlation observed in this study is consistent with previous empirical findings that have reported meaningful associations between supervision practices and pedagogical competence across various educational contexts (Angelicha & Sanoto, 2021; Maslihah et al., 2024; Sanoto & Prastania, 2022). However, the strength of the relationship in the present study appears relatively higher than that reported in several earlier studies, which may be attributed to contextual factors. One plausible explanation is that the participating schools had implemented professional learning communities, which may have amplified the perceived effectiveness of academic supervision. Within such environments, supervision is more likely to be experienced as collegial and reflective rather than evaluative, thereby enhancing its alignment with teachers' pedagogical development. This finding resonates with sociocultural perspectives on teacher learning, which emphasize the importance of collaborative contexts in shaping professional growth (Mainuddin et al., 2021).

Despite these contributions, the findings must be interpreted with caution. The reliance on self-reported questionnaire data raises the possibility of common method bias, as both academic supervision and pedagogical competence were measured using the same instrument at a single point in time (Podsakoff et al., 2003). Teachers who hold generally positive perceptions of their professional environment may be inclined to rate both supervision and their own competence more favorably, thereby inflating the observed correlation. Additionally, the cross-sectional design of the study limits the ability to determine the directionality of the relationship. While academic supervision is theoretically positioned as a factor that supports pedagogical competence, it is also plausible that teachers with higher pedagogical competence are more receptive to supervision or perceive supervision practices more positively.

Another important consideration relates to the contextual specificity of the findings. Cilegon City represents a unique educational setting characterized by both industrial development and persistent challenges in educational quality. In such contexts, academic supervision may function as a compensatory mechanism that partially offsets limitations in infrastructure or access to formal professional development programs. However, the extent to which these findings can be generalized to other regions with different institutional conditions remains uncertain. Future research involving larger and more diverse samples would be necessary to assess the robustness of the observed relationship across varying educational contexts.

From a policy and practice perspective, the findings underscore the importance of positioning academic supervision as a developmental rather than procedural activity. When supervision is conducted through regular classroom observations, constructive feedback, and reflective dialogue, it has the potential to support teachers' pedagogical competence in ways that align with contemporary

educational reforms, such as *Kurikulum Merdeka*, which emphasizes autonomy, differentiation, and reflective practice. Nevertheless, the effectiveness of supervision is likely contingent upon the competencies of supervisors themselves, as well as the organizational culture within schools. Without adequate training and institutional support, supervision risks being reduced to a formal requirement with limited impact on instructional quality.

In conclusion, while this study provides empirical evidence of a strong association between academic supervision and pedagogical competence, it also highlights the need for more nuanced and methodologically robust investigations. Longitudinal designs, mixed-method approaches, and multi-source data collection would enable future studies to move beyond correlational evidence and develop a more comprehensive understanding of how and under what conditions academic supervision contributes to sustained pedagogical improvement. Such efforts are essential for informing evidence-based supervision policies that genuinely support teacher professionalism and educational quality.

4. CONCLUSION

This study demonstrates a strong and statistically significant positive relationship between academic supervision and the pedagogical competence of senior high school teachers in Cilegon City, as evidenced by a high correlation coefficient ($r = 0.836$, $p = 0.001$), indicating that well-structured and developmental supervision is closely associated with teachers' capacity to plan, implement, and evaluate student-centered learning. These findings align with current national education reforms, including *Kurikulum Merdeka* and Permendikbudristek No. 2626 of 2023, which emphasize teacher professionalism, reflective practice, and collaborative learning, suggesting that academic supervision can serve as a strategic mechanism for fostering continuous instructional improvement within schools. Nevertheless, the study is subject to several limitations, including a relatively small sample size, reliance on self-reported data, and a cross-sectional correlational design that precludes causal inference and limits generalizability. Future research is therefore encouraged to employ larger and more diverse samples, utilize longitudinal or mixed-method approaches, and incorporate multi-source data to better capture the dynamic and contextualized nature of academic supervision and its long-term impact on teachers' pedagogical development across varied educational settings.

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