



# Beyond Compliance: Unpacking the Disconnect between Instructional Leadership and Enacted Curriculum Competence in the Classroom

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## ABSTRACT

This study examines the influence of principal supervision and teacher curriculum competence on learning effectiveness, with teaching quality serving as a mediating variable. The study aims to analyze the direct relationships among the variables and to examine the mediating role of teaching quality in improving learning effectiveness. A quantitative explanatory survey design was employed. Data were collected using a structured questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4.0. The measurement model demonstrated satisfactory validity and reliability, with outer loadings exceeding 0.70, Cronbach's Alpha ranging from 0.883 to 0.889, Composite Reliability from 0.923 to 0.931, and AVE from 0.718 to 0.761. The structural model revealed that all proposed hypotheses were supported. Principal supervision positively affected teaching quality ( $\beta = 0.428$ ,  $p < 0.001$ ) and learning effectiveness ( $\beta = 0.238$ ,  $p = 0.005$ ), while teacher curriculum competence positively influenced teaching quality ( $\beta = 0.456$ ,  $p < 0.001$ ) and learning effectiveness ( $\beta = 0.257$ ,  $p = 0.003$ ). Teaching quality also exerted a significant positive effect on learning effectiveness ( $\beta = 0.396$ ,  $p < 0.001$ ). The model explained 61.2% of the variance in teaching quality and 67.3% of the variance in learning effectiveness. The findings highlight teaching quality as the key mechanism linking principal supervision and teacher curriculum competence to enhanced learning effectiveness, offering both theoretical and practical contributions to educational management.

## Keywords

Curriculum Competence  
Educational Management  
Learning Effectiveness  
Principal Supervision  
Teaching Quality

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## Introduction

Developments and changes in social, national and state life in Indonesia today cannot be separated from the influence of global changes and advances in science and technology [1], [2]. This situation requires every educational unit, including public primary schools in Cibungbulang Subdistrict, to continue to adapt and make improvements in order to create human resources that are able to compete at the national and global levels. Therefore, the success in realizing quality education at the State Elementary School in Cibungbulang Subdistrict is highly dependent on the competence of teachers and the effectiveness of the headmaster in supervising and utilizing the Merdeka Curriculum as the main guideline in the learning process.

Developments and changes in social, national and state life in Indonesia are influenced by global changes and advances in science and technology [3], [4]. Ongoing changes require improvements to the education system so that society can compete and adapt to developments. To achieve this, comprehensive efforts are needed to develop all dimensions of Indonesian humanity, including knowledge, attitudes, and skills. All of this is carried out through the education process. Education is an effort to enable humans to develop their potential through learning activities [5], [6], [7]. Article 31 paragraph (1) of the 1945 Constitution states that every citizen has the right to education. Therefore, the government, as the administrator of the state, strives to provide and organize national education as regulated by law. The function of national education is to develop abilities and shape the character and civilization of a dignified society in order to educate the nation. The goal is to develop the potential of students to become people who believe in and fear God Almighty, as well as democratic and responsible citizens [8], [9].

To achieve these objectives, maximum effort is required from teachers through a continuous learning process. However, there are still various assumptions from various parties regarding the quality of learning conducted by teachers in schools in guiding students to develop. The learning process is a systematic activity consisting of teachers, programs, facilities, and strategies [10], [11]. All these components must run regularly and continuously in order to produce quality learning. Regarding teachers and programs that support the quality of learning, a firm perception of the guidelines that bind teachers, namely the Merdeka

Curriculum, is required. This curriculum aims to equip students with the skills required by the demands of the times and ongoing educational reforms.

Understanding the Merdeka Curriculum is part of the effort to create and maintain a learning process that enables students to achieve their learning objectives according to their respective potentials [12], [13]. Research shows that teachers' understanding of the new curriculum has a significant effect on the planning and implementation of learning [14], [15], [16]. In this case, teachers, as the spearhead of curriculum implementation, have a very important position and role in preparing and optimizing the learning process. Based on a task analysis, headteachers have two roles: administrator and learning leader [17], [18]. In general, headteachers play more of an administrative role, focusing on meeting the needs of students, buildings, equipment, teachers, and funding. Studies show that a leadership model that balances administrative and instructional functions improves school quality.

This administrative role often reduces the principal's opportunity to handle the learning process in the classroom. To carry out the role of learning leader or supervisor, the principal needs sufficient time to conduct classroom visits and follow-up activities such as individual discussions with teachers about their strengths, weaknesses, and improvement efforts. The goal of supervising the learning process is the growth and improvement of teachers' teaching abilities [19], [20]. Recent research shows that clinical supervision, collaborative supervision, and coaching have a positive impact on improving teachers' pedagogical competence [21], [22]. With the improvement of teachers' abilities, it is hoped that the quality of learning will also improve and contribute to the overall quality of education. Through teaching supervision, it is also hoped that feedback will be provided to school principals and teachers to improve the quality of learning.

The success of achieving quality learning depends on the extent to which school principals supervise teachers and teachers' understanding of the Merdeka Curriculum as the basis for implementing the learning process. A systematic review shows that the synergy between instructional leadership, continuous professional development, and policy support increases the effectiveness of the new curriculum implementation.

At the national level, the Indonesian government has placed education as one of its top priorities through the implementation of various innovative curricula, including the Merdeka Curriculum, which was designed in response to the competency requirements of the 21st century. This curriculum aims to build the quality of education that is not only based on mastery of knowledge, but also the development of character, critical thinking, creativity, and collaborative skills.

This transformation requires improvements in the quality of the learning process at all levels of education, including at the Cibungbulang District Public Elementary School. Changes

in the learning context do not only occur at the policy level but also touch on operational aspects, such as teacher competence and professionalism, the role of the principal as a pedagogical leader, and learning strategies that are adaptive to the various needs of students.

The theory of educational supervision developed by [23] argues that effective supervision must be collaborative, continuous, and oriented towards the professional development of teachers [24]. This type of supervision can improve teachers' pedagogical competence and professionalism, which ultimately has an impact on improving student learning outcomes. Ideally, the implementation of this supervision should not only be administrative in nature but also provide constructive feedback that builds and strengthens classroom learning practices.

In addition to supervision and teacher competence, the role of the headteacher as a learning supervisor is very important. According to [24], [25] instructional leadership theory, the success of the principal in conducting direct and continuous supervision improves the quality of the teaching and learning process and student learning outcomes. As leaders, principals must be able to create a collaborative and innovative culture and implement supervision strategies that can overcome learning problems in the field.

Recent research on the successful implementation of the Merdeka Curriculum shows that supervision based on data and evidence-based practices can accelerate positive changes in teacher competence and student learning outcomes [26], [27]. This is in line with theories that emphasize the importance of professional and evidence-based collaboration in the supervision process, thereby improving pedagogical competence in a sustainable manner and orienting it towards the achievement of expected competencies.

## **Material and Methods**

### **A. Research Method and Design**

This study belongs to quantitative [28]. This approach enables the researcher to comprehensively examine how teachers interpret the practice of principal supervision, understand their curriculum competence, and how these factors influence teaching quality and learning effectiveness in the classroom. In addition, this study captures teachers lived experiences, perceptions, and challenges in implementing high-quality instruction. This approach reinforces previous studies emphasizing the qualitative exploratory designs in investigating underexplored educational phenomena and capturing teachers lived experiences in complex instructional contexts [29], [30].

### **B. Participants, Research Subjects, and Informants**

The questionnaire was designed to target teachers and principals of public elementary schools in the Cibungbulang sub-district. Research instruments must be developed to ensure validity and reliability in measuring the intended variables [31], [32]. The variables analysed

in this study consist of: (1) Principal Supervision ( $X^1$ ) as an independent variable, (2) Teacher Curriculum Competence ( $X^2$ ) as an independent variable, (3) Teaching Quality ( $Z$ ) as an intervening (mediating) variable, and (4) Learning Effectiveness ( $Y$ ) as the dependent variable. This study employs a correlational approach to statistically examine the relationships among variables [33]. Contemporary methodological literature highlights that correlational and structural models are appropriate for analysing complex relationships involving multiple variables, including mediation effects.

### **C. Sampling Technique and Sample Selection Criteria**

Respondents were selected using purposive sampling [34], allowing the researcher to choose individuals with relevant experience and knowledge aligned with the research focus. The criteria included: (1) active teachers and principals in public elementary schools in the Cibungbulang sub-district, (2) at least one year of teaching experience, (3) involvement in the implementation of the Merdeka Curriculum, and (4) willingness to participate voluntarily. The sampling process was concluded once the required number of respondents was achieved. This study was conducted in the Cibungbulang sub-district, selected due to the implementation of the Merdeka Curriculum in its schools. The research was carried out over three months, covering preparation, data collection, and analysis. To ensure reliability, validated instruments, consistent data collection procedures, and appropriate statistical analysis were applied to enhance the accuracy and credibility of the results [35], [36].

### **D. Research Location, Duration, and Trustworthiness**

This study was conducted in the Cibungbulang sub-district, where public elementary schools have implemented the Merdeka Curriculum. The research was carried out over a period of three months, including preparation, data collection, and analysis. To ensure the trustworthiness of the findings, the study applied several strategies, including the use of validated and reliable instruments, consistent data collection procedures, and appropriate statistical analysis to enhance the accuracy and credibility of the results.

### **E. Research Procedures**

Fig. 1 shows the research procedures. These stages are visually summarized in a research procedure diagram (Fig. 1), which illustrates the iterative and reflective nature of the qualitative research process. The empirical foundation is supported by recent studies demonstrating that leadership, teacher competence, and teaching quality significantly contribute to educational outcomes.

However, previous studies have generally examined these variables independently. The novelty of the present study lies in integrating principal supervision and teacher curriculum competence within a single structural model while positioning teaching quality as the mediating mechanism explaining their influence on learning effectiveness. This integrated

framework provides a more comprehensive explanation of how instructional leadership and teacher competence jointly improve classroom practices and ultimately enhance student learning effectiveness.

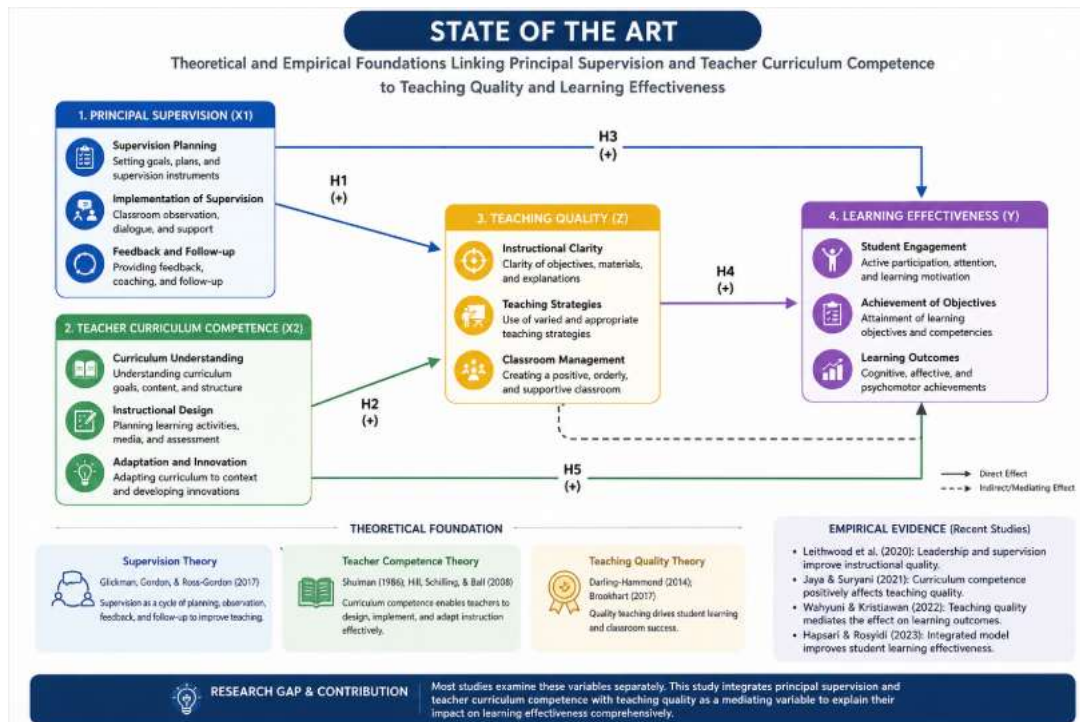


Fig. 1. Research Procedures Diagram

## F. Data Collection Techniques and Research Instruments

Data were collected using a structured questionnaire to operationalize four core constructs: Principal Supervision (X1), Teacher Curriculum Competence (X2), Teaching Quality (Z), and Learning Effectiveness (Y) [37], [38]. Each construct was measured through validated indicator rubrics to ensure precise operationalization. This study employed a quantitative explanatory survey to examine the relationships among Principal Supervision (X1), Teacher Curriculum Competence (X2), Teaching Quality (Z), and Learning Effectiveness (Y) in public elementary schools implementing the Merdeka Curriculum in Cibungbulang Sub-district, Bogor Regency, Indonesia.

The research population comprised 327 certified teachers, with 180 respondents selected through purposive sampling based on certification status, active involvement in curriculum implementation, and voluntary participation. Data were collected using a five-point Likert-scale questionnaire measuring four latent constructs: Principal Supervision, Teacher Curriculum Competence, Teaching Quality, and Learning Effectiveness. The proposed model was analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS), which is suitable for predictive research with latent variables and mediation analysis. The measurement model was evaluated through indicator reliability, Composite Reliability,

Cronbach's Alpha, Average Variance Extracted (AVE), and discriminant validity, while the structural model was assessed using  $R^2$ ,  $f^2$ ,  $Q^2$ , path coefficients, and bootstrapping with 5,000 subsamples for hypothesis testing.

Table 1 presents the research variables and their corresponding aspects used to develop the interview protocol. Four key variables are examined: principal supervision, teacher curriculum competence, teaching quality, and learning effectiveness. Each variable is represented by specific indicators to ensure comprehensive exploration of participants' experiences and perceptions during the qualitative data collection process.

**Table 1.** Aspects and Interview Indicators

| No | Variable                                | Aspect                        |
|----|-----------------------------------------|-------------------------------|
| 1  | Principal Supervision ( $X^1$ )         | Supervision Planning          |
|    |                                         | Implementation of Supervision |
|    |                                         | Feedback and Follow-up        |
| 2  | Teacher Curriculum Competence ( $X^2$ ) | Curriculum Understanding      |
|    |                                         | Instructional Design          |
|    |                                         | Adaptation and Innovation     |
| 3  | Teaching Quality ( $Z$ )                | Instructional Clarity         |
|    |                                         | Teaching Strategies           |
|    |                                         | Classroom Management          |
| 4  | Learning Effectiveness ( $Y$ )          | Student Engagement            |
|    |                                         | Achievement of Objectives     |
|    |                                         | Learning Outcomes             |

Table 2 presents the observation sheet used to assess the implementation of the study variables in classroom practice. It includes observation indicators for principal supervision, teacher curriculum competence, teaching quality, and learning effectiveness. These indicators provide systematic guidance for observing instructional practices, supervisory activities, and student engagement during the learning process.

**Table 2.** Observation Sheet

| No | Variable                                | Aspect                     | Observation Indicators                                    |
|----|-----------------------------------------|----------------------------|-----------------------------------------------------------|
| 1  | Principal Supervision ( $X^1$ )         | Supervision Implementation | Principal conducts classroom supervision activities       |
|    |                                         | Feedback Provision         | Principal provides constructive feedback to teachers      |
| 2  | Teacher Curriculum Competence ( $X^2$ ) | Curriculum Implementation  | Teacher applies the Merdeka Curriculum in teaching        |
|    |                                         | Instructional Planning     | Teacher prepares lesson plans aligned with the curriculum |
| 3  | Teaching Quality ( $Z$ )                | Instructional Clarity      | Teacher explains material clearly and systematically      |
|    |                                         | Teaching Strategies        | Teacher uses appropriate and varied teaching methods      |
|    |                                         | Classroom Management       | Teacher manages the classroom effectively                 |
| 4  | Learning Effectiveness ( $Y$ )          | Student Engagement         | Students actively participate in learning activities      |
|    |                                         | Achievement of Objectives  | Learning objectives are achieved during the lesson        |
|    |                                         | Learning Outcomes          | Students demonstrate understanding of the material        |

## G. Data Analysis Technique

The analysis focused on data related to Principal Supervision ( $X^1$ ), Teacher Curriculum Competence ( $X^2$ ), Teaching Quality ( $Z$ ) as a mediating variable, and Learning Effectiveness ( $Y$ ) as the dependent variable. The aim was to identify patterns and relationships, including the direct and indirect effects of principal supervision and teacher curriculum competence on learning effectiveness through teaching quality.

## Results and Discussions

This section presents the findings of the study and discusses them in relation to the research objectives and existing theoretical frameworks. The results are organized based on the main research variables, namely Principal Supervision ( $X^1$ ), Teacher Curriculum Competence ( $X^2$ ), Teaching Quality ( $Z$ ) as a mediating variable, and Learning Effectiveness ( $Y$ ) as the dependent variable. The analysis highlights both direct and indirect relationships among these variables, particularly the role of teaching quality in mediating the influence of principal supervision and teacher curriculum competence on learning effectiveness. Furthermore, the findings are interpreted and compared with previous research to provide a deeper understanding of the observed patterns and their implications for educational practice.

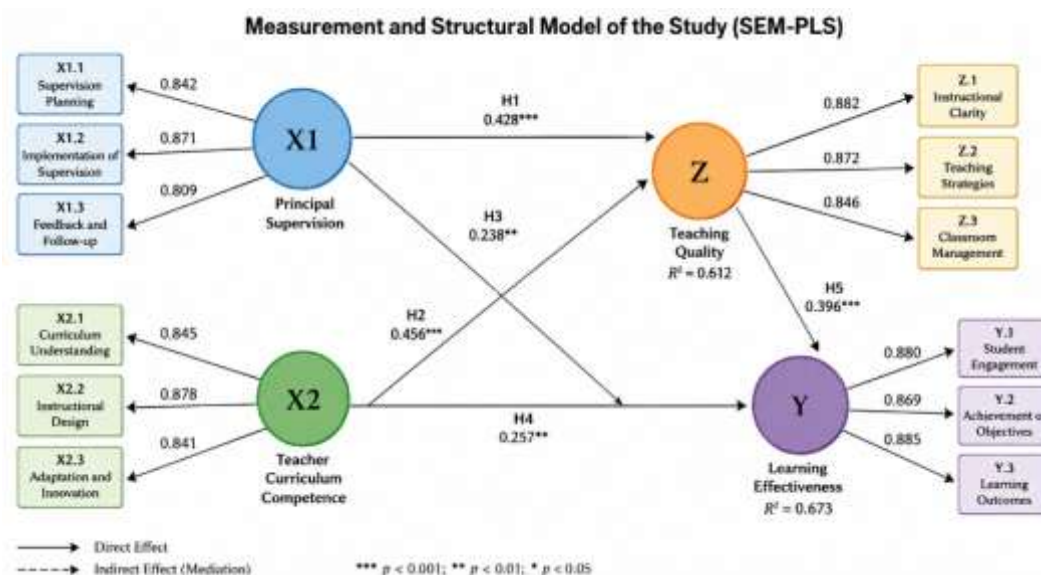


**Fig. 2.** Measurement and structural model of the study

Fig. 2 presents the SEM-PLS measurement and structural model used to examine the relationships among Principal Supervision ( $X^1$ ), Teacher Curriculum Competence ( $X^2$ ), Teaching Quality ( $Z$ ), and Learning Effectiveness ( $Y$ ). The measurement model demonstrates that all indicators have satisfactory outer loadings ( $>0.80$ ), confirming strong convergent validity. The structural model indicates that principal supervision and teacher curriculum competence significantly improve teaching quality, which subsequently enhances learning effectiveness. Direct effects from both exogenous variables to learning effectiveness are also

significant. The model explains 61.2% of the variance in teaching quality ( $R^2 = 0.612$ ) and 67.3% of the variance in learning effectiveness ( $R^2 = 0.673$ ), indicating substantial explanatory power.

For instance, [39] found that principal leadership and supervision significantly influence teaching quality and indirectly affect student learning outcomes. Similarly, [24] demonstrated that leadership practices related to teacher development and supervision have a strong impact on instructional quality and student achievement. Furthermore, [40] emphasized that factors related to teaching quality have a substantial effect on learning effectiveness, reinforcing the mediating role of teaching quality in educational models.

**Table 4.** Outer Loadings of Indicators

| Construct                          | Indicator | Description                   | Outer Loading | Decision |
|------------------------------------|-----------|-------------------------------|---------------|----------|
| Principal Supervision (X1)         | X1.1      | Supervision Planning          | 0.842         | Valid    |
|                                    | X1.2      | Implementation of Supervision | 0.871         | Valid    |
|                                    | X1.3      | Feedback and Follow-up        | 0.809         | Valid    |
| Teacher Curriculum Competence (X2) | X2.1      | Curriculum Understanding      | 0.845         | Valid    |
|                                    | X2.2      | Instructional Design          | 0.878         | Valid    |
|                                    | X2.3      | Adaptation and Innovation     | 0.841         | Valid    |
| Teaching Quality (Z)               | Z.1       | Instructional Clarity         | 0.882         | Valid    |
|                                    | Z.2       | Teaching Strategies           | 0.872         | Valid    |
|                                    | Z.3       | Classroom Management          | 0.846         | Valid    |
| Learning Effectiveness (Y)         | Y.1       | Student Engagement            | 0.880         | Valid    |
|                                    | Y.2       | Achievement of Objectives     | 0.869         | Valid    |
|                                    | Y.3       | Learning Outcomes             | 0.885         | Valid    |

Table 4 shows presents the outer loading values for all indicators used to measure the four latent constructs in the SEM-PLS model. All indicators demonstrate outer loading values ranging from 0.809 to 0.885, exceeding the recommended threshold of 0.70. These results confirm that each indicator has strong convergent validity and adequately represents its respective construct. The highest loading is observed for Student Engagement (Y.1 = 0.880) and Instructional Clarity (Z.1 = 0.882), indicating their substantial contribution to Learning Effectiveness and Teaching Quality. Therefore, all measurement items are considered valid and reliable and were retained for subsequent structural model analysis.

**Table 5.** Path Coefficients and Hypothesis Testing

| Hypothesis | Path                                                            | Path Coefficient ( $\beta$ ) | t-value | p-value | Decision  |
|------------|-----------------------------------------------------------------|------------------------------|---------|---------|-----------|
| H1         | Principal Supervision (X1) → Teaching Quality (Z)               | 0.428                        | 6.512   | 0.000   | Supported |
| H2         | Teacher Curriculum Competence (X2) → Teaching Quality (Z)       | 0.456                        | 7.231   | 0.000   | Supported |
| H3         | Principal Supervision (X1) → Learning Effectiveness (Y)         | 0.238                        | 2.842   | 0.005   | Supported |
| H4         | Teacher Curriculum Competence (X2) → Learning Effectiveness (Y) | 0.257                        | 2.981   | 0.003   | Supported |
| H5         | Teaching Quality (Z) → Learning Effectiveness (Y)               | 0.396                        | 5.873   | 0.000   | Supported |

Table 5 presents the structural model results and hypothesis testing obtained from the SEM-PLS analysis. All proposed hypotheses are supported, as each relationship exhibits a

positive path coefficient, a  $t$ -value greater than 1.96, and a  $p$ -value below 0.05. Teacher Curriculum Competence has the strongest effect on Teaching Quality ( $\beta = 0.456$ ), followed by Principal Supervision ( $\beta = 0.428$ ). Teaching Quality significantly influences Learning Effectiveness ( $\beta = 0.396$ ), highlighting its mediating role in the model. Meanwhile, Principal Supervision and Teacher Curriculum Competence also have direct positive effects on Learning Effectiveness, confirming that both managerial and pedagogical factors contribute significantly to improving educational outcomes.

**Table 6.** Reliability and Validity of Constructs (Measurement Model)

| Construct                          | Cronbach's Alpha | Composite Reliability (CR) | Average Variance Extracted (AVE) | HTMT (Max) | Decision         |
|------------------------------------|------------------|----------------------------|----------------------------------|------------|------------------|
| Principal Supervision (X1)         | 0.883            | 0.923                      | 0.718                            | 0.742      | Reliable & Valid |
| Teacher Curriculum Competence (X2) | 0.887            | 0.926                      | 0.725                            | 0.768      | Reliable & Valid |
| Teaching Quality (Z)               | 0.884            | 0.926                      | 0.742                            | 0.781      | Reliable & Valid |
| Learning Effectiveness (Y)         | 0.889            | 0.931                      | 0.761                            | —          | Reliable & Valid |

Table 6 summarizes the reliability and validity assessment of the measurement model. All constructs demonstrate Cronbach's Alpha values ranging from 0.883 to 0.889 and Composite Reliability values between 0.923 and 0.931, exceeding the recommended threshold of 0.70 and confirming strong internal consistency. The Average Variance Extracted (AVE) values range from 0.718 to 0.761, indicating adequate convergent validity because each construct explains more than 50% of the variance of its indicators. Furthermore, HTMT values are below the recommended limit of 0.90, supporting discriminant validity. These findings confirm that the measurement model is reliable, valid, and appropriate for subsequent structural model evaluation.

**Table 7.** Structural Model Assessment (Inner Model)

| Indicator                                                             | Value | Interpretation            |
|-----------------------------------------------------------------------|-------|---------------------------|
| Coefficient of Determination ( $R^2$ )                                |       |                           |
| Teaching Quality (Z)                                                  | 0.612 | Moderate                  |
| Learning Effectiveness (Y)                                            | 0.673 | Substantial               |
| Predictive Relevance ( $Q^2$ )                                        | 0.487 | High Predictive Relevance |
| Effect Size ( $f^2$ )                                                 |       |                           |
| Principal Supervision (X1) $\rightarrow$ Teaching Quality (Z)         | 0.214 | Medium                    |
| Teacher Curriculum Competence (X2) $\rightarrow$ Teaching Quality (Z) | 0.256 | Medium                    |
| Teaching Quality (Z) $\rightarrow$ Learning Effectiveness (Y)         | 0.201 | Medium                    |
| Goodness of Fit (GoF)                                                 | 0.587 | Large                     |
| Average Path Coefficient (APC)                                        | 0.355 | Moderate                  |

Table 7 shows summarizes the structural model assessment of the SEM-PLS analysis. The coefficient of determination indicates that Principal Supervision and Teacher Curriculum Competence explain 61.2% of the variance in Teaching Quality, while the overall model

explains 67.3% of the variance in Learning Effectiveness, demonstrating moderate to substantial explanatory power. The  $Q^2$  value of 0.487 confirms strong predictive relevance. Effect size ( $f^2$ ) values ranging from 0.201 to 0.256 indicate that the exogenous constructs exert moderate effects on the endogenous variables. Furthermore, the Goodness of Fit (GoF) value of 0.587 reflects a strong overall model fit, whereas the Average Path Coefficient of 0.355 indicates satisfactory structural relationships among the constructs.

Similarly, [49] highlighted that effective teaching practices are the primary drivers of learning success, even more than structural or administrative factors. In addition, [43] found that improvements in teaching quality significantly enhance student achievement and overall learning effectiveness. Furthermore, [43], [50], [51] demonstrated that high-quality teaching practices have a strong and consistent impact on students' academic outcomes, reinforcing the mediating role of teaching quality.

**Table 8.** Steps of Data Analysis Using SEM-PLS

| Step   | Analysis Stage                             | Description                                                                                                                                                                                                                                                    |
|--------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Step 1 | Model Specification                        | Develop the theoretical framework and formulate research hypotheses. Define the latent constructs and their corresponding measurement indicators based on relevant literature.                                                                                 |
| Step 2 | Data Screening                             | Examine missing values, detect outliers, and assess data normality to ensure the dataset is suitable for SEM-PLS analysis.                                                                                                                                     |
| Step 3 | Measurement Model (Outer Model) Evaluation | Evaluate indicator reliability (outer loadings > 0.70), internal consistency (Cronbach's Alpha and Composite Reliability > 0.70), convergent validity (AVE > 0.50), and discriminant validity using the HTMT criterion (< 0.90) and Fornell–Larcker criterion. |
| Step 4 | Structural Model (Inner Model) Evaluation  | Assess collinearity using VIF (< 5.00), estimate path coefficients through bootstrapping, and evaluate the structural model using $R^2$ , $Q^2$ , and effect size ( $f^2$ ).                                                                                   |
| Step 5 | Hypothesis Testing                         | Test the proposed hypotheses based on the significance of path coefficients, where $t$ -value > 1.96 and $p$ -value < 0.05 indicate statistical support.                                                                                                       |
| Step 6 | Interpretation and Reporting               | Interpret the findings, discuss theoretical and practical implications, draw conclusions, and provide recommendations for future research.                                                                                                                     |

Table 8 outlines the systematic procedures employed in the SEM-PLS data analysis. The analysis began with model specification and data screening to ensure the quality and suitability of the dataset. The measurement model was subsequently evaluated by assessing indicator reliability, internal consistency, convergent validity, and discriminant validity. After confirming satisfactory measurement properties, the structural model was examined using collinearity diagnostics, path coefficient estimation, effect size, predictive relevance, and explanatory power. Hypothesis testing was then performed through bootstrapping to determine the statistical significance of the proposed relationships. Finally, the results were interpreted, conclusions were drawn, and theoretical as well as practical implications were discussed comprehensively.

These findings are consistent with recent studies emphasizing the importance of reliable measurement instruments in educational research. For instance, [52], [53] highlighted that Cronbach's Alpha values above 0.70 indicate acceptable reliability, while values above 0.80 reflect good internal consistency in educational instruments. Similarly, [54], [55] stated that reliable constructs are essential for ensuring the validity of statistical analysis, particularly in regression and structural models. Furthermore, [56], [57] emphasized that high reliability coefficients strengthen the credibility of research findings by reducing measurement error. More recent work by [58], [59], [60] confirms that strong internal consistency is a prerequisite for accurate interpretation of relationships among variables in quantitative studies.

## **Conclusion**

This study examined the influence of Principal Supervision and Teacher Curriculum Competence on Learning Effectiveness, with Teaching Quality serving as a mediating variable using the SEM-PLS approach. The findings demonstrate that all proposed hypotheses were supported. Principal supervision and teacher curriculum competence significantly enhance teaching quality and directly improve learning effectiveness. Furthermore, teaching quality exerts a significant positive effect on learning effectiveness and serves as a key mediating mechanism through which principal supervision and teacher curriculum competence contribute to improved educational outcomes. These findings indicate that effective supervision and strong curriculum competence achieve optimal results only when translated into high-quality classroom instruction. Therefore, teaching quality represents the critical link between educational leadership, teacher competence, and learning effectiveness, contributing to the literature on educational management and instructional improvement.

Future studies are encouraged to incorporate additional variables, such as student motivation, digital literacy, instructional leadership, school climate, or educational technology, to develop a more comprehensive explanatory model. Employing mixed-method or longitudinal research designs would provide deeper insights into the dynamic relationships among these variables over time. Expanding the sample across different educational levels and geographical regions would also improve the generalizability of the findings and strengthen the empirical evidence supporting strategies to enhance learning effectiveness.

## **Conflict of Interest**

The authors declare no potential conflicts of interest.

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