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# The Effect of Facilities and Infrastructure Management and Teacher Performance on Student Learning Achievement

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## ABSTRACT
Student academic achievement is a key indicator of educational quality and is influenced by both instructional and organizational factors, including facility management and teacher performance. This study aims to examine the direct and indirect effects of school facilities and infrastructure management and teacher performance on students' academic achievement. A quantitative approach with an explanatory survey design was employed. Data were collected from 226 students at MTsN 4 Aceh Utara using structured questionnaires and academic record documentation. The data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The results indicate that facilities and infrastructure management has a positive and significant effect on students' academic achievement and teacher performance. Teacher performance also shows a positive and significant effect on students' academic achievement and serves as a mediating variable in the relationship between facilities management and academic achievement. These findings demonstrate that effective management of educational facilities supports a conducive learning environment and enhances teacher performance, which in turn contributes to improved student outcomes. This study contributes to the literature on educational management by providing empirical evidence from the context of Islamic secondary education and highlighting the integrated role of facilities management and teacher performance in improving students' academic achievement.

Keywords: Facilities Management, Teacher Performance, Student Academic Achievement, PLS-SEM, *Madrasah*.

## *ABSTRAK*
*Prestasi belajar siswa merupakan indikator penting mutu pendidikan yang dipengaruhi oleh berbagai faktor internal dan eksternal, termasuk pengelolaan sarana prasarana dan kinerja guru. Penelitian ini bertujuan menganalisis pengaruh manajemen sarana dan prasarana serta kinerja guru terhadap prestasi belajar siswa, baik secara langsung maupun tidak langsung. Penelitian menggunakan pendekatan kuantitatif dengan desain survei eksplanatori. Data dikumpulkan dari 226 siswa MTsN 4 Aceh Utara melalui angket dan dokumentasi nilai akademik, kemudian dianalisis menggunakan Partial Least Squares–Structural Equation Modeling (PLS-SEM) dengan bantuan SmartPLS 4. Hasil penelitian menunjukkan bahwa manajemen sarana dan prasarana berpengaruh positif dan signifikan terhadap prestasi belajar siswa dan kinerja guru. Kinerja guru juga terbukti berpengaruh positif dan signifikan terhadap prestasi belajar siswa, serta berperan sebagai variabel mediasi dalam hubungan antara manajemen sarana prasarana dan prestasi belajar. Temuan ini menegaskan bahwa pengelolaan fasilitas pendidikan yang efektif dan peningkatan kinerja guru merupakan faktor strategis dalam meningkatkan mutu pembelajaran. Penelitian ini berkontribusi pada penguatan kajian manajemen pendidikan, khususnya dalam konteks madrasah, dengan menghadirkan model empiris yang mengintegrasikan aspek fasilitas pendidikan dan kinerja guru dalam peningkatan prestasi belajar siswa.*

*Kata Kunci: Manajemen Sarana Prasarana, Kinerja Guru, Prestasi Belajar Siswa, PLS-SEM, Madrasah*

## INTRODUCTION

Student learning achievement is the primary indicator in assessing the success of the educational process in schools.[1] This success is not only determined by the intellectual abilities of the students but is also heavily influenced by external factors, particularly the quality of learning, teacher performance, as well as the availability and management of educational facilities and infrastructure. A learning environment supported by adequate facilities and managed effectively can create a comfortable learning atmosphere, increase student motivation, and help teachers carry out their instructional tasks optimally. Therefore, the management of facilities and infrastructure becomes a strategic element in efforts to improve the quality of education sustainably.[2]

The quality of education is measured not only by the final result in the form of academic grades but also by how the learning process takes place.[3] Quality education is education capable of creating a learning process that is effective, efficient, and has a positive impact on both the academic and non-academic development of students. In the context of MTsN 4 Aceh Utara, strengthening the role of teachers through training in technology-based learning methods has shown an increase in students' academic achievement. Empirical data shows that since the implementation of technology-based learning, the average test scores of students have increased by approximately 20 percent, particularly in Mathematics and Science. This finding indicates that learning innovations supported by technological facilities can provide a real contribution to the improvement of student learning achievement.

However, the successful implementation of innovative learning cannot be separated from the support of adequate facilities and infrastructure. Educational facilities and infrastructure, such as proper classrooms, technology learning facilities, and adequate learning tools, are essential prerequisites for the implementation of effective learning.[4] Good management of facilities and infrastructure functions not only as technical support for learning but also plays a role in creating a conducive work environment for teachers.[5] When educational facilities are managed regularly and in accordance with learning needs, teachers will feel more supported and motivated to improve the quality of their teaching.

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[1] Fitri Lutfia Zahroh and Fitri Hilmiyati, "Indikator Keberhasilan Dalam Evaluasi Program Pendidikan: Success Indicators in Educational Program Evaluation," *Edu Cendikia: Jurnal Ilmiah Kependidikan* 4, no. 03 (2024): 1052–62, https://doi.org/10.47709/educendikia.v4i03.5049.

[2] Dewi Fatimah and Didin Sirojudin, "Manajemen Sarana Dan Prasarana Sekolah Dalam Meningkatkan Mutu Pendidikan Di MTs Al-Ihsan Kalikejambon Tembelang Jombang," *ISLAMIKA* 6, no. 3 (2024): 981–1002, https://doi.org/10.36088/islamika.v6i3.4889.

[3] Mustafa Yağcı, "Educational Data Mining: Prediction of Students' Academic Performance Using Machine Learning Algorithms," *Smart Learning Environments* 9, no. 1 (2022): 11, https://doi.org/10.1186/s40561-022-00192-z; Santiago Iglesias-Pradas et al., "Emergency Remote Teaching and Students' Academic Performance in Higher Education during the COVID-19 Pandemic: A Case Study," *Computers in Human Behavior* 119 (June 2021): 106713, https://doi.org/10.1016/j.chb.2021.106713; Monika Hooda et al., "Artificial Intelligence for Assessment and Feedback to Enhance Student Success in Higher Education," *Mathematical Problems in Engineering* 2022, no. 1 (2022): 5215722, https://doi.org/10.1155/2022/5215722.

[4] Maryam Ikram and Husaina Banu Kenayathulla, "Education Quality and Student Satisfaction Nexus Using Instructional Material, Support, Classroom Facilities, Equipment and Growth: Higher Education Perspective of Pakistan," *Frontiers in Education* 8 (March 2023), https://doi.org/10.3389/feduc.2023.1140971.

[5] Miyv Fayzhall et al., "Transformational versus Transactional Leadership: Manakah Yang Mempengaruhi Kepuasan Kerja Guru?," *EduPsyCouns: Journal of Education, Psychology and Counseling* 2, no. 1 (2020): 256–75.

Teacher performance is another key factor that significantly determines the quality of education. Professional, competent teachers with good job satisfaction tend to demonstrate high motivation and commitment in carrying out their teaching duties. Conversely, unsupportive working conditions, both in terms of facilities and institutional policies, can have a negative impact on teacher performance and ultimately affect student learning achievement. In recent years, the Indonesian government has issued various strategic policies to improve the quality and welfare of teachers, such as the teacher certification program, the recruitment of Government Employees with Work Agreements (PPPK), and the Merdeka Belajar (Freedom to Learn) policy.[6] These policies are expected to increase the focus and professionalism of teachers in performing their duties.[7]

The Merdeka Belajar program, for example, provides flexibility for teachers to apply creative and innovative learning methods.[8] However, the implementation of this program in the field still faces various challenges, especially the limitations of adequate training and mentoring. Without the support of competence enhancement and sufficient supporting facilities, these policies have the potential to become an additional administrative burden for teachers. Therefore, the success of educational policies depends heavily on the readiness of human resources and the availability of supporting facilities and infrastructure.[9]

The relationship between facilities and infrastructure management, teacher performance, and student learning achievement is interconnected and forms a unified educational system. The Qur'an provides an important illustration of effective resource management through the story of the bee in Surah An-Nahl verses 68–69, which reflects the principles of planning, organizing, implementing, and controlling to produce optimal benefits.[10] This principle is relevant in the context of educational management, where planned facilities management and wise resource utilization will produce quality educational output, namely optimal student learning achievement.

In the context of MTsN 4 Aceh Utara, although facilities and infrastructure conditions are generally considered adequate, initial observations show inequalities in learning achievement between classes. This phenomenon indicates that the availability of facilities alone is not enough; it must be supported by effective management and optimal teacher performance. This encourages the need for more in-depth research to understand

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[6] Muhammad Dzikry Alfath and Yayah Huliatunisa, "Analisis Kebijakan Sertifikasi Terhadap Kinerja Guru," *Indonesian Journal of Elementary Education (IJOEE)* 2, no. 1 (2021): 78, https://doi.org/10.31000/ijoee.v2i1.3900.

[7] Subkhi Mahmasani, *Pengaruh Sertifikasi Guru Dan Motivasi Kerja Guru Terhadap Kinerja Guru SMA N 5 Surakarta*, 2, no. 1 (2020): 274–82.

[8] Konstantinus Denny Pareira Meke et al., "Dampak Kebijakan Merdeka Belajar Kampus Merdeka (MBKM) Pada Perguruan Tinggi Swasta Di Indonesia," *Edukatif : Jurnal Ilmu Pendidikan* 4, no. 1 (2021): 675–85, https://doi.org/10.31004/edukatif.v4i1.1940.

[9] M. Rofiq Asmawi and Abd Kholid, "Analysis of Availability of Human Resources and Infrastructure Facilities in Supporting the Successful Learning," *SCHOOLAR: Social and Literature Study in Education* 2, no. 4 (2023): 271–75, https://doi.org/10.32764/schoolar.v2i4.3927; Olasile Babatunde Adedoyin et al., "National Policy on Open Educational Resources for Higher Education in Nigeria: Evaluation of Institutional Compliance Rate to Infrastructure and the Connectivity Goal," *Higher Education Policy*, ahead of print, November 21, 2024, https://doi.org/10.1057/s41307-024-00387-8.

[10] Alfi Ni'amissa'adah et al., "Urgensi Sarana Dan Prasarana Dalam Meningkatkan Prestasi Belajar Di Era Society 5.0 Dalam Perspektif Al-Qur'an Surat An-Nahl 68-69," *Raudhah Proud To Be Professionals : Jurnal Tarbiyah Islamiyah* 7, no. 2 (2022): 219–28, https://doi.org/10.48094/raudhah.v7i2.208.

how facilities management and teacher performance collectively influence student learning achievement in the madrasah environment.

A number of studies in the last five years have discussed the influence of facilities and infrastructure and teacher performance on student learning achievement. Martini et al. (2024) found that facilities management and teacher performance significantly influence the learning achievement of junior high school students in Indonesia, with teacher performance being the dominant variable.[11] Another study by Elselita and Masrur (2025) shows that good facilities management and optimal teacher performance contribute positively to student learning achievement in faith-based schools.[12] In an international context, Espinosa Andrade et al. (2024) reported that the quality of school infrastructure has a positive relationship with students' academic achievement in Ecuador.[13] Hanaysha et al. (2023) also showed that teacher competence and technological facility support influence student engagement and academic performance.[14] Meanwhile, Agyei et al. (2024) emphasized that inequality in educational facilities negatively impacts students' academic achievement in developing countries.[15]

Despite these various studies providing empirical evidence regarding the importance of facilities and infrastructure and teacher performance, significant research gaps still exist. First, most previous studies examined the influence of each variable separately, and not many have examined the simultaneous influence of facilities management and teacher performance in one integrated research model. Second, research specifically taking the madrasah context is still relatively limited, even though madrasahs have unique characteristics regarding resource management, institutional policies, and teacher welfare. Third, there is still minimal research linking these factors to empirical conditions at the specific educational unit level, such as what occurs at MTsN 4 Aceh Utara. Based on these gaps, this research is important to provide a more comprehensive understanding of the influence of facilities and infrastructure management and teacher performance on student learning achievement in the madrasah context. This study aims to analyze the influence of facilities and infrastructure management on student learning achievement, analyze the influence of teacher performance on student learning achievement, and examine the simultaneous influence of these two variables on student learning achievement at MTsN 4 Aceh Utara. Theoretically, this research is expected to enrich the study of Islamic education management by presenting an empirical model that integrates aspects of facilities and infrastructure and teacher performance.

[11] Rina Martini et al., "Pengaruh Manajemen Sarana Prasarana Dan Kinerja Guru Terhadap Prestasi Belajar Siswa," *Journal of Education Research* 5, no. 3 (2024): 3396–401, https://doi.org/10.37985/jer.v5i3.1057.
[12] Ajeng Elselita and Moh Masrur, "Pengaruh Manajemen Kesiswaan, Manajemen Sarana Prasarana Dan Kinerja Guru Terhadap Prestasi Belajar Siswa Di SMP Qur'an Al-Hamidy," *Jurnal Pendidikan Tambusai* 9, no. 1 (2025): 10312–19, https://doi.org/10.31004/jptam.v9i1.26270.
[13] Alejandra Espinosa Andrade et al., "Educational Spaces: The Relation between School Infrastructure and Learning Outcomes," *Heliyon* 10, no. 19 (2024): e38361, https://doi.org/10.1016/j.heliyon.2024.e38361.
[14] Jalal Rajeh Hanaysha et al., "Impact of Classroom Environment, Teacher Competency, Information and Communication Technology Resources, and University Facilities on Student Engagement and Academic Performance," *International Journal of Information Management Data Insights* 3, no. 2 (2023): 100188, https://doi.org/10.1016/j.jjimei.2023.100188.
[15] Ellen Animah Agyei et al., "Education Infrastructure Inequality and Academic Performance in Ghana," *Heliyon* 10, no. 14 (2024): e34041, https://doi.org/10.1016/j.heliyon.2024.e34041.

Practically, the results of this study are expected to serve as a basis for policymakers and madrasah managers in formulating strategies to improve education quality through effective facility management and the sustainable strengthening of teacher performance.

## METHOD

This study employs a quantitative approach to examine the causal relationships among facilities and infrastructure management, teacher performance, and student learning achievement. This approach was chosen because it allows objective measurement of variables and hypothesis testing through statistical analysis based on numerical data.[16] The research design used is an explanatory survey, which aims to explain both direct and simultaneous effects among the variables under investigation.[17] To analyze direct and indirect relationships among variables, this study applies path analysis based on Partial Least Squares–Structural Equation Modeling (PLS-SEM). The PLS-SEM method was selected because it is suitable for predictive research with structural models involving latent variables, capable of handling data that are not fully normally distributed, and effective for use with medium-sized samples. The analysis was conducted using SmartPLS version 4.0 software.

The study was conducted at MTsN 4 Aceh Utara, a state Islamic junior secondary school selected because it has a relatively large number of students and shows variation in learning achievement across classes. The research population comprised all students of MTsN 4 Aceh Utara, totaling 519 students. The sampling technique used was probability sampling, which provides equal opportunities for each member of the population to be selected as a respondent. The sample size was determined using the Slovin formula, resulting in a sample of 226 students, which was considered representative for PLS-SEM analysis. Data were collected using structured questionnaires to measure students' perceptions of facilities and infrastructure management and teacher performance, while data on learning achievement were obtained from documentation of students' academic records. The collected data were analyzed through descriptive statistical analysis to describe data characteristics, followed by evaluation of the measurement model and structural model using SmartPLS 4.0.

Evaluation of the measurement model was conducted to ensure the validity and reliability of the research instruments. Convergent validity was tested using outer loading values and Average Variance Extracted (AVE), with criteria of a minimum outer loading value of 0.50 and an AVE value above 0.50. Discriminant validity was assessed by comparing cross-loading values, where each indicator must have the highest loading value on the construct it measures. Construct reliability was evaluated using Composite Reliability values, with values above 0.70 indicating an adequate level of reliability.[18] After the measurement model met the validity and reliability criteria, the analysis proceeded to the evaluation of the structural model. Model strength was explained through the $R^2$ value, which indicates the

[16] Hironymus. Ghodang, *Path Analysis (Analisis Jalur)* (Penerbit Mitra Grup, 2020).
[17] Anas Sudijono, *Pengantar Statistik Pendidikan* (Depok : Rajawali Press, 2018).
[18] Samantha Surya et al., "Analisis Faktor-Faktor Yang Memengaruhi Brand Loyalty Gojek Indonesia Dengan Efek Mediator Menggunakan Partial Least Square Structural Equation Modeling (PLS-SEM)," *Jurnal Matematika Integratif* 16, no. 2 (2020): 127, https://doi.org/10.24198/jmi.v16.n2.29248.127-137.

proportion of variance in student learning achievement that can be explained by facilities and infrastructure management and teacher performance. The direction and strength of relationships among variables were analyzed using path coefficients.[19] Hypothesis testing was conducted through the bootstrapping procedure, with the level of significance set at $p < 0.05$. Relationships among variables were considered significant if the p-value was below this threshold.

## RESULTS AND DISCUSSION

### Outer Model Measurement Evaluation

The evaluation of the outer model measurement began with testing convergent validity, which aims to ensure that each indicator is able to adequately represent the latent construct it measures. Convergent validity was assessed through outer loading values generated from the Partial Least Squares (PLS) analysis, where an indicator is considered valid if it has an outer loading value greater than 0.70. The results of the initial model design, data input, and PLS Algorithm output are presented in Figure 1. Based on these results, it was found that indicators KG_8 and MSP_2 had factor loading values below the 0.70 threshold and therefore did not meet the convergent validity criteria. Consequently, both indicators were removed from the measurement model. The correlation values between indicators and latent constructs in the initial model are presented in Table 1, which shows that most indicators met the validity criteria, except for the two indicators that were eliminated. Subsequently, the model was re-estimated by removing the invalid indicators. The re-estimation results show that all remaining indicators have outer loading values above 0.70, as illustrated in Figure 2 and detailed in Table 2. Thus, it can be concluded that all indicators in the re-estimated model meet the convergent validity criteria and are suitable for further analysis.

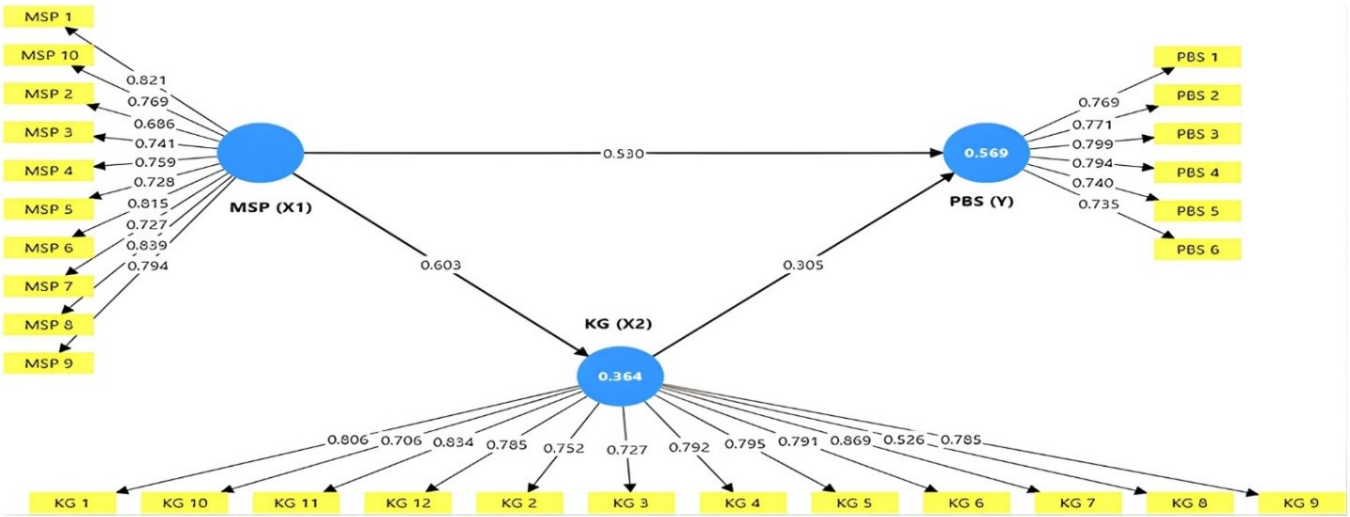


**Figure 1. Results of Model Design, Data Input, and PLS Algorithm Output**

[19] Istmu Adzan et al., "Pengaruh Logistics Quality Terhadap Loyalitas Dengan Keputusan Pelanggan Sebagai Variabel Intervening Pada Jasa Freight Forwarding Divisi Sea Freight Di PT HRW," *INNOVATIVE: Journal Of Social Science Research* 3, no. 6 (2023): 765–75.

**Table 1. Outer Loading Values of Indicators on Latent Constructs**

| Indicator | KG (X2) | MSP (X1) | PBS (Y) |
|---|---|---|---|
| KG 1 | 0,806 | | |
| KG 2 | 0,752 | | |
| KG 3 | 0,727 | | |
| KG 4 | 0,792 | | |
| KG 5 | 0,795 | | |
| KG 6 | 0,791 | | |
| KG 7 | 0,869 | | |
| KG 8 | 0,526 | | |
| KG 9 | 0,785 | | |
| KG 10 | 0,706 | | |
| KG 11 | 0,834 | | |
| KG 12 | 0,785 | | |
| MSP 1 | | 0,821 | |
| MSP 2 | | 0,686 | |
| MSP 3 | | 0,741 | |
| MSP 4 | | 0,759 | |
| MSP 5 | | 0,728 | |
| MSP 6 | | 0,815 | |
| MSP 7 | | 0,727 | |
| MSP 8 | | 0,839 | |
| MSP 9 | | 0,794 | |
| MSP 10 | | 0,769 | |
| PBS 1 | | | 0,769 |
| PBS 2 | | | 0,771 |
| PBS 3 | | | 0,799 |
| PBS 4 | | | 0,794 |
| PBS 5 | | | 0,740 |
| PBS 6 | | | 0,735 |

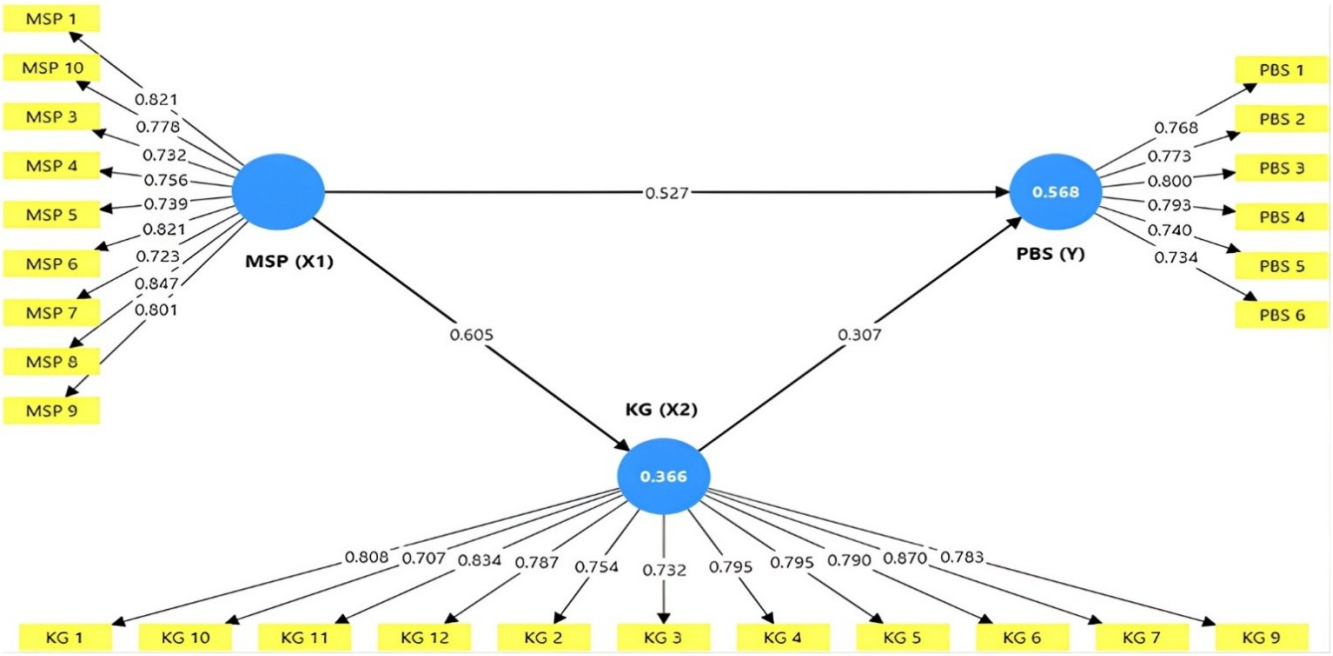


**Figure 2. Re-estimated PLS-SEM Model with Valid Indicators**

In addition to convergent validity, the outer model evaluation also included discriminant validity testing, which aims to ensure that each latent construct has clear distinctions and does not overlap with other constructs. Discriminant validity was evaluated by comparing the loading values of each indicator on its original construct with its loading values on other constructs, as shown in the cross-loading table generated by SmartPLS analysis. The results of the discriminant validity test presented in Table 3 indicate that each indicator has the highest loading value on the construct it measures compared to other constructs. These findings suggest that all constructs in the model have good discriminant capability, meaning that each indicator consistently represents its corresponding latent construct. With the fulfillment of this criterion, it can be concluded that the measurement model adequately satisfies discriminant validity.

**Table 2. Reliable Outer Loadings**

| Indicator | KG (X2) | MSP (X1) | PBS (Y) |
|---|---|---|---|
| KG 1 | 0.808 | | |
| KG 10 | 0.702 | | |
| KG 11 | 0.834 | | |
| KG 12 | 0.782 | | |
| KG 2 | 0.752 | | |
| KG 3 | 0.732 | | |
| KG 4 | 0.795 | | |
| KG 5 | 0.795 | | |
| KG 6 | 0.790 | | |
| KG 7 | 0.870 | | |
| KG 9 | 0.783 | | |
| MSP 1 | | 0.821 | |
| MSP 10 | | 0.778 | |
| MSP 3 | | 0.732 | |
| MSP 4 | | 0.756 | |
| MSP 5 | | 0.739 | |
| MSP 6 | | 0.821 | |
| MSP 7 | | 0.723 | |
| MSP 8 | | 0.867 | |
| MSP 9 | | 0.801 | |
| PBS 1 | | | 0.768 |
| PBS 2 | | | 0.773 |
| PBS 3 | | | 0.800 |
| PBS 4 | | | 0.793 |
| PBS 5 | | | 0.740 |
| PBS 6 | | | 0.734 |

The final stage in the outer model evaluation was construct reliability testing, which aims to assess the internal consistency of the research instrument. Reliability was measured using Cronbach's Alpha, composite reliability (rho_a and rho_c), and Average Variance Extracted (AVE). A construct is considered reliable if the values of Cronbach's Alpha and composite reliability exceed 0.70, and the AVE value is greater than 0.50. The reliability test results presented in Table 4 show that all constructs—Teacher Performance (X2), Facilities and Infrastructure Management (X1), and Student Learning Achievement (Y)—have high

Cronbach's Alpha and composite reliability values, as well as AVE values that meet the specified criteria. These findings indicate that the research instrument has a very good level of consistency and reliability. Therefore, it can be concluded that all indicators and constructs in this study have met the criteria of reliability and validity and are suitable for structural model testing and hypothesis analysis at the subsequent stage.

**Table 3. Cross Loadings from SmartPLS Analysis**

| | Teacher Performance ($X_2$) | Facilities and Infrastructure Management ($X_1$) | Student Learning Achievement (Y) |
|---|---|---|---|
| KG 1 | 0.808 | 0.560 | 0.528 |
| KG 2 | 0.754 | 0.462 | 0.507 |
| KG 3 | 0.732 | 0.438 | 0.397 |
| KG 4 | 0.795 | 0.508 | 0.510 |
| KG 5 | 0.795 | 0.411 | 0.498 |
| KG 6 | 0.790 | 0.481 | 0.504 |
| KG 7 | 0.870 | 0.490 | 0.525 |
| KG 9 | 0.783 | 0.530 | 0.501 |
| KG 10 | 0.707 | 0.371 | 0.382 |
| KG 11 | 0.834 | 0.466 | 0.474 |
| KG 12 | 0.787 | 0.484 | 0.560 |
| MSP 1 | 0.523 | 0.821 | 0.568 |
| MSP 3 | 0.466 | 0.732 | 0.528 |
| MSP 4 | 0.372 | 0.756 | 0.519 |
| MSP 5 | 0.543 | 0.739 | 0.547 |
| MSP 6 | 0.431 | 0.821 | 0.559 |
| MSP 7 | 0.401 | 0.723 | 0.464 |
| MSP 8 | 0.483 | 0.847 | 0.571 |
| MSP 9 | 0.522 | 0.801 | 0.642 |
| MSP 10 | 0.472 | 0.778 | 0.584 |
| PBS 1 | 0.433 | 0.506 | 0.768 |
| PBS 2 | 0.484 | 0.556 | 0.773 |
| PBS 3 | 0.524 | 0.582 | 0.800 |
| PBS 4 | 0.521 | 0.618 | 0.793 |
| PBS 5 | 0.433 | 0.497 | 0.740 |
| PBS 6 | 0.479 | 0.512 | 0.734 |

**Table 4. Reliability Test Results**

| Construct Reliability and Validity | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) | Conclusion |
|---|---|---|---|---|---|
| Teacher Performance (KG/X2) | 0.939 | 0.941 | 0.947 | 0.621 | Reliable |
| Facilities and Infrastructure Management (MSP/X1) | 0.920 | 0.922 | 0.933 | 0.610 | Reliable |
| Student Learning Achievement (PBS/Y) | 0.861 | 0.864 | 0.896 | 0.590 | Reliable |

## Inner Model Measurement Evaluation

The evaluation of the inner model measurement was conducted to assess the strength of relationships among latent variables as well as the ability of the structural model to explain endogenous variables. One of the main measures used in this evaluation is the R-Square value, which indicates the proportion of variance in the dependent variable that can be explained by the independent variables in the model. The R-Square test results presented in Table 5 show that the Student Learning Achievement variable (Y) has an R-Square value of 0.568 and an adjusted R-Square value of 0.564. This value indicates that 56.8% of the variation in student learning achievement can be explained by the facilities and infrastructure management and teacher performance variables included in the model, while the remaining 43.2% is influenced by other factors outside the scope of this study. Meanwhile, the Teacher Performance variable (X2) has an R-Square value of 0.366 and an adjusted R-Square value of 0.363, indicating that 36.6% of the variation in teacher performance can be explained by facilities and infrastructure management, while the remaining 63.4% is influenced by external factors that were not examined. These findings confirm that the variables used in this study make a fairly strong contribution to explaining the phenomena under investigation, although there remains an opportunity for further research to explore other influencing factors.

**Table 5. R-Square Test Results**

| R Square | R-square | R-square adjusted |
|---|---|---|
| Teacher Performance (KG/X2) | 0.366 | 0.363 |
| Student Learning Achievement (PBS/Y) | 0.568 | 0.564 |

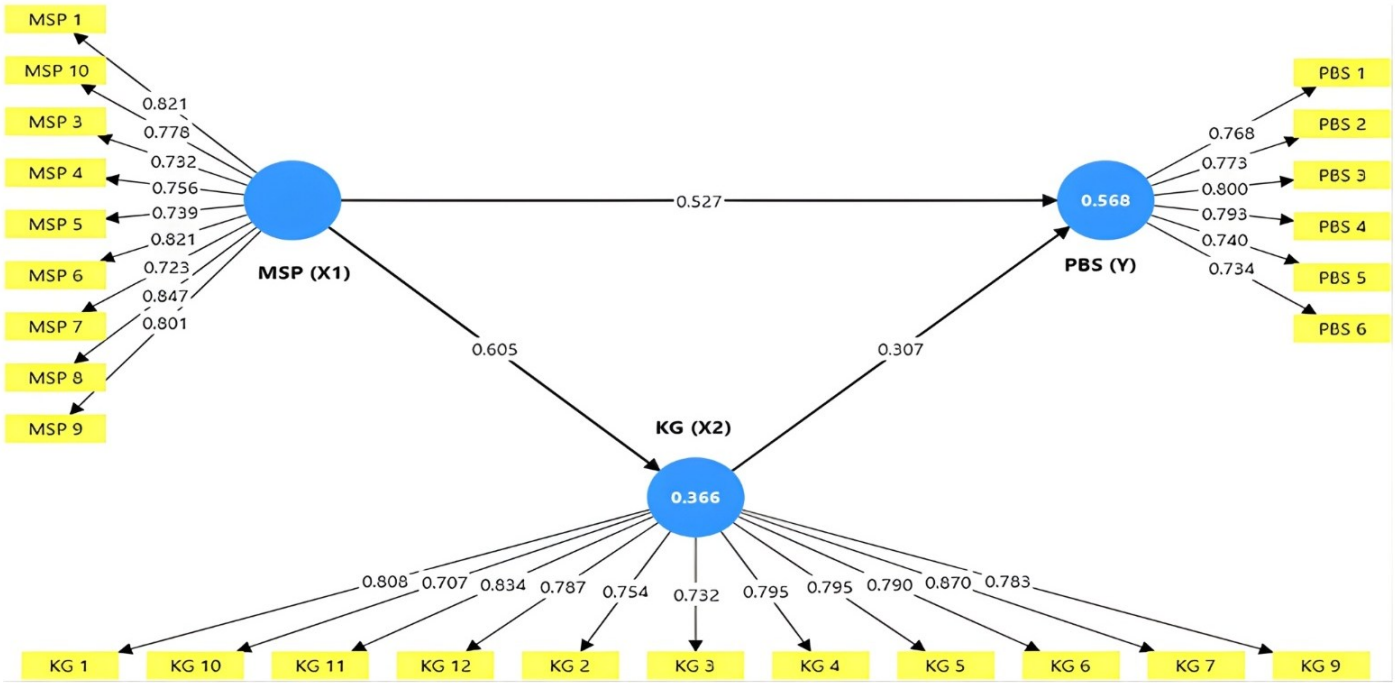


**Figure 3. Bootstrapping Output**

**Table 6. Path Coefficient Values**

| Path Coefficient | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values |
|---|---|---|---|---|---|
| MSP (X1) -> PBS (Y) | 0.527 | 0.517 | 0.083 | 6.317 | 0.000 |
| KG (X2) -> PBS (Y) | 0.307 | 0.320 | 0.093 | 3.310 | 0.001 |
| MSP (X1) -> KG (X2) | 0.605 | 0.613 | 0.069 | 8.746 | 0.000 |
| MSP (X1) -> KG (X2) -> PBS (Y) | 0.186 | 0.201 | 0.075 | 2.488 | 0.013 |

**Table 7. Summary of Hypothesis Testing Results**

| Description | Hypothesis | Test Result |
|---|---|---|
| **H1** | Facilities and infrastructure management (X1) has a positive and significant effect on student learning achievement (Y) | Accepted with p-value = 0.000 < 0.050 |
| **H1** | Teacher performance (X2) has a positive and significant effect on student learning achievement (Y) | Accepted with p-value = 0.001 < 0.050 |
| **H1** | Facilities and infrastructure management (X1) has a positive and significant effect on teacher performance (X2) | Accepted with p-value = 0.000 < 0.050 |
| **H1** | Facilities and infrastructure management (X1) has a positive and significant effect on student learning achievement (Y) through teacher performance (X2) | Accepted with p-value = 0.013 < 0.050 |

The next stage in the inner model evaluation is hypothesis testing, which was conducted using the bootstrapping method through SmartPLS version 4 software. This procedure aims to test the significance of both direct and indirect effects among latent variables in the structural model. The bootstrapping output is shown in Figure 3, while the path coefficient values along with their supporting statistical values are presented in detail in Table 6. Hypothesis testing was based on p-values with a significance level of 5%, where relationships among variables are considered significant if the p-value is less than 0.05.

The analysis results indicate that facilities and infrastructure management (X1) has a positive and significant effect on student learning achievement (Y), with a path coefficient value of 0.527, a t-statistic value of 6.317, and a p-value of 0.000. This finding indicates that better management of educational facilities and infrastructure is associated with higher student learning achievement. In addition, teacher performance (X2) is also proven to have a positive and significant effect on student learning achievement, with a coefficient value of 0.307, a t-statistic of 3.310, and a p-value of 0.001. This result shows that improvements in the quality of teacher performance directly contribute to increased student academic achievement.

Furthermore, the results also show that facilities and infrastructure management (X1) has a positive and significant effect on teacher performance (X2), with a path coefficient value of 0.605, a t-statistic of 8.746, and a p-value of 0.000. This finding indicates that the availability and proper management of facilities and infrastructure are able to support improvements in teacher performance in carrying out instructional tasks. In addition to the direct effects, facilities and infrastructure management is also proven to have a significant indirect effect on student learning achievement through teacher performance, with a mediation coefficient value of 0.186, a t-statistic of 2.488, and a p-value of 0.013. This result confirms the role of teacher performance as a mediating variable that strengthens the

relationship between facilities and infrastructure management and student learning achievement.

Overall, the summary of hypothesis testing results presented in Table 7 shows that all research hypotheses are accepted because they have p-values below the 0.05 significance threshold. These findings confirm that facilities and infrastructure management and teacher performance play important roles in improving student learning achievement, both directly and indirectly. Thus, it can be concluded that efforts to improve the quality of education in madrasahs do not depend solely on teacher quality, but are also strongly influenced by effective and sustainable management of educational facilities and infrastructure.

**The Effect of Facilities and Infrastructure Management (X1) on Student Learning Achievement (Y)**

Testing of the first hypothesis indicates that facilities and infrastructure management (X1) has a positive and significant effect on student learning achievement (Y). This is evidenced by a p-value of 0.000, which is lower than the significance level of 0.05; therefore, the alternative hypothesis (Ha) is accepted. This finding implies that the better the management of facilities and infrastructure carried out by the school, the higher the level of student learning achievement. This result supports the theoretical assumption that a conducive learning environment and the availability of adequate educational facilities influence effective learning processes and lead to improved learning outcomes. These findings are consistent with Yangambi's (2023) study, which states that modern physical facilities contribute significantly to student achievement.[20]

Martini et al. (2024) found that facilities and infrastructure management significantly affects student learning achievement, both directly and indirectly through teacher performance as an intervening variable.[21] This study extends the understanding that not only the existence of facilities is important, but also how these facilities are managed to support the effectiveness of educators' performance. This reinforces the results of the present study, which emphasize the aspect of "management" rather than merely the "availability" of facilities. In addition, Saputra (2024) also reported that facilities and infrastructure contribute to student learning achievement.[22] Meanwhile, Tuanany and Triwiyanto (2024) provide an overview and consolidation of various previous studies, showing that the effect of facilities and infrastructure on student learning outcomes falls into a large effect category.[23] These findings constitute strong evidence from accumulated cross-study data that facilities and infrastructure have a significant influence on learning achievement. On the other hand, Fauzi et al. (2024) demonstrated that learning facilities not only have a direct impact on achievement, but also exert influence through achievement motivation as a mediating

[20] Matthieu Yangambi, "Impact of School Infrastructures on Students Learning and Performance: Case of Three Public Schools in a Developing Country," *Creative Education* 14, no. 04 (2023): 788–809, https://doi.org/10.4236/ce.2023.144052.

[21] Martini et al., "Pengaruh Manajemen Sarana Prasarana Dan Kinerja Guru Terhadap Prestasi Belajar Siswa."

[22] Asroful Reza Saputra et al., "Pengaruh Sarana Dan Prasarana Terhadap Prstasi Belajar Siswa Kelas VIII Di SMK Abdi Karya Kota Bekasi," *Science and Educational Journal* 2, no. 3 (2024): 43–52.

[23] Nursyahar Jihan Tuanany and Teguh Triwiyanto, "Meta Analisis : Pengaruh Sarana Dan Prasarana Terhadap Hasil Belajar Siswa Meta," *Jurnal Manajemen Pendidikan* 6, no. 1 (2024): 1–11.

variable.[24] This highlights the importance of facilities in shaping a motivating and outcome-oriented learning climate.

Several critical notes should be considered. First, the influence of facilities and infrastructure on learning achievement is not always linear. Schools with complete facilities do not necessarily demonstrate high achievement if pedagogical aspects, student motivation, or teacher support are not optimal. Second, several studies indicate that external factors, such as students' socio-economic background and learning patterns at home, also contribute significantly to learning achievement; therefore, strengthening facilities and infrastructure needs to be combined with other interventions to maximize their impact. Third, the quantitative nature of this study emphasizes correlations and statistical significance, but does not fully explain students' psychological and behavioral mechanisms in depth; qualitative research could complement these findings by providing a more comprehensive understanding.

Based on the findings obtained and comparisons with a number of recent empirical studies, it can be asserted that the management of educational facilities and infrastructure plays a strategic role in improving student learning achievement. Structured and systematic facilities management—covering aspects of planning, procurement, maintenance, and utilization—has been proven to support the optimization of learning processes within the school environment. The practical implications of these results point to the importance of strengthening the governance of educational facilities through responsive policies, adequate resource allocation, and continuous supervision. Improving the quality of learning does not rely solely on teacher competence, but is also strongly determined by the availability of adequate facilities that are managed effectively to create a safe, comfortable, and productive learning environment.

The results of this study receive strong validation from various previous studies employing quantitative, meta-analytic, and practice-based theoretical approaches, which consistently show that the influence of facilities and infrastructure on learning achievement is significant, stable, and generalizable across educational levels and contexts. Several studies even report substantial contributions of facilities and infrastructure to learning achievement and identify positive and significant correlations between facility adequacy and academic outcomes. In addition, findings indicating the mediating role of learning motivation suggest that learning facilities also have a psychological impact on students' readiness and motivation to learn. These conclusions are not only statistically valid, but also theoretically and practically robust. Efforts to improve educational quality must therefore be accompanied by strengthening infrastructure and educational facilities management systems as a prerequisite for effective and sustainable learning.

**The Effect of Teacher Performance (X2) on Student Learning Achievement (Y)**

Based on the analysis results, teacher performance is proven to have a positive and significant effect on student learning achievement, as indicated by a p-value of 0.001, which is smaller than 0.05. This finding is consistent with previous studies showing that the quality

[24] Muhamad Afif Fauzi ; Tiya Meiliawaty *; Muhtadin Assidieq ; Ahmad Dzakwan Alfaini, "Pengaruh Sarana Pembelajaran Dan Kompetensi Guru Terhadap Prestasi Belajar Dengan Motivasi Berprestasi Sebagai Intervening," preprint, n.d., https://doi.org/10.37366/master.v3i1.661.

of teacher performance contributes significantly to improving student learning achievement. For example, a study by Sholeh et al. (2024) demonstrated that the teacher performance variable makes a significant contribution to student learning achievement, with a high coefficient value and a strong level of significance ($p < 0.001$), thereby confirming the importance of teacher performance in enhancing learning outcomes.[25]

In line with the findings of Kadir et al. (2022), teacher performance is shown to play a significant role in determining student learning outcomes.[26] This can be understood because teachers are responsible for designing learning strategies that are appropriate to students' characteristics, optimally utilizing media as well as facilities and infrastructure, and implementing systematic learning evaluations. This finding is reinforced by the study of Ilmi et al. (2022), which shows that teacher performance contributes to student achievement, while the effect of teacher performance is also influenced by learning approaches and the school environmental context.[27] Thus, the effectiveness of teacher performance in improving student learning achievement cannot be generalized, but must be analyzed based on the conditions of each educational unit.

This is supported by Kamil et al. (2022), who found that teaching performance at the elementary school level has a significant effect on student learning achievement, as indicated by the test results.[28] This demonstrates the consistency of the crucial role of teachers across all levels of education, particularly in ensuring that the learning process runs effectively and meaningfully. Teachers with high competence in planning, implementing, and evaluating learning tend to be able to create learning experiences that stimulate students' motivation and interest, thereby directly impacting improvements in academic achievement.

From the results of the analysis, it can be concluded that teacher performance is a consistent and significant determinant influencing student learning outcomes. Teachers who possess high competence in planning, implementation, and evaluation of learning are more likely to create meaningful and effective learning processes, which directly contribute to improved student academic achievement. Therefore, efforts to improve educational quality must be accompanied by improvements in teacher performance quality, which can be achieved through various strategies such as continuous professional development programs, structured and data-based performance evaluations, and institutional support including facilities, supervision, and incentives for teacher professional development. Investment in strengthening teacher performance not only impacts student academic achievement, but also enhances the overall quality of learning.

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[25] Muh Ibnu Sholeh et al., "Pengaruh Kinerja Guru dan Pengembangan Kurikulum Terhadap Prestasi Belajar Siswa di SDI Al-Badar Tulungagung," *Jurnal Karya Ilmiah Pendidik dan Praktisi SD&MI (JKIPP)* 3, no. 1 (2024): 47–64, https://doi.org/10.24260/jkipp.v3i1.2782.

[26] Marniati Kadir et al., "Pengaruh Kinerja Guru Terhadap Hasil Belajar Pada Siswa Kelas Iv Pada Masa Pandemi Covid-19 Di Madrasah Ibtidaiyah Ma'Arif Nahdlatul Ulama 003 Samarinda," *Borneo Journal of Islamic Education* 2, no. 1 (2022): 277–85.

[27] Yusina Fadla Ilmi et al., "Pengaruh Kinerja Guru Terhadap Prestasi Belajar Siswa Kelas Xi Akuntansi Di Smkn 6 Dan Smkn 7 Kota Serang," *Progress: Jurnal Pendidikan, Akuntansi Dan Keuangan* 5, no. 2 (2022): 202–9, https://doi.org/10.47080/progress.v5i2.2518.

[28] Kamil et al., "Pengaruh Kinerja Mengajar Guru Terhadap Prestasi Belajar Siswa Di SD Negeri 34 Bontosoa," *Jurnal Education and Development* 10, no. 2 (2022): 241–45.

The positive relationship between teacher performance and student learning achievement is not always absolute. External factors such as students' socio-economic background, family support, psychological conditions, and the availability of facilities and infrastructure can also significantly influence learning outcomes. In other words, improving teacher performance alone does not automatically guarantee optimal learning achievement. A holistic approach that considers the interaction of various internal and external factors is required so that strategies to improve educational quality can be implemented effectively and sustainably.

**The Effect of Facilities and Infrastructure Management (X1) on Teacher Performance (X2)**

Based on the analysis results, facilities and infrastructure management is proven to have a positive and significant effect on teacher performance, as indicated by a p-value of 0.000, which is smaller than 0.05. In other words, the better the management of facilities and infrastructure carried out by the school, the higher the level of teacher performance in carrying out professional duties. This finding is in line with the results of a study by Sitompul and Gaol (2025), which shows that the availability and management of school facilities and infrastructure have a positive and significant effect on teacher performance at SMK Negeri 2 Siatas Barita, enabling teachers to work more effectively in the learning process.[29] Another study conducted by Marliya et al. (2020) confirms that facilities and infrastructure significantly influence teacher performance, where adequate facility support creates a conducive working environment that positively impacts teacher performance.[30] In addition, a quantitative study by Mohzana et al. (2025) shows that school facilities and infrastructure have a positive and significant effect on teacher performance in secondary schools, emphasizing the importance of physical support in the educational context.[31] These empirical findings strengthen the validation of the hypothesis in this study that effective facilities and infrastructure management significantly contributes to improving teacher performance. Thus, optimal management of facilities and infrastructure is a strategic step in creating a work environment that supports teachers' professional performance.

**The Effect of Facilities and Infrastructure Management (X1) and Teacher Performance (X2) on Learning Achievement**

The hypothesis testing results show that a p-value of 0.013 (< 0.05) indicates that facilities and infrastructure management (X1) has a positive and significant effect on teacher performance (X2) through student learning achievement (Y). This means that improvements in facilities and infrastructure management not only have a direct impact on student learning achievement, but also indirectly encourage improvements in teacher performance through

[29] Bunhai Sitompul and Nasib Tua Lumban Gaol, "Pengaruh Ketersediaan Sarana Dan Prasarana Sekolah Terhadap Kinerja Guru Di Sekolah SMK Negeri 2 Siatas Barita Tahun 2023/2024," *Jurnal Pendidikan Dan Media Pembelajaran* 4, no. 1 (2025): 1–9, https://doi.org/10.59584/jundikma.v4i1.76.

[30] Marliya Marliya et al., "Pengaruh Sarana Prasarana Dan Lingkungan Kerja Terhadap Kinerja Guru Di SMP Negeri Se-Kecamatan Prabumulih Barat," *Journal of Education Research* 1, no. 3 (2020): 206–2012, https://doi.org/10.37985/jer.v1i3.23.

[31] Mohzana et al., "Analysis of the Influence of Facilities and Infrastructure, Adoption of IT and Principal Leadership on Teacher Performance," *Edu Cendikia: Jurnal Ilmiah Kependidikan* 5, no. 01 (2025): 229–36, https://doi.org/10.47709/educendikia.v5i01.5758.

better student learning outcomes. This finding is consistent with the study conducted by Nursiwati and Rahmawati (2024), which found that available facilities and infrastructure significantly influence teacher performance in schools, where the more complete the facilities provided, the higher the quality of teacher performance recorded.[32] Another study by Sudiyanto et al. (2022) also reported that educational facilities and infrastructure have a positive effect on teacher performance, indicating that school facility support is an important factor in supporting the teaching profession and learning effectiveness.[33] Furthermore, a study by Sari et al. (2021) shows that school infrastructure has a significant effect on teacher performance in elementary schools, strengthening the empirical evidence of the relationship between educational facility conditions and teacher work effectiveness.[34] These findings are consistent with the results of this study, which show that effective facilities and infrastructure management can create a conducive learning environment, improve student learning achievement, and indirectly enhance teacher performance through positive feedback from improved learning outcomes.

The mediating relationship between facilities and infrastructure management and teacher performance through student learning achievement can be explained through an educational system ecology approach, which views the physical environment (facilities and infrastructure) as an important component in creating high-quality learning processes. A high-quality learning environment not only accelerates the achievement of student learning outcomes, but also fosters teacher job satisfaction, a sense of belonging, and professional commitment. When students demonstrate improved achievement, teachers receive positive feedback that motivates them to perform more optimally.

From a managerial perspective, these findings imply that investment in school facilities and infrastructure management is not solely intended to support student learning activities, but also represents an indirect strategy for improving teacher performance.[35] Schools that are able to provide supporting learning facilities such as adequate classrooms, libraries, learning media, and well-equipped laboratories indirectly create a more productive and professional working atmosphere for teachers. Conversely, a lack of facilities can reduce work motivation and hinder the effectiveness of instructional implementation.

Therefore, it can be concluded that facilities and infrastructure management not only has a direct impact on student learning achievement, but also plays an indirect role in shaping teacher performance through improvements in student learning outcomes. These findings

[32] Nursiwati Nursiwati and Rahmawati Rahmawati, "Pengaruh Sarana Dan Prasarana Terhadap Kinerja Guru Serta Dampaknya Pada Mutu Lulusan Pada Smp Negeri Se-Kecamatan Bandar Laksamana," *Jurnal Menara Ekonomi : Penelitian dan Kajian Ilmiah Bidang Ekonomi* 10, no. 2 (2024), https://doi.org/10.31869/me.v10i2.5339.
[33] Aris Sudiyanto et al., "Pengaruh Kompetensi Guru Dan Sarana Prasarana Terhadap Kinerja Guru Pada Sekolah Menengah Pertama Negeri 12 Krui Kabupaten Pesisir Barat," *Dikombis : Jurnal Dinamika Ekonomi, Manajemen, Dan Bisnis* 1, no. 1 (2022): 11–20, https://doi.org/10.24967/dikombis.v1i1.1627.
[34] Eka Purnama Sari et al., "The Influence of School Facilities and the Work Environment on Teachers Performance," *JPGI (Jurnal Penelitian Guru Indonesia)* 6, no. 2 (2021): 472–77, https://doi.org/10.29210/021073jpgi0005.
[35] Lawal Adebola Abidemi and Lateef Adeola Bilikis, "The Impact of Government Funding on Infrastructure Improvement and Educational Performance in Rural Schools," *International Journal of Progressive Research in Engineering Management And Science (IJPREMS)* 3, no. 12 (2023): 593–99, https://doi.org/10.58257/IJPREMS32400.

provide a strong argumentative basis that improving the quality of learning in schools must begin with strengthening comprehensive facilities and infrastructure governance, as this component has a chain effect on educational success. Thus, in formulating educational quality policies, facilities management should be positioned as a key priority integrated with human resource development within the school environment.

**Empirical Path Analysis Diagram**

The empirical diagram of infrastructure management and teacher performance on student learning achievement at MTsN 4 Aceh Utara is illustrated in Figure 4.

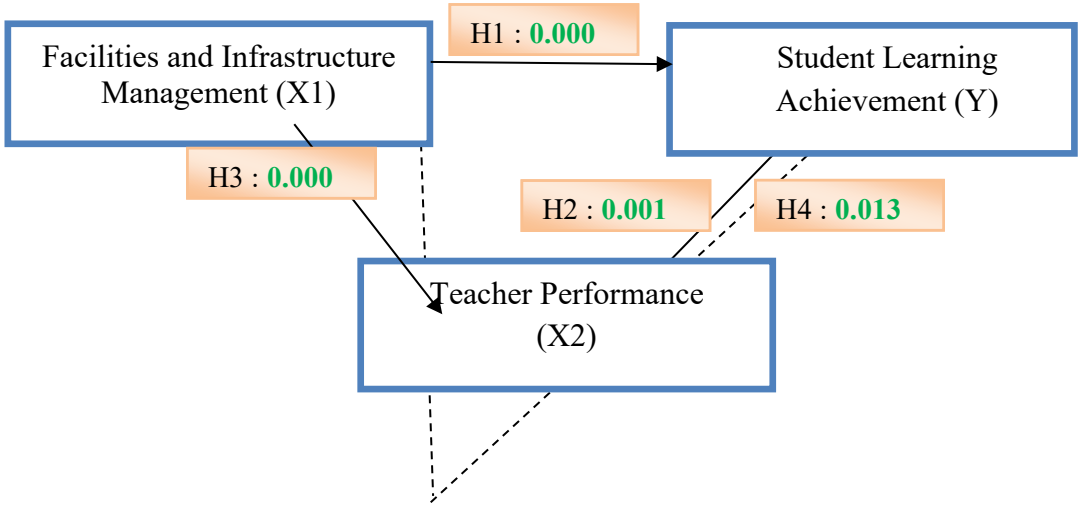


**Figure 4. Empirical Path Diagram of Hypothesis Testing Results**

Figure 4 explains, first, the influence of the facility management variable (X1) on learning achievement (Y) with a P-Value of 0.000 < 0.05, so it can be said that (X1) has an influence on (Y). This finding shows that the more optimal the management of facilities and infrastructure within the school environment, the higher the level of learning achievement attained by students. This is consistent with learning environment theory, which states that the availability and quality of educational facilities can influence the effectiveness of learning processes and students' learning outcomes.

Second, the effect of teacher performance (X2) on student learning achievement (Y) is evidenced by a p-value of 0.001 < 0.05, indicating that X2 has a significant effect on Y. This result suggests that teachers who possess strong pedagogical competence, professionalism, and high dedication are able to create meaningful learning processes and encourage improvements in students' academic achievement. This finding is in line with the study by Sholeh et al. (2024), which shows that teacher performance contributes significantly to student learning achievement with a high coefficient value and a strong level of significance ($p < 0.001$), thereby reinforcing the importance of teacher performance in improving learning outcomes.[36]

[36] Sholeh et al., "Pengaruh Kinerja Guru dan Pengembangan Kurikulum Terhadap Prestasi Belajar Siswa di SDI Al-Badar Tulungagung."

Third, the effect of facilities and infrastructure management (X1) on teacher performance (X2) shows significant results, with a p-value of 0.000 (< 0.05). This means that X1 has a significant effect on X2. This finding indicates that adequate facilities and infrastructure not only provide support for students, but also facilitate teachers in carrying out their duties optimally. With the availability of good facilities, teachers tend to be more motivated, feel more comfortable in their work, and ultimately this has a positive impact on their performance.

Fourth, the simultaneous effect of facilities and infrastructure management (X1) and teacher performance (X2) on student learning achievement (Y) is proven to be significant, with a p-value of 0.013 (< 0.05). This finding indicates the presence of a mediating relationship, in which facilities and infrastructure management influences student learning achievement not only directly, but also indirectly through improvements in teacher performance. In other words, improvements in facilities and infrastructure management do not merely have a direct impact on student achievement, but also strengthen the role of teachers in delivering high-quality learning processes. Ultimately, this condition contributes to an overall improvement in student learning outcomes.

## CONCLUSION

The findings of this study indicate that effective management of school facilities and infrastructure contributes significantly to students' academic achievement, both directly and indirectly through teacher performance. Well-managed educational facilities support a conducive learning environment and enable teachers to implement instructional activities more effectively. Teacher performance also demonstrates a positive and significant influence on students' learning outcomes, underscoring the central role of teachers in translating institutional resources into meaningful learning experiences. The results further show that teacher performance serves as an important mediating factor in the relationship between facilities and infrastructure management and students' academic achievement. Improvements in the management of educational facilities not only enhance learning conditions for students but also strengthen teachers' motivation, comfort, and professional effectiveness, which in turn leads to improved academic outcomes. This pattern suggests that facility management and teacher performance function as interconnected components within the educational system.

Several limitations should be acknowledged. The study relies on quantitative data collected from a single madrasah, which may limit the generalizability of the findings. The use of self-reported data may also introduce response bias. Future research could expand the scope by involving multiple schools across different regions, applying mixed-method approaches, and incorporating additional variables such as school leadership, organizational culture, student motivation, and parental involvement to provide a more comprehensive understanding of factors influencing academic achievement.

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