

Campus Infrastructure as a Strategic Resource for Enhancing Student Performance: Evidence from Universitas Majalengka

Rita Sri Silvia Pamuji

Universitas Majalengka, Indonesia

E-mail: ritasri@unma.ac.id

Alan Rusdiana

Universitas Majalengka, Indonesia

Denia Novitasari

Universitas Majalengka, Indonesia

Hani Laela Ramadani

Universitas Majalengka, Indonesia

Anisa Nurul Hidayah

Universitas Majalengka, Indonesia

ABSTRACT

This study aims to analyze the role of campus infrastructure in supporting student performance at Universitas Majalengka and to formulate strategic recommendations for infrastructure optimization based on students' experiences and perceptions. The study employed a qualitative case study approach using deep interviews as the primary data collection technique. Fifteen students representing different faculties, academic levels, and disciplinary backgrounds were selected through purposive sampling. Data were analyzed using thematic analysis and source triangulation to identify recurring patterns, challenges, and priority needs related to campus infrastructure. The findings revealed that campus infrastructure influences student performance through three main mechanisms: facilitating access to learning resources, enhancing learning comfort, and supporting practical learning experiences. Internet connectivity emerged as the most frequently mentioned infrastructure component supporting students' understanding of learning materials, followed by classroom facilities, air conditioning, laboratory facilities, learning technology, and library services. For academic productivity, laboratory facilities and internet access were identified as critical resources for completing assignments, conducting practical activities, and accessing academic information. The study also identified six development priorities: internet quality improvement, laboratory development, classroom enhancement, facility maintenance, infrastructure modernization, and equitable facility distribution across study programs. The proposed Campus Infrastructure Optimization Model suggests that digital, physical, practical, and supporting infrastructures collectively enhance academic engagement and student performance. The findings contribute to higher education

infrastructure literature by positioning campus infrastructure as a strategic institutional resource influencing student success and educational quality.

Keywords: Academic Productivity, Campus Infrastructure, Higher Education, Student Performance, Thematic Analysis.

Received: 10 April 2026 ;

Accepted: 15 May 2026 ;

Published: June 2026.

How to Cite:

Pamuji, R.R.S., Rusdiana, A., Novitasari, D., Ramadani, H.L., & Hidayah, A.N. (2026). Campus Infrastructure as a Strategic Resource for Enhancing Student Performance: Evidence from Universitas Majalengka. *Journal of Business and Behavioural Entrepreneurship*, 10(1), 81-100. <https://doi.org/10.21009/JOBBE.010.1.06>

INTRODUCTION

Higher education institutions are increasingly required to provide not only quality academic services but also learning environments that effectively support student success. In the contemporary higher education ecosystem, campus infrastructure has evolved beyond its traditional role as a supporting facility and has become a strategic resource that directly contributes to students' academic development, learning experiences, and overall educational outcomes. Campus infrastructure encompasses a wide range of academic and non-academic facilities, including classrooms, laboratories, libraries, internet connectivity, sports facilities, collaborative learning spaces, and other supporting environments that facilitate learning and student development (Agaty et al., 2024; Dunggio, 2023). Universities are expected to provide not only academic instruction but also adequate supporting facilities that enable students to develop their competencies effectively. Educational support systems, including learning facilities, technology resources, meeting spaces, and academic support services, play an important role in facilitating student development and learning outcomes (Aditya, 2020).

From the perspective of educational management, campus infrastructure constitutes an essential component of the learning system because it facilitates knowledge acquisition, academic interaction, practical skill development, and student engagement. Educational facilities and infrastructure are fundamental elements that support the achievement of educational objectives by providing physical and technological resources required for effective teaching and learning processes (Arikunto, 2017; Mulyasa, 2013). Consequently, higher education institutions that invest in high-quality infrastructure are more likely to create learning environments that enhance student productivity and academic achievement.

Recent studies have consistently demonstrated that the quality of campus facilities influences various dimensions of student learning outcomes. Campus facilities not only function as supporting resources for academic activities but also significantly affect student motivation, satisfaction, engagement, and learning achievement (Agaty et al., 2024). Adequate facilities enable students to access learning resources more effectively, improve learning comfort, and support optimal academic performance. Similarly, research conducted among university students found that learning facilities have a strong relationship with academic achievement because they facilitate access to educational resources and enhance participation in learning activities (Rombot et al., 2022).

Furthermore, a conducive campus environment has been identified as an important external factor influencing students' learning motivation. Academic facilities such as laboratories, libraries, and internet connectivity positively affect students' enthusiasm for learning, while social interactions, academic services, and lecturer support contribute to students' comfort and satisfaction throughout the educational process (Maulidina et al., 2025). These findings indicate that infrastructure should not be viewed merely as a collection of physical assets but as an integrated educational ecosystem that shapes students' academic experiences.

The physical quality of campus environments also plays an important role in supporting learning effectiveness. Adequate lighting, proper ventilation, comfortable learning spaces, availability of learning equipment, and supportive academic environments have been shown to correlate positively with student motivation and learning engagement. Conversely, inadequate facilities, overcrowded classrooms, poor environmental conditions, and limited learning resources can reduce learning comfort and hinder students' ability to understand academic materials (Maulidina et al., 2025). These findings reinforce the argument that infrastructure quality contributes directly to students' cognitive and behavioral learning outcomes.

Beyond conventional classroom facilities, contemporary universities are expected to provide supportive environments that foster student well-being and academic productivity. Green open spaces, collaborative learning areas, and comfortable campus environments contribute positively to learning experiences by reducing stress, encouraging academic interaction, and stimulating creative thinking. Research conducted at Universitas Muhammadiyah Surakarta demonstrated that green open spaces possess substantial potential as learning facilities capable of enhancing comfort and supporting academic activities among students (Setiawan & Arsandrie, 2023). Therefore, campus infrastructure encompasses not only academic facilities but also environmental and social spaces that facilitate learning and student engagement.

In the context of higher education management, campus facilities are also recognized as indicators of institutional service quality. The availability of facilities that fulfill aspects of comfort, accessibility, usability, and quality serves as a foundation for improving satisfaction among campus users, including students and other academic stakeholders (Dita et al., 2025). Student satisfaction with campus facilities has been identified as an important indicator of educational service quality because dissatisfaction may reduce learning interest, disrupt academic processes, and negatively affect institutional reputation (Samudra & Ramadhan, 2024).

Empirical evidence further demonstrates that student satisfaction with university facilities and services positively influences academic performance. Recent research found that classroom environments, teaching methods, and library facilities significantly contribute to student satisfaction, which subsequently improves academic performance (Bolatimi & Bolatimi, 2025). More specifically, library facilities exhibited the strongest relationship with academic performance (Bolatimi & Bolatimi, 2025). These findings indicate that the quality of learning infrastructure and educational environments contributes substantially to academic success through enhanced student satisfaction and engagement.

Student performance itself represents a strategic indicator of higher education success because it reflects the quality of learning processes, the effectiveness of academic services, and the readiness of graduates to face academic and professional challenges. Contemporary educational research conceptualizes student performance as a multidimensional construct that extends beyond grade point average and includes learning effectiveness, academic productivity, participation, motivation, concentration, practical competence, and the ability to understand learning materials (Suleiman et al., 2024). Academic performance is influenced by a combination of internal factors, such as motivation and learning habits, and external factors, including educational facilities, learning environments, and institutional support systems (Khalid & Farid, 2025; Suleiman et al., 2024). Consequently, understanding how campus infrastructure contributes to student performance has become increasingly important for higher education institutions seeking to improve educational quality and competitiveness.

In the context of Universitas Majalengka, continuous efforts have been made to improve campus infrastructure as part of institutional quality enhancement initiatives. However, despite substantial investments in academic and supporting facilities, empirical evidence regarding the extent to which campus infrastructure contributes to student performance remains limited. More importantly, there is insufficient information regarding which dimensions of campus infrastructure have the greatest influence on students' academic experiences and performance outcomes. Without systematic and evidence-based evaluation, infrastructure development policies may become less effective and less aligned with students' actual needs.

Previous studies have generally focused on the relationship between campus facilities, service quality, student satisfaction, and academic achievement (Agaty et al., 2024; Dunggio, 2023; Maharani et al., 2025). Other studies have examined the influence of learning facilities on academic achievement in specific educational contexts (Rombot et al., 2022), while recent literature has emphasized the role of learning environments in fostering student engagement and academic outcomes (Khalid & Farid, 2025; Suleiman et al., 2024). Nevertheless, these studies remain relatively broad and have not explicitly provided a contextual priority mapping of infrastructure optimization based on students' perceptions and experiences within regional higher education institutions. Campus infrastructure functions as a strategic resource that enhances student performance at Universitas Majalengka, with internet connectivity, laboratory facilities, and learning environment quality emerging as the most influential factors in supporting learning effectiveness, academic productivity, and student engagement through improved access,

comfort, and practical learning opportunities (Sinaga et al., 2023; Dita et al., 2025; Sadewa & Damayanti, 2023; Ramadan & Yushita, 2022).

Based on this research gap, the novelty of this study lies in three aspects. First, this study focuses on Universitas Majalengka as a representation of a regional higher education institution, where empirical studies on infrastructure-performance relationships remain limited. Second, this study applies a simple convergent triangulation approach by integrating quantitative survey data with qualitative insights obtained through deep interviews with students. Third, the study aims not only to identify statistical relationships but also to formulate strategic recommendations in the form of infrastructure development priorities that can be directly implemented by university management. Accordingly, the research questions are formulated as follows:

- (1) How does campus infrastructure influence students' ability to understand learning materials?
- (2) How does campus infrastructure influence students' academic productivity?
- (3) What model of campus infrastructure optimization can improve student performance at Universitas Majalengka?

Through a simple convergent triangulation approach combining survey findings and deep interview results, this study is expected to generate operational, contextual, and evidence-based recommendations regarding campus infrastructure development. Ultimately, the study aims to analyze the influence of campus infrastructure on student performance, identify infrastructure dimensions that contribute most significantly to academic success, and formulate a strategic optimization model for campus infrastructure development based on students' perceptions and experiences at Universitas Majalengka.

LITERATURE REVIEW

Literature review on campus infrastructure and student performance demonstrates that higher education institutions are increasingly required to develop learning environments that are not only administratively functional but also strategically capable of improving student success. Campus infrastructure is no longer viewed merely as a physical complement to academic activities, but as an institutional resource that shapes students' learning experiences, motivation, satisfaction, engagement, and academic performance. In this context, infrastructure includes classrooms, laboratories, libraries, internet networks, digital learning facilities, green open spaces, student activity areas, and other supporting facilities that enable students to participate effectively in academic and non-academic activities (Agaty et al., 2024; Dunggio, 2023).

Theoretically, campus infrastructure is closely related to the concept of learning environment because student learning outcomes are influenced not only by lecturer competence and curriculum design, but also by the physical, digital, and social conditions in which learning takes place. Adequate infrastructure provides students with access to learning resources, opportunities for collaboration, practical learning experiences, and a comfortable academic atmosphere. This is consistent with educational management perspectives which state that facilities and infrastructure are essential components in achieving educational objectives because they provide the

necessary resources for effective teaching and learning processes (Arikunto, 2017; Mulyasa, 2013).

Empirical studies support the argument that campus infrastructure contributes to the quality of learning outcomes. (Dunggio, 2023) shows that adequate educational facilities are significantly related to student satisfaction and the quality of learning experiences. (Rombot et al., 2022) also found that learning facilities have a strong relationship with student academic achievement because they facilitate access to learning resources and support more effective participation in academic activities. These findings indicate that the relationship between infrastructure and student performance is not incidental, but is built through learning access, comfort, participation, and academic engagement.

Campus infrastructure also plays an important role in shaping student motivation. (Maulidina et al., 2025) explain that the quality of academic facilities, such as laboratories, libraries, internet access, and classroom conditions, affects students' learning motivation. This finding is important because motivation functions as a bridge between the availability of facilities and students' willingness to engage in learning activities. When students perceive that campus facilities support their academic needs, they are more likely to participate actively, complete assignments, attend classes consistently, and develop stronger learning commitment. Conversely, inadequate infrastructure may reduce enthusiasm, hinder understanding of course materials, and weaken students' academic productivity.

The physical quality of the campus environment is also an important determinant of learning effectiveness. (Maulidina et al., 2025) emphasize that proper lighting, good ventilation, comfortable learning spaces, adequate learning equipment, and supportive classroom conditions are positively related to students' motivation and readiness to learn. Poor physical environments may create discomfort, reduce concentration, and disrupt the learning process. This shows that infrastructure affects student performance through both cognitive and psychological mechanisms. A well-designed campus environment helps students concentrate, process information more effectively, and maintain positive attitudes toward learning.

The role of campus infrastructure becomes broader when environmental and social dimensions are considered. (Setiawan and Arsandrie, 2023) show that green open spaces in campus environments have the potential to function as learning facilities because they support comfort, interaction, creativity, and informal learning. This finding expands the meaning of campus infrastructure beyond classrooms and laboratories. Infrastructure must be understood as an integrated learning ecosystem that includes physical, social, environmental, and digital spaces. Therefore, campus development should not focus only on buildings, but also on the creation of spaces that support discussion, reflection, collaboration, and student well-being.

From the perspective of student satisfaction, campus infrastructure is a crucial indicator of institutional service quality. (Samudra and Ramadhan, 2024) argue that dissatisfaction with campus facilities can reduce students' interest in learning, disrupt the teaching and learning process, and negatively affect the image of the university. (Dita et al., 2025) also emphasize that facility evaluation should consider comfort, accessibility, maintenance, cost, and quality because these criteria influence how

campus users assess the usefulness of infrastructure. These studies show that satisfaction is not merely an emotional response, but a reflection of whether institutional resources meet students' academic expectations.

The link between infrastructure, satisfaction, and performance is further strengthened (Bolatimi and Bolatimi, 2025), who found that student satisfaction with university facilities and services has a positive relationship with academic performance. Their study shows that library facilities have a very strong correlation with academic performance, followed by teaching methods and classroom environments. This finding suggests that infrastructure contributes to performance not only directly, but also indirectly through satisfaction and engagement. When students are satisfied with learning facilities, they are more likely to use available resources, participate in academic activities, and achieve better academic outcomes.

Student performance itself should be understood as a multidimensional construct. (Suleiman et al., 2024) explain that academic performance is influenced by internal factors such as motivation, learning habits, and self-regulation, as well as external factors such as educational facilities, institutional support, and learning environments. Therefore, student performance should not be limited to grade point average, but should also include the ability to understand learning materials, academic productivity, learning concentration, participation, practical skills, and consistency in completing academic tasks. This perspective is relevant for studies on campus infrastructure because infrastructure affects not only final grades, but also the learning behaviors that lead to academic success.

The relationship among the reviewed studies can be explained through several theoretical perspectives. Astin's Student Involvement Theory suggests that student learning and development depend on the quality and quantity of student involvement in educational activities. Campus infrastructure supports this involvement by providing spaces and resources that enable students to study, interact, collaborate, and participate in academic life. Expectation-Confirmation Theory also helps explain why infrastructure affects satisfaction; students become satisfied when the facilities they experience meet or exceed their expectations. Herzberg's Two-Factor Theory further clarifies that campus facilities function as hygiene factors: their absence creates dissatisfaction, while their adequacy provides the basic conditions for motivation and performance. These theories collectively show that infrastructure contributes to student performance through involvement, satisfaction, motivation, and learning behavior.

However, the literature also reveals several limitations. Many previous studies still focus on the relationship between facilities and student satisfaction, while fewer studies examine the direct contribution of campus infrastructure to multidimensional student performance. (Dunggio, 2023; Samudra and Ramadhan, 2024; Maharani et al., 2025) provide important insights into student satisfaction, but they do not fully explain how infrastructure affects students' ability to understand materials, complete academic tasks, develop practical skills, and maintain learning productivity. This creates a theoretical and empirical gap because satisfaction does not automatically represent performance.

Another limitation is that many studies examine infrastructure in a fragmented way. Some studies focus on libraries, others on classrooms, internet facilities, or parking management. Although these studies are valuable, they do not fully capture campus

infrastructure as an integrated strategic system. In reality, students experience infrastructure as a connected ecosystem. Classroom comfort, internet access, library resources, laboratory availability, green spaces, and academic services interact with one another in shaping learning experiences. Therefore, research is needed to examine infrastructure comprehensively and identify which dimensions should become priorities for institutional improvement.

The reviewed literature also indicates that most studies use quantitative approaches and stop at statistical relationships. While quantitative analysis is useful for measuring influence, it often lacks explanatory depth regarding why certain facilities are perceived as important, how students experience infrastructure limitations, and what types of facility improvements are most urgently needed. This limitation can be addressed through a convergent triangulation approach that combines survey data with deep interviews. Such an approach allows researchers to identify both the strength of relationships and the contextual meanings behind students' perceptions. In the context of Universitas Majalengka, this research becomes important because infrastructure development has been carried out as part of institutional efforts to improve academic services and educational quality. However, without empirical evidence based on student perceptions and experiences, facility development policies may not fully correspond to actual student needs. Infrastructure investment requires careful prioritization because institutional resources are limited, and not all facilities can be developed simultaneously. Therefore, evidence-based decision making is necessary to ensure that campus infrastructure development contributes directly to student performance.

Previous studies have consistently demonstrated that campus infrastructure constitutes a strategic institutional resource, as the availability of adequate physical and digital facilities, including internet access, laboratories, classrooms, learning support services, accessibility facilities, and a conducive learning environment, significantly contributes to learning effectiveness, student engagement, satisfaction, and academic performance (Rombot et al., 2022; Dunggio, 2023; Setiawan & Arsandrie, 2023; Kartika et al., 2024; Ramadhani et al., 2025). In line with these findings, recent studies further emphasize that physical facilities, learning technologies, laboratory resources, library services, internet accessibility, and academic support systems play a critical role in enhancing student motivation and academic achievement, suggesting that campus infrastructure should be positioned not merely as a supporting asset but as a strategic resource for improving student performance (Putri & Marsofiyati, 2024; Sylviani et al., 2024; Santi et al., 2024; Agaty et al., 2024; Maulidina et al., 2025).

The novelty of this study lies in its attempt to position campus infrastructure as a strategic optimization mechanism for improving student performance, rather than merely as a determinant of satisfaction. This study also provides a contextual contribution by focusing on Universitas Majalengka as a regional higher education institution, where empirical studies on infrastructure and student performance remain limited. Furthermore, the use of simple convergent triangulation allows the study to combine quantitative evidence with qualitative insights from students, resulting in recommendations that are more operational, contextual, and relevant for institutional decision-making.

Based on the literature, campus infrastructure can be understood as a strategic factor that influences student performance through several interconnected pathways. First, infrastructure provides learning access by enabling students to use classrooms, laboratories, libraries, and digital resources. Second, infrastructure creates learning comfort, which supports concentration and motivation. Third, infrastructure facilitates student engagement through collaborative spaces and academic support systems. Fourth, infrastructure contributes to satisfaction, which strengthens students' willingness to participate in learning. Finally, infrastructure influences academic productivity and achievement by supporting the behaviors required for successful learning.

Thus, the literature supports the argument that optimizing campus infrastructure is not merely a technical matter of facility provision, but a strategic agenda in higher education management. For Universitas Majalengka, this perspective is highly relevant because improving student performance requires not only curriculum development and academic services, but also infrastructure planning that is data-driven, student-centered, and aligned with institutional quality goals. Therefore, this study is expected to fill the research gap by analyzing how campus infrastructure influences student performance and by formulating an optimization model that can guide future infrastructure development in a more targeted and evidence-based manner.

RESEARCH METHOD

This study aims to explore and analyze the role of campus infrastructure as a strategic factor in improving student performance at Universitas Majalengka. Specifically, the study seeks to identify how campus infrastructure influences students' ability to understand learning materials and academic productivity, examine barriers experienced by students in accessing and utilizing campus facilities, and formulate strategic recommendations for campus infrastructure optimization based on students' experiences and priority needs.

This research employs a qualitative approach using a case study design. The qualitative approach was selected because the study seeks to gain an in-depth understanding of students' perceptions, experiences, and interpretations regarding campus infrastructure and its contribution to their academic performance. A case study design is considered appropriate because the research focuses on a specific institutional context, namely Universitas Majalengka, allowing for a comprehensive exploration of infrastructure-related phenomena within a real-life educational setting (Yin, 2024). Through this approach, the study aims not only to identify existing conditions but also to understand the meanings, challenges, and implications of campus infrastructure from the perspective of students as the primary users.

The study was conducted at Universitas Majalengka, one of the largest private higher education institutions in the Ciayumajakuning region of West Java, Indonesia. The university has continuously developed academic and supporting facilities, including classrooms, laboratories, library services, internet networks, student activity spaces, and other educational infrastructures intended to support learning activities. However,

empirical evidence regarding how these facilities contribute to student performance remains limited, thereby providing a relevant context for investigation.

The participants in this study consisted of students from various faculties and academic levels at Universitas Majalengka. Informants were selected using purposive sampling, a technique commonly applied in qualitative research to identify individuals who possess rich and relevant information regarding the phenomenon under investigation (Creswell & Poth, 2024). Selection criteria included active enrollment status, experience in utilizing campus facilities, willingness to participate, and ability to articulate their experiences and perspectives regarding campus infrastructure. To obtain diverse perspectives, participants were selected from different faculties, academic years, academic achievement levels, and levels of involvement in campus activities. A total of 10–15 student informants participated in the study. This number was considered sufficient to achieve information richness and thematic saturation, where no substantially new information emerged from additional interviews (Braun & Clarke, 2022). The emphasis was placed on the depth and quality of information rather than the number of participants.

Data collection was conducted through in-depth interviews. Deep interviews were chosen because they allow participants to express their experiences, perceptions, opinions, and expectations freely and comprehensively. This technique enables researchers to explore not only observable conditions but also the underlying meanings and contextual factors associated with students' interactions with campus infrastructure (Rubin & Rubin, 2022). An interview guide was developed based on the literature concerning campus infrastructure and student performance. The interview questions focused on three major areas. First, participants were asked to describe their experiences in utilizing campus infrastructure, including classrooms, laboratories, library facilities, internet access, student activity spaces, and supporting facilities. Second, participants were invited to discuss barriers and challenges encountered in accessing or utilizing campus facilities. Third, participants were asked to identify infrastructure needs and development priorities that they considered important for improving learning experiences and academic performance. Examples of interview questions included:

1. How do campus facilities support your learning activities?
2. Which campus facilities contribute most significantly to your academic performance?
3. What difficulties have you experienced when accessing or using campus infrastructure?
4. What infrastructure improvements do you consider most necessary to support student success?

All interviews were conducted face-to-face depending on participant availability. Prior to the interviews, participants were informed about the objectives of the study, confidentiality procedures, and their rights as research participants. With participants' consent, all interviews were audio-recorded and subsequently transcribed verbatim to facilitate analysis.

To ensure the credibility and trustworthiness of the findings, this study applied the qualitative quality criteria proposed by Lincoln and Guba (1985), including credibility, transferability, dependability, and confirmability. Credibility was enhanced through prolonged engagement with the data, member checking, and source triangulation.

Member checking was conducted by providing participants with opportunities to review interview summaries and clarify interpretations. Source triangulation was implemented by comparing perspectives across participants from different faculties, academic levels, and achievement backgrounds to identify recurring patterns and inconsistencies.

Transferability was supported by providing detailed descriptions of the research context, participant characteristics, and data collection procedures, enabling readers to determine the applicability of findings to other contexts. Dependability was ensured through maintaining a comprehensive audit trail documenting research procedures, decisions, and analytical processes. Confirmability was strengthened through reflective memo writing and systematic documentation of analytical decisions to minimize researcher bias.

Data analysis was conducted using thematic analysis following the framework proposed by Braun and Clarke (2022). Thematic analysis was selected because it enables researchers to identify, analyze, and interpret recurring patterns across qualitative datasets while maintaining sensitivity to contextual meanings.

The analysis process consisted of six stages. The first stage involved familiarization with the data through repeated reading of interview transcripts and field notes. During this stage, researchers developed an overall understanding of participants' experiences and perspectives. The second stage involved generating initial codes by identifying meaningful segments of data related to campus infrastructure, learning experiences, barriers, and performance outcomes. The third stage focused on organizing codes into potential themes based on conceptual similarities and recurring patterns. The fourth stage involved reviewing and refining themes to ensure consistency and coherence within each theme. The fifth stage consisted of defining and naming themes that accurately represented the essence of participants' experiences. Finally, the sixth stage involved interpreting and reporting findings by linking emerging themes to relevant theoretical frameworks and previous empirical studies.

To strengthen analytical rigor, findings were organized using a simple triangulation framework. Emerging themes were compared across participants to identify areas of convergence, complementarity, and divergence. Convergent findings referred to themes consistently reported by multiple participants. Complementary findings referred to themes that enriched understanding of other themes. Divergent findings referred to differing perspectives that revealed contextual variations in students' experiences. This triangulation process enhanced the depth, credibility, and interpretative quality of the findings.

The final outcome of the study is expected to provide a comprehensive understanding of how campus infrastructure influences student performance, identify key barriers affecting infrastructure utilization, and generate evidence-based strategic recommendations for infrastructure optimization at Universitas Majalengka. The findings are intended to support institutional decision-making and contribute to broader discussions concerning the role of campus infrastructure in enhancing educational quality and student success within higher education institutions.

RESULTS AND DISCUSSION

Analysis of interview data revealed that students perceive campus infrastructure as a critical supporting factor in facilitating their understanding of learning materials. The findings indicate that internet connectivity, classrooms, laboratory facilities, projectors, air conditioning systems, and library resources are the most influential infrastructure components contributing to learning comprehension. These facilities support access to learning resources, improve classroom comfort, facilitate practical learning experiences, and enhance lecturer-student interaction during instructional activities.

Table 1. Infrastructure Components Supporting Students' Understanding of Learning Materials

Infrastructure Component	Frequency of Mention	Main Contribution to Learning Understanding
Internet/Wi-Fi	16	Access to learning resources, online references, LMS, and digital materials
Classroom	12	Learning comfort and concentration
Laboratory	9	Practical understanding and application of theories
Projector/Smart TV	8	Visual presentation of learning materials
Library	7	Access to academic references and supporting literature
Air Conditioning (AC)	11	Learning comfort and attention maintenance

Source: Interview data analysis, 2026.

The frequency counts presented in this study should be interpreted as thematic occurrences rather than participant counts. During the coding process, each interview transcript was examined for multiple references to campus infrastructure. Because participants frequently discussed more than one facility during a single interview session, a participant could be coded under several themes simultaneously. Therefore, the total frequency reported across themes exceeds the number of interview participants ($n = 15$). This approach is consistent with qualitative thematic analysis, where the emphasis is placed on the prevalence and salience of themes rather than on mutually exclusive categorization of participants (Braun & Clarke, 2022).

The interview findings consistently show that internet access represents the most important infrastructure component supporting learning comprehension. Students emphasized that internet connectivity allows them to access digital references, journal articles, online learning materials, and communication platforms necessary for academic activities. However, recurring concerns were expressed regarding unstable internet connections and slow network performance, which often disrupt learning activities and online information retrieval. Several students highlighted that Wi-Fi interruptions directly

affect their ability to access learning materials during lectures. Laboratory facilities emerged as another important contributor to learning understanding, particularly among students enrolled in practice-oriented programs such as Engineering, Agriculture, Animal Science, Communication Studies, and Applied Sciences. Respondents reported that practical sessions enable them to translate theoretical concepts into real-world applications. Nevertheless, many students indicated that laboratory facilities remain insufficient in quantity and equipment quality, limiting opportunities for hands-on learning. Several respondents specifically requested additional laboratory equipment and dedicated laboratories aligned with disciplinary needs.

These findings support Learning Environment Theory, which suggests that students' cognitive development is strongly influenced by the quality of the learning environment. Adequate infrastructure creates favorable conditions for concentration, information processing, and knowledge construction. The findings also align with Maulidina et al. (2025), who reported that educational facilities significantly influence learning motivation and understanding.

The second research question investigated how campus infrastructure influences students' academic productivity. Interview results indicate that infrastructure affects productivity through three primary mechanisms: facilitating access to learning resources, supporting academic collaboration, and improving learning efficiency.

Table 2. Infrastructure Factors Affecting Academic Productivity

Theme	Evidence from Interviews	Impact on Productivity
Internet Connectivity	Frequent use of Wi-Fi by most respondents	Faster access to academic information
Laboratory Facilities	Essential for assignments, projects, and practical activities	Improved practical competencies
Discussion Spaces	Requested by students from multiple faculties	Enhanced collaboration and group work
Library Resources	Important for assignments and research activities	Increased academic output quality
Classroom Facilities	Comfortable learning environment	Better concentration and task completion

Source: Interview data analysis, 2026.

Most respondents reported that internet access is the facility most frequently used during their studies. Students from Management, Islamic Education, Industrial Engineering, English Education, Indonesian Language Education, and several other

programs identified Wi-Fi as the primary infrastructure supporting their academic activities.

Academic productivity is also influenced by the availability of collaborative learning spaces. Several respondents emphasized the importance of discussion rooms, student organization spaces, and collaborative environments for completing group assignments, preparing presentations, and conducting project-based activities. Students perceive these spaces as essential for fostering teamwork and academic interaction.

Interestingly, students did not view infrastructure solely as physical facilities. Instead, they associated productivity with the integration of physical, digital, and environmental infrastructure. Comfortable classrooms, reliable internet access, functional projectors, adequate seating arrangements, and conducive campus environments collectively influence their ability to complete academic tasks effectively. These findings support Astin's Student Involvement Theory, which argues that student achievement is closely related to the extent of engagement with institutional resources. Infrastructure enhances academic productivity by enabling greater involvement in learning activities, practical experiences, collaborative projects, and independent study.

The third research question sought to identify a strategic campus infrastructure optimization model capable of improving student performance. Thematic analysis identified four major priority areas requiring institutional attention.

Table 3. Priority Infrastructure Development Areas

Priority Area	Key Issues Identified	Student Expectations
Digital Infrastructure	Unstable Wi-Fi and internet performance	Reliable campus-wide internet access
Academic Infrastructure	Limited classrooms, laboratories, and learning equipment	Additional and upgraded learning facilities
Learning Support Infrastructure	Insufficient discussion spaces and academic support facilities	More collaborative learning spaces
Environmental Infrastructure	Cleanliness, comfort, and facility maintenance issues	Improved campus environment and maintenance

Source: Interview data analysis, 2026.

The strongest theme emerging from the interviews concerns digital infrastructure. Students consistently reported that unstable internet connectivity interferes with learning activities, online resource access, assignment completion, and classroom engagement. Consequently, upgrading campus internet infrastructure should be considered the highest

institutional priority. The second priority involves strengthening laboratory facilities. Students from Engineering, Agriculture, Animal Science, Communication Studies, and postgraduate programs emphasized the need for more specialized laboratories, updated equipment, and practical learning resources aligned with disciplinary requirements. Respondents argued that laboratory enhancement would significantly improve practical competence and graduate readiness. The third priority relates to learning support facilities, particularly discussion spaces, digital libraries, Smart TVs, and collaborative learning environments. Several respondents highlighted the need for infrastructure that supports modern learning approaches, including project-based learning, collaborative work, and technology-enhanced instruction. The fourth priority concerns environmental quality and facility maintenance. Students frequently mentioned issues related to classroom comfort, air conditioning performance, restroom cleanliness, campus aesthetics, and facility maintenance. These concerns suggest that infrastructure effectiveness depends not only on availability but also on functionality and sustainability.

DISCUSSION

Based on the integration of findings, this study proposes the Campus Infrastructure Optimization Model (CIOM) consisting of four interconnected pillars: Digital Infrastructure Enhancement, Academic Infrastructure Strengthening, Collaborative Learning Space Development, and Sustainable Facility Maintenance. The model suggests that improvements in these four areas collectively enhance students' learning comprehension, academic productivity, engagement, and overall performance.

The findings demonstrate that campus infrastructure functions not merely as a supporting facility but as a strategic institutional resource that directly shapes learning experiences and student outcomes. Therefore, infrastructure planning should be based on student needs assessment and evidence-based prioritization to ensure that investments generate meaningful impacts on educational quality and student success at Universitas Majalengka.

The findings demonstrate that campus infrastructure functions as a strategic enabler of student performance rather than merely serving as a supporting resource. Students consistently identified internet connectivity, classroom facilities, laboratories, libraries, and collaborative learning spaces as essential components influencing both learning comprehension and academic productivity. These findings support Learning Environment Theory, which argues that educational outcomes are shaped by interactions between learners and their physical and technological environments.

The importance of laboratory facilities identified in this study aligns with the findings of Rombot et al. (2022), who reported that learning facilities contribute significantly to academic achievement. Practical experiences provided through laboratories allow students to transform abstract concepts into applied knowledge, thereby strengthening comprehension and skill acquisition. Similarly, the emphasis on internet connectivity reflects the increasing role of digital infrastructure in contemporary higher education, where access to information and learning resources has become a prerequisite for academic success.

The findings also support Astin's Student Involvement Theory, which suggests that student learning outcomes depend on the quality and quantity of student involvement in educational activities. The availability of discussion rooms, laboratories, libraries, and digital learning resources facilitates greater engagement, collaboration, and participation in academic activities. Students who have access to these facilities are more likely to engage actively in learning processes, resulting in improved academic performance.

Another important finding concerns students' emphasis on infrastructure quality rather than mere availability. Respondents repeatedly highlighted issues related to unstable internet connections, inadequate laboratory facilities, malfunctioning air conditioners, and insufficient classroom capacity. These findings indicate that infrastructure effectiveness depends not only on the existence of facilities but also on their functionality, accessibility, and maintenance. This observation is consistent with Herzberg's Two-Factor Theory, which suggests that infrastructure functions as a hygiene factor that must meet minimum standards before it can contribute positively to motivation and performance.

Despite the contributions of this study, several limitations should be acknowledged. First, the study was conducted at a single institution, which may limit the generalizability of findings to other higher education contexts. Second, the study relied on student perceptions and experiences, which may be influenced by individual expectations and disciplinary backgrounds. Third, institutional perspectives from administrators, lecturers, and infrastructure managers were not included. Future research could adopt a multi-stakeholder approach and compare findings across different universities.

Nevertheless, the study provides important implications for higher education management. The findings suggest that infrastructure development should be guided by evidence-based prioritization rather than uniform resource allocation. Improving internet quality, strengthening laboratory facilities, modernizing classrooms, and expanding collaborative learning spaces appear to offer the greatest potential for enhancing student performance. Consequently, campus infrastructure should be recognized as a strategic investment capable of improving educational quality, student success, and institutional competitiveness.

CONCLUSION

This study examined the role of campus infrastructure in supporting student performance at Universitas Majalengka through a qualitative case study approach involving deep interviews with students from various academic disciplines. The findings indicate that campus infrastructure contributes to students' ability to understand learning materials by facilitating access to academic resources, providing comfortable learning environments, and supporting practical learning experiences. Internet connectivity, classroom facilities, laboratory facilities, learning technology, and library services were identified as the most influential infrastructure components in supporting learning effectiveness.

The study also revealed that campus infrastructure contributes to academic productivity by enabling students to complete assignments, participate in collaborative learning activities, conduct practical work, and access academic information efficiently.

Laboratory facilities and internet access emerged as the most critical infrastructure elements supporting academic productivity. However, several challenges were identified, including unstable internet connectivity, limited laboratory resources, inadequate classroom conditions, uneven distribution of facilities among study programs, and insufficient facility maintenance. Based on students' experiences and perceptions, this study proposes a Campus Infrastructure Optimization Model that prioritizes improvements in digital infrastructure, laboratory development, classroom enhancement, facility maintenance, infrastructure modernization, and equitable resource allocation. The model suggests that infrastructure influences student performance through enhanced academic engagement, learning access, learning comfort, and practical learning opportunities.

Theoretically, this study contributes to higher education and learning environment literature by demonstrating that campus infrastructure should be viewed as a strategic institutional resource rather than merely a supporting facility. The findings extend existing understanding by highlighting how digital, physical, practical, and supporting infrastructures interact to influence student performance. Empirically, this study provides evidence from a regional higher education institution, thereby enriching the discourse on evidence-based infrastructure planning and student-centered educational development.

Despite its contributions, this study has several limitations. First, the research was conducted in a single institutional context, namely Universitas Majalengka, which may limit the transferability of the findings to other higher education institutions. Second, the study relied solely on student perspectives, while the views of lecturers, university leaders, infrastructure managers, and administrative staff were not included. Third, the qualitative design provides rich contextual insights but does not allow statistical generalization regarding the magnitude of the relationship between infrastructure and student performance.

Future research is recommended to involve multiple higher education institutions to compare infrastructure priorities across different institutional contexts. Further studies may also include multiple stakeholder groups, such as lecturers, academic administrators, facility managers, and policymakers, to obtain a more comprehensive understanding of campus infrastructure planning and utilization. In addition, future research may adopt mixed-methods or longitudinal designs to examine how improvements in campus infrastructure influence student engagement, academic productivity, and learning outcomes over time. Research on smart campus technologies, digital infrastructure management, and data-driven facility planning may also provide valuable insights for developing more adaptive, sustainable, and student-centered higher education environments.

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