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Standards for Facilities and Infrastructure in Building Quality Education in Senior High Schools

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ABSTRACT

The intent of this study is to evaluate and measure the gaps in various components—design, installation, process, and product—so that it can provide information for improvement and development related to the Facilities and Infrastructure Standards in Building Educational Quality at Senior High School. The evaluation model approach used in this study is the Discrepancy Evaluation Model, developed by Malcolm Provus. This research method is a mixed method, not only qualitative, descriptive, and evaluative but also quantitative, and it combines both. The evaluation subjects were 12 people, including principals, vice principals, educators, parents, committees, and supervisors at Fatahillah Ciledug Senior High School, Tangerang City. The evaluation findings indicate that the gap or discrepancy in the design aspect is 70% according to the standard indicators of facilities and infrastructure, based on the reference criteria categorized as "High/Sufficiently Appropriate." For the installation aspect, the gap level is 75% on the standard indicators of facilities and infrastructure, which falls into the category of "High/Good." Additionally, there is a gap level of 37% on the same standard indicators, placing it in the category of "Medium/Good." For the process aspect, the gap level of 37% on the standard indicators of facilities and infrastructure with reference to the discrepancy/inequality reference criteria is included in the category of “Medium/Good,” and for the product aspect, the gap or inequality level is 39%. This rating is after consulting the reference criteria of discrepancy/inequality.

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1. INTRODUCTION

The quality of education is a key pillar of a nation's progress. At various levels, including senior high schools, Indonesia continuously undertakes efforts to improve the quality of education (Bahri et al., 2024; Sain et al., 2024). The availability and quality of educational facilities and infrastructure greatly influence this improvement, which extends beyond curriculum and teacher competency. Adequate facilities and infrastructure are essential components that create a conducive learning environment, support an effective learning process, and ultimately contribute significantly to student

learning outcomes (Barrett et al., 2019; Swai et al., 2022; Ibrahim, 2023). Facilities and infrastructure refer to all facilities needed for the educational process (El Mhouti et al., 2018; Nurmayuli, 2022; Mohzana et al., 2023), from classrooms and laboratories (such as science, language, and computer labs), libraries, learning media to other supporting facilities such as teachers' lounges, canteens, sports fields, and sanitation. The government has established standards for facilities and infrastructure through regulations aimed at ensuring that every school meets the minimum criteria to ensure the delivery of quality education.

The availability and utilization of standard infrastructure has a direct impact on several crucial aspects, including Learning Effectiveness (Gil-Flores et al., 2017; Ntorukiri et al., 2022): For example, a well-equipped laboratory allows students to conduct practical experiments, which are far more effective than just theory. Health and Safety: Sanitation facilities and a clean and safe school environment affect the physical and psychological health of the school community. Learning Motivation: A comfortable, modern school environment supported by adequate facilities can increase students' motivation and interest in learning.

As educational institutions, schools also carry out educational functions, including administration, management, human resources, governance, facilities and infrastructure, and learning (Pasaribu et al., 2020). Regardless of the theory or policy on education, the ultimate goal of implementation is the school. Schools lead the way in educational functions, especially in formal education (Fatayan et al., 2023).

Facilities serve as tools. These facilities include learning materials, tools, and equipment (Tanjung et al., 2022). All types of learning resources are employed. Learning tools include anything and media used to communicate information and messages (Sun et al., 2018; Nabila et al., 2022; Rizki, 2023). Educational equipment includes all objects that aid learning. Facilities must meet the needs of specific educational pathways, levels, and types; accommodate student characteristics and needs, including gender, cultural diversity, language, religion, and beliefs; and accommodate students with disabilities. Be ecologically responsible, use educational unit resources, and assure safety, security, and health (Granatuma & Fatayan, 2022). In addition to these requirements, these facilities must meet children's needs, including education, health, nutrition, care, nurturing, protection, and welfare; provide diverse and playful opportunities; ensure developmental stages; and facilitate students' freedom to make choices based on their interests.

The government often improves school quality by restructuring components, regulations, school management training, principal leadership, teacher quality, school curricula, and school facilities and infrastructure (Suryadi et al., 2024; Irfansyah et al., 2025). Cultural approaches to school quality improvement involve school-wide reforms such student character development, literacy campaigns, and more (Sfakianaki et al., 2018; Ozberk et al., 2019; Khurniawan et al., 2020). The fourth paragraph of the Preamble to the Constitution of Indonesia states that educational facilities and infrastructure are necessary for excellent education and intellectual development. While following morals and ethics, the school's vision, mission, and goals are legitimate.

Complete facilities and infrastructure facilitate learning. Thus, as part of his EMASLIM (Educator, Managerial, Administrator, Supervisor, Leadershif, Innovator, and Motivator) duties, the principal must oversee and govern school facilities and infrastructure. As top management, the Principal can apply this for his subordinates, such as the Vice Principal in charge of facilities and infrastructure.

Educational quality improves when school facilities and infrastructure are appropriate and managed to provide learning services (Zhang & Wu, 2016; Leslie et al., 2017; Helda & Syahrani, 2022). Both student achievement and the school's human resources, especially teachers and administrators, determine educational quality (Fatayan et al., 2023). High-performing teachers improve learning, work environment, and public trust in the school (Hwang et al., 2021; Demerath et al., 2022; Agirdag & Muijs, 2023).

Although standards have been established, the reality on the ground often reveals significant disparities in meeting infrastructure standards between high schools, particularly between urban and rural schools, or between public and private schools. Some high schools may boast comprehensive and state-of-the-art facilities, while others struggle with limited classroom space, a shortage of books in the library, or even a lack of adequate laboratories. This disparity has the potential to become a major obstacle to achieving equitable educational quality. Inadequate infrastructure can limit optimal curriculum implementation, hinder learning innovation, and ultimately produce graduates with varying competencies (Barrett et al., 2019; Buabeng & Amo-Darko, 2025). Therefore, it is crucial to critically examine the extent to which meeting and managing these infrastructure standards truly impacts and builds educational quality at the high school level.

In this regard, researchers aim to evaluate the facilities and infrastructure used to improve educational quality in secondary schools to determine whether they align with the existing National Education Standards (NES) and the applicable national education system. The evaluation uses the Decrepancy Evaluation Model (DEM) approach. The evaluation findings will provide input and inform further policy development for the school. The results of this study are expected to provide empirical contributions and strong policy recommendations for related parties, especially the education office and school management, in formulating more effective and targeted strategies to make facilities and infrastructure a fundamental catalyst in improving the quality of education in Senior High Schools.

2. METHOD

This research used paradigms that include quantitative and qualitative research and a combination of quantitative and qualitative research, known as mixed methods research. In other words, mixed methods research is neither quantitative nor qualitative but rather combines both research paradigms. This research falls into the category of descriptive-evaluative qualitative research. Therefore, research design is crucial as a framework in Figure 1. The evaluation subjects were 12 people, including principals,

vice principals, educators, parents, committees, and supervisors at Fatahillah Ciledug Senior High School, Tangerang City.

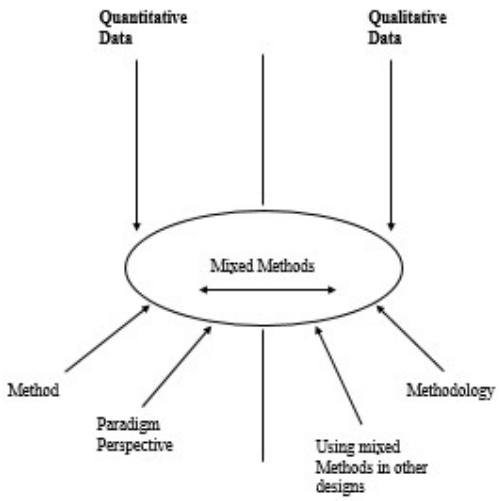

Figure 1. Mixed Methods research

The evaluation design in research is intended to provide a clearer framework for evaluation research. In addition to being more flexible, it should evolve and emerge during the evaluation process. The evaluation design is also important, as is the evaluation model used. This evaluation research uses the Discrepancy Evaluation Model (disparity).

The evaluation method in this study is qualitative-evaluative, employing qualitative methodology. This method is a research procedure that produces descriptive data in the form of written or spoken narratives of people and behaviors that can be observed or obtained by researchers or evaluators through evaluation subjects who manage or handle the facilities and infrastructure of senior high schools held in this evaluation. Qualitative research aims to understand the phenomena of what is experienced by research subjects, such as behavior, perception, motivation, actions, and others, holistically, and by means of descriptions in the form of words and language, in a specific natural context by utilizing various natural methods. Qualitative evaluation uses qualitative data, and to collect it, it uses qualitative instruments. Qualitative data is in-depth and detailed because it consists of detailed descriptions of situations, events, people, interactions, and observed behaviors; direct quotes from people about their experiences, attitudes, beliefs, and thoughts; and quotes or whole sections from documents, correspondence, recordings, and historical cases.

Qualitative evaluation procedures include determining the focus and scope of the evaluation, formulating the evaluation problem, identifying the benefits and uses of the evaluation, understanding relevant concepts and sub-concepts, reviewing pertinent research studies, collecting data, processing data, analyzing data, checking the validity of the data, and making improvements to recommendations based on evaluation findings. However, in some evaluation models, the evaluator does not determine improvements and changes to facilities and infrastructure; instead, they provide recommendations based on their analysis of the current situation, leaving it to the

policymakers to decide on any necessary improvements, additions, or changes based on the evaluator's findings.

3. RESULTS AND DISCUSSION

Results

The school where the research was conducted found a 70% gap in the standard indicator for facility and infrastructure design, categorized as "Sufficiently Appropriate." This data was supported by interviews and observations, including the Vision, Mission, Goals, Targets, Statements of Choice, and Obstacles and Challenges.

Interviewer	:	*Good morning, Principal. Based on the initial data we collected regarding the standard indicators for facility and infrastructure design, your school shows a 70% gap from the ideal standard, which means it falls into the "Quite Appropriate" category. What is your response to this finding?*
Principal	:	*Good morning. Thank you for the information. Honestly, the 70% figure is quite large, even though it's in the "Quite Appropriate" category. This figure reflects the real conditions we face, particularly regarding long-term planning and the reorganization of existing assets.*
Interviewer	:	*Could you please elaborate more specifically, Sir/Madam. Which aspect of the facility and infrastructure design aspect is most prominently affected? Is it related to layout, room function, or licensing and completeness of design documents?*
Principal	:	*The biggest gaps are in two areas. First, the ratio of space to student population. We lack classrooms and supporting spaces that meet standards. We were forced to convert some rooms, for example, the audio-visual room into two classrooms. Second, the adaptive design. Many of the older buildings here are designed to no longer support a modern curriculum, especially for laboratories and practical workshops. Our renovation plans are often patchwork, not comprehensive redesigns.*
Interviewer	:	*So, the problem isn't just physical availability, but also the suitability of function and design to current curriculum needs?*
Principal	:	*Exactly. We may have 15 classrooms, but if the design doesn't support collaborative learning or provide adequate connectivity, they won't function optimally. Our designs don't fully adhere to minimum standards for green open space and ideal site planning.*
Interviewer	:	*With this 70% gap in design, how does the school maintain educational quality? What impacts are most noticeable on the learning process?*
Principal	:	*The most noticeable impact is on practical learning and extracurricular activities. We must schedule science laboratories in such a way that time efficiency is often sacrificed. To maintain quality, we emphasize innovative teaching methods that don't always rely on physical infrastructure. Teachers are encouraged to utilize technology and digital learning media, such as virtual simulations, to compensate for the lack of physical facilities.*
Interviewer	:	*In the context of future planning, what are the school's top priorities to reduce this 70% gap?*
Principal		*Our priority is to submit a proposal for total rehabilitation with a new design integrated with 21st-century learning needs. This includes adding classrooms, building integrated laboratories, and redesigning the cafeteria and sanitation areas to meet health standards. We hope that in*

		the next two-year strategic plan, we can reduce this gap to at least below 40%.
Interviewer	:	*Okay, sir/madam. This insight is crucial for our research, especially in understanding the managerial challenges behind statistics. Thank you very much for your time and openness.*
Principal	:	*You're welcome. We hope your research is beneficial.*

The school has adequate facilities and infrastructure to support student learning in accordance with National Education Standards, including: Planning, Procurement, Utilization, Maintenance and Care, Monitoring and Evaluation, Reporting and Accountability, and Creating a conducive learning environment. Interviews with the principal revealed that the provision of facilities and infrastructure comes from the School Operational Assistance fund, a budget allocated each academic year from the Banten Provincial Government, and 10% of the school's annual prioritized independent funds.

The school's analysis also found a 75% gap in the standard indicator for facility and infrastructure installation, categorized as "Sufficiently Appropriate." The data is supported by interviews and observations, including: Purchase planning and evaluation reporting, Procurement of learning facilities, Administration/Inventory management innovations such as monitoring and maintaining cleanliness and security, and the elimination of unusable items.

Interviewer	:	*Good afternoon, Sir/Madam. Our research shows that this school has a 75% gap in the infrastructure installation standard indicator, with the category "Quite Appropriate." This figure is quite high. What are your thoughts on this 75% finding?*
Principal	:	*Good afternoon. This 75% figure is certainly not ideal, and we recognize that. This gap is primarily related to the technical procedures for installing and placing existing assets, not simply a lack of materials.*
Interviewer	:	*Please explain in more detail, Sir/Madam. What aspects of the "installation standard" are still a challenge here? Are they related to electricity, the internet connection, or furniture placement?*
Principal	:	*Yes. For example, we have new projectors, but they are not installed optimally in some classrooms. They are placed too high or at the wrong angle, making it difficult for students in the back rows to see. Another major issue is internet connection. Our access points (APs) are limited, and they have not yet reached all learning areas, such as the library and some laboratories. As a result, there is a digital divide in the utilization of infrastructure.*
Interviewer	:	*So, even though the facilities (e.g., hardware or media) are available, the installation doesn't support their optimal function?*
Principal	:	*Exactly. This also applies to laboratory equipment. The water and gas lines on some lab tables are outdated and don't meet the latest safety standards. We know this is risky, but budget constraints prevent us from completely overhauling the installations. We make minimal modifications, and this is what leads to the 75% gap score.*
Interviewer	:	*So, how does this 75% gap in installation affect the quality of daily learning?*
Principal	:	*The impact is discomfort and ineffectiveness. Teachers are forced to limit technology use in class due to unstable internet signals caused by uneven*

		installation. Learning time is often wasted because teachers must adjust the position of projectors or connections. While quality can be maintained by the quality of the teachers, the delivery process is inevitably disrupted by these technical installation issues.
Interviewer	:	*What strategic steps are schools taking or will take to address this 75% gap in infrastructure installation standards?*
Principal	:	*We are allocating School Operational Assistance funds and seeking other funding sources for infrastructure audits and installation reorganization. Our priority is to strengthen the school's internet network by adding access points (APs) and installing them according to technical standards, as well as rearranging electrical installations and classroom furniture for ergonomic and functional performance. We will also involve a team of professional technicians in all future installations, rather than relying solely on our limited internal resources.*
Interviewer	:	*Very clear explanation, sir/madam. This clarifies that "owning" infrastructure is not the same as "installing" it optimally. Thank you very much for your time and information.*
Principal	:	*You're welcome. We hope these findings can help formulate effective recommendations.*

The results of interviews with the Vice Principal for School Facilities and Infrastructure, specifically regarding the provision of facilities and infrastructure, include: Limited budget availability due to the lenient policy that orphans are exempt from tuition fees, and minimal monitoring and regular maintenance of existing/owned items at the school.

Interviewer	:	*Good morning, Sir/Madam. We would like to discuss the provision of facilities and infrastructure. Are there any significant obstacles in the school's efforts to meet and provide facilities and infrastructure that meet standards?*
Vice Principal for Facilities and Infrastructure	:	*Good morning. Our main obstacle is budget constraints. We have a strong social commitment, namely providing full tuition waivers for orphans at this school. This is a flexible policy, and the number of students who benefit is quite large.*
Interviewer	:	*Very interesting. How does this fee waiver policy directly impact on the budget allocation for infrastructure procurement?*
Vice Principal for Facilities and Infrastructure	:	*The impact is very noticeable. Funds that could ideally be allocated for the procurement of new infrastructure or technology upgrades are forced to be diverted to cover operational costs lost due to the tuition waiver. We strongly support this social policy, but financially, this limits funds for infrastructure development and maintenance. We often have to postpone major purchases, such as new computers or roof repairs.*
Interviewer	:	*Besides procurement issues, what about the maintenance and periodic upkeep of existing infrastructure? Are there any obstacles there?*
Vice Principal for Facilities and Infrastructure	:	*That's the second crucial obstacle: the lack of supervision and periodic maintenance. Often, we only undertake repairs when there is urgent or serious damage. Our preventive maintenance is very weak.*
Interviewer	:	*What is the main cause of this lack of supervision and preventive maintenance? Is it human resources (HR) or procedural?*
Vice Principal for Facilities	:	*It's a combination. Our human resources are limited to infrastructure technicians. We don't have full-time technicians for specific items like computers or lab equipment. Furthermore, the school community's*

and Infrastructure		*awareness of asset supervision and ownership is still low. For example, the air conditioner in the teachers' lounge is only cleaned when it's no longer cold, not every three months.*
Interviewer	:	*So, the impact is that the lifespan of school equipment is shortened, and the cost of emergency repairs is higher than the cost of routine maintenance?*
Vice Principal for Facilities and Infrastructure	:	*Exactly. We often incur large costs for emergency repairs that could have been avoided with regular maintenance and strict supervision. It's a vicious cycle: limited budget, minimal maintenance, items that quickly break down, which ultimately drains that limited budget.*
Interviewer	:	*In closing, what mitigation strategies have you implemented to address these two issue-limited budget and lack of maintenance—to maintain the quality of education?*
Vice Principal for Facilities and Infrastructure	:	*We are carefully maximizing the School Operational Assistance (BOS) Fund, prioritizing those that directly impact teaching and learning. For maintenance, we have begun forming a Small Task Force (Satgas) of teachers and students tasked with conducting weekly inspection checklists, particularly for cleanliness and classroom supplies. We are also actively seeking external donations to cover the budget gap.*
Interviewer	:	*Okay, sir/madam. This information is invaluable, especially regarding the dilemma between social policy and infrastructure budgeting challenges. Thank you very much for your time and honesty.*
Vice Principal for Facilities and Infrastructure	:	*You're welcome. I hope you succeed with your research.*

Discussion

This study is to evaluate and measure the gaps in various components—design, installation, process, and product—so that it can provide information for improvement and development related to the Facilities and Infrastructure Standards in Building Educational Quality at Fatahillah Ciledug Senior High School. Researchers found "good enough" school buildings and infrastructure to increase school quality. This meets the inequality criterion (Coco et al., 2020; Scheider et al., 2023; Prieto et al., 2023). This data is compared to relevant product evaluation research. The evaluation shows multiple levels of educational facility and infrastructure management. Facility and infrastructure management begins with planning. This planning process involves the lab leader, teachers, and others discussing needs. A decision triggers the creation of a proposal that includes the necessary facilities and infrastructure. This procurement is funded by school operational assistance and proposal funding. A special officer or coordinator oversees proposal preparation.

Lists of rooms, fields, and yards are used to inventory facilities and infrastructure. This inventory is managed by the Facilities and Infrastructure vice principal. All residents must maintain facilities and infrastructure. Damage is repaired frequently. Borrowing learning materials is done through the lending system. Facilities and infrastructure must be disposed of according to government processes. Targeted usage

and removal of unused classroom and learning equipment must be considered during disposal.

The assessment findings have design implications for education, particularly for constructing a forward-looking vision for developing and upgrading education at Fatahillah Ciledug Senior High School, Tangerang City, Banten. The school, especially the principal and foundation, and the community need this effect. Current conditions and advances, while flexible, are vital for avoiding obsolescence in today's world. According to installation, objective evaluation findings by researchers or evaluators affect school education, particularly teaching and learning. Even though the evaluation results are moderate or satisfactory, the school and others must address any issues and maintain progress.

Process evaluation results show moderate to satisfactory performance. This also affects teaching and learning, especially in areas that need improvement. Thus, the school's and other stakeholders' roles in the school ecosystem must be assessed (Daly-Smith et al., 2020; Nadeem, 2024). They must work to strengthen education to help the nation's children develop intellectually. Product evaluation results suggest fair or satisfactory performance. Valid data supports this. Due to the potential impact of evaluation findings on education sustainability, the school, Foundation, and ecosystem are addressing concerns that have not yet led to a "very good" rating. To achieve a golden Indonesia by 2045, the community and Education Office must work together to promote education (Masykur, 2024; Pranita et al., 2025; Al Waroi et al., 2025).

Evaluation results show that classroom and laboratory facilities are being built to increase learning quality, the budget is still tight, and late-paying students have outstanding tuition and other financial concerns. Due to a limited budget for school facilities and infrastructure, deficiencies in their completeness, late tuition payments, and a review of the vision and mission with relevant parties must be addressed. Thus, the school and linked parties must evaluate to provide the finest service to create and improve education quality for the nation's youth (Suryadi et al., 2024; Yanti et al., 2024). The installation review found limited money availability due to the school's free tuition for orphaned children and minimal facility and infrastructure monitoring. Finally, the school's facilities and infrastructure aren't up to date with National Education Standards and the digital system. Thus, the institution must reconsider its free tuition for orphans (Khahro & Javed, 2022). The school and its stakeholders must also stay current on digital advances to boost teaching and learning (Mogas et al., 2022; Timotheou et al., 2023).

An evaluation of Fatahillah Ciledug Elementary School in Tangerang City shows that children, educators, and staff lack sufficient facilities to facilitate learning. Human resources expertise is lacking in facility maintenance. Additionally, some facilities are missing or under construction. These issues must be addressed immediately by the school and its stakeholders. Given limited facilities, human resources for upkeep, and inadequate facilities, schools and connected parties must solve these issues immediately. This ensures that students, educators, and staff may use school teaching and learning tools for better education. Product evaluations show that restricted money is still

insufficient, requiring careful selection during school facility and infrastructure applications. Financial resources are also needed to participate in sub-district, local, provincial, and national competitions to develop abilities and interests that will help students succeed in academic and non-academic domains.

Overall, meeting infrastructure standards is a non-negotiable prerequisite. Efforts to improve the quality of education in high schools must be supported by prudent budgetary policies and professional asset management so that infrastructure truly becomes a solid foundation, not just an addition, to the education system. Although schools strive to maintain quality through innovative digital teaching methods, this infrastructure gap has direct implications:

1. Disrupted Teaching and Learning Effectiveness: Limited classroom space, suboptimal facility installation (e.g., poor internet connection), and laboratory equipment that does not meet technical standards force teachers to limit the implementation of practical curriculum.
2. Uncomfortable Learning Environment: Poor maintenance and limited facilities (such as sanitation and ergonomics) create a less conducive environment, impacting students' motivation to learn.

4. CONCLUSION

This study aims to analyze the role and implementation of facilities and infrastructure standards in efforts to improve educational quality in senior high schools. The research results consistently confirm that Sarpras is a fundamental catalyst for achieving optimal educational quality, although its implementation in the field faces various complex challenges stemming from planning, technical, and managerial aspects. Key findings from the analysis and interviews indicate significant gaps that hinder the fulfillment of Sarpras standards included design and installation gaps (70% and 75% "Quite Appropriate" category): Quantitative analysis found that the study schools had high gaps, namely 70% in design standards and 75% in installation standards for Sarpras. This gap indicates that the problem lies not only in the availability of materials but also in the quality of layout planning that adapts to modern curricula and suboptimal technical installation procedures (such as network and electrical installation), which directly disrupt the effectiveness of teaching and learning activities.

Budget and Social Policy Dilemma: An interview with the vice principal for infrastructure revealed the dilemma of a loose policy—namely, exempting orphans from tuition fees—which, while noble, is constraining the school's budget. Funds that should have been allocated for infrastructure procurement and improvements are diverted to cover lost operational costs, hindering compliance with new standards. Additionally, weak preventive maintenance: The school faces a serious problem related to the lack of regular monitoring and maintenance of existing assets. This situation shortens the lifespan of assets, increases the cost of emergency (reactive) repairs, and creates a vicious cycle that further drains the already limited maintenance budget.

To build sustainable education quality, the following are suggested and recommended: Revised Budgeting Strategy: Regional governments or schools need to seek alternative funding solutions (for example, through partnerships or external donations) so that tuition-free policies do not compromise the budget for infrastructure procurement and maintenance. Improved Managerial Standards: Schools must shift their focus from mere procurement to preventive maintenance and regular technical audits of infrastructure. Technical Training for Infrastructure: Improving the competency of school human resources in technical design and installation (for example, network, electrical, and ergonomic furniture) is necessary to ensure that all infrastructure purchased functions optimally and meets quality standards.

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