

Infrastructure Deficits and Their Impact on Learning Conditions in Elementary Schools in Madagascar

Rakotoniriana Noelisoa Jean Michel¹, Ralaivao Hanginiaina Emynorane², Razafitahindraza Erica Feyzine Sulla³, Hangivola Emyblonde Ratna⁴

¹ Université de l'Itasy Soavinandriana, Madagascar

² Université de Toliara, Madagascar

³ Université de Toliara, Madagascar

⁴ Universitas Hasanuddin, Indonesia

Email: ¹misah25d@gmail.com, ²emymorane@gmail.com, ³razafsulla@gmail.com, ⁴ratnahe24e@ms.unhas.ac.id

Available Online in

<https://jurnal.educ3.org/index.php/pendagogia>

Article History

Received : 10 October 2025

Accepted : 28 November 2025

Published : 30 December 2025

Keywords:

Infrastructures, Elementary Schools, Learning, Strategies, Madagascar

Abstract: This study aims to examine infrastructure deficits and their impact on learning conditions in elementary schools in the Haute Matsiatra region of Madagascar. Using a qualitative research approach, data were collected through classroom observations and semi-structured interviews with 45 key informants, including teachers, school principals, local education officials, and parents. The findings reveal that many schools operate under poor physical conditions characterized by inadequate classrooms, overcrowding, insufficient teaching materials, and limited access to sanitation facilities. These conditions negatively affect students' concentration, participation, and academic performance, while also reducing teacher effectiveness and motivation. The study further highlights significant disparities between rural and peri-urban schools, where unequal distribution of resources reinforces educational inequities. Although local communities attempt to address some infrastructural gaps through collective efforts, their contributions remain limited without sufficient institutional and governmental support. Data analysis using thematic coding revealed recurring patterns linking poor infrastructure to weakened teaching and learning processes. The study concludes that improving school infrastructure is essential for enhancing educational quality and equity in the region.

INTRODUCTION

Infrastructure plays a fundamental role in shaping the quality of education and the conditions under which learning takes place in elementary schools. According to Barrett et al. (2019), the physical environment of schools significantly influences students' academic performance and overall well-being. Similarly, Duarte et al. (2012) emphasize that adequate school infrastructure is closely linked to improved learning outcomes, particularly in developing regions. In the context of Madagascar, where educational challenges remain persistent, understanding the impact of infrastructural deficits becomes crucial (Michel et al., 2026). These deficits include inadequate classrooms, lack of teaching materials, poor sanitation, and insufficient access to basic utilities, all of which hinder effective teaching and learning processes.

The relationship between school infrastructure and learning conditions has been widely explored in educational research. Barrett et al. (2015) highlights that classroom design, including lighting, ventilation, and spatial organization, can directly affect students' concentration and academic achievement. In addition, Wargoeki and Wyon (2013) demonstrate that improved air quality and thermal conditions enhance

students' cognitive performance and productivity. Furthermore, Espinosa et al. (2024) argue that educational spaces must be conducive to interaction and engagement to maximize learning outcomes. However, many elementary schools in Madagascar face significant infrastructural limitations, which undermine these essential conditions for effective education.

In developing countries, infrastructural deficits in schools are often linked to broader socio-economic challenges. Ayembilla and Ayanwale (2024) note that inadequate funding and poor management contribute to the deterioration of school facilities. Similarly, Mgimba and Mwila (2022) found that infrastructural challenges in rural schools significantly affect students' academic performance and attendance rates. In Madagascar, these issues are further compounded by geographic disparities and limited governmental resources (Eric et al., 2025). As a result, many schools operate in environments that are not conducive to learning, thereby widening the gap between educational goals and actual outcomes.

The impact of infrastructure on learning is not limited to physical conditions but also extends to educational equity and inclusion. Melda (2021) emphasizes that appropriate facilities are essential for inclusive education, ensuring that all students, including those with special needs, have access to quality learning environments. Ruhyana and Aeni (2019) also confirm that the availability of educational facilities positively influences students' academic achievements in primary schools. In Madagascar, where disparities between urban and rural schools are pronounced, infrastructural deficits exacerbate inequalities in access to quality education (Sulla et al., 2026). Consequently, addressing these deficits is critical for promoting equitable learning opportunities.

The role of infrastructure in supporting teachers' effectiveness cannot be overlooked. Emynorane et al. (2024) highlights that teachers' professionalism and performance are influenced by the availability of adequate teaching resources and supportive environments. In addition, Saripah and Tejawiani (2026) argue that effective management of school facilities contributes to improved teaching practices and learning quality. However, in many Malagasy elementary schools, teachers often face challenges such as overcrowded classrooms and lack of instructional materials, which hinder their ability to deliver quality education (Léa et al., 2025). These conditions not only affect teaching efficiency but also reduce students' engagement and motivation.

Community involvement has also been identified as a key factor in addressing infrastructural challenges in schools. Emynorane et al. (2026) demonstrate that active participation of local communities can significantly improve school conditions and student outcomes. Similarly, Sulla et al. (2026) highlight the importance of community-based governance mechanisms in strengthening educational systems in Madagascar. Despite these efforts, many communities lack the financial capacity and institutional support needed to effectively address infrastructural deficits (Michel et al., 2026). Therefore, collaborative approaches involving government, communities, and stakeholders are essential for sustainable improvements.

Comparative studies further illustrate the global relevance of infrastructure in education. Kumar and Sundararajan (2025) show that improvements in school infrastructure in urban India have led to better learning outcomes and educational development indicators. Likewise, Njong et al. (2025) provide empirical evidence from Cameroon demonstrating that well-equipped schools significantly enhance students' academic performance. These findings align with the observations of Duarte et al.

(2012), who emphasize that investments in infrastructure are crucial for improving educational quality. In Madagascar, similar investments are needed to address existing gaps and support the country's educational development.

In addition to academic performance, school infrastructure also influences students' social and emotional development. Ratna et al. (2026) argue that well-designed educational environments contribute to students' long-term success by supporting holistic development. Furthermore, Augustin and Emynorane (2024) highlight the importance of adapting educational environments to learners' cultural and contextual needs. In Madagascar, where cultural diversity and socio-economic challenges intersect, improving school infrastructure can play a vital role in fostering inclusive and supportive learning environments (Pauji et al., 2025). This underscores the need for context-specific solutions that address both physical and socio-cultural aspects of education.

Despite the recognized importance of infrastructure, many elementary schools in Madagascar continue to operate under substandard conditions. Idris et al. (2025) emphasize that poor school environments negatively affect the provision of quality education, particularly in resource-constrained settings. Similarly, Espinosa et al. (2024) note that inadequate infrastructure limits the effectiveness of teaching and learning processes. In Madagascar, these challenges are evident in the lack of basic facilities such as classrooms, sanitation, and learning materials (Eric et al., 2025). Addressing these issues requires comprehensive policies and sustained investments in the education sector.

Infrastructure deficits represent a significant barrier to improving learning conditions in elementary schools in Madagascar. The literature consistently demonstrates that adequate school facilities are essential for enhancing academic performance, promoting equity, and supporting teachers' effectiveness (Njong et al., 2025). However, persistent challenges related to funding, management, and socio-economic constraints continue to hinder progress (Mgimba & Mwila, 2022). Therefore, this study seeks to examine the extent of infrastructural deficits in Malagasy elementary schools and their impact on learning conditions, with the aim of providing insights for policymakers and stakeholders to improve educational outcomes in the country.

METHODOLOGY

This study adopts a qualitative research approach to explore infrastructure deficits and their impact on learning conditions in elementary schools in the Haute Matsiatra region of Madagascar. Data were collected through direct classroom and school environment observations, as well as semi-structured interviews. A total of 45 key informants were purposively selected to ensure diverse and relevant perspectives, including 20 elementary school teachers, 10 school principals, 5 local education officials, and 10 parents actively involved in school activities. These informants were chosen based on their direct experience with school infrastructure and their ability to provide in-depth insights into its effects on teaching and learning processes. Purposive sampling was complemented by snowball techniques to identify additional participants with valuable knowledge of the issue. Data analysis followed a thematic approach, involving transcription, coding, categorization, and identification of recurring patterns related to infrastructural challenges and learning conditions. Triangulation of data sources was used to enhance validity, while member checking ensured that participants' views were accurately represented. The credibility and trustworthiness of the findings

were further strengthened through prolonged engagement in the field, detailed field notes, and consistent comparison of emerging themes across different participant groups.

RESULTS

The findings from the field reveal that infrastructural deficits significantly shape the daily learning conditions in elementary schools across the Haute Matsiatra region. Observations indicated that many schools operate in deteriorated physical environments, with cracked walls, leaking roofs, and insufficient classroom space. Overcrowding was a recurrent issue, with some classrooms accommodating more than 60 pupils. One teacher explained, *“When it rains, we have to stop teaching because water enters the classroom, and the children cannot concentrate.”* Another teacher added, *“There are too many students in one room; it is difficult to manage them and give attention to each child.”* These conditions were observed consistently across both rural and peri-urban schools, suggesting a widespread infrastructural challenge.

The lack of basic facilities such as desks, teaching materials, and sanitation services further exacerbates the problem. In several schools, students were seen sitting on the floor or sharing inadequate furniture. A school principal stated, *“We do not have enough desks, so some children sit on the ground, which affects their ability to write properly.”* Similarly, a parent noted, *“My child comes home with dirty clothes every day because there are no proper benches or clean classrooms.”* In terms of sanitation, many schools lacked functional toilets and access to clean water, which raises concerns about students’ health and attendance. One local education official remarked, *“Some schools do not have toilets, and this especially affects girls, who may miss classes during certain periods.”*

The interviews also highlighted how these infrastructural deficits negatively impact teaching effectiveness and student motivation. Teachers reported feeling discouraged due to the lack of resources and supportive environments. As one teacher expressed, *“We try our best, but without materials and proper classrooms, it is very hard to deliver quality lessons.”* Another teacher emphasized the psychological impact on learners, stating, *“Students lose motivation because the environment is not comfortable or attractive for learning.”* Observations confirmed that poorly maintained classrooms often led to distractions, reduced engagement, and lower participation among students.

Community involvement emerged as both a strength and a limitation in addressing these challenges. In some cases, parents and local communities contributed to minor repairs or construction efforts. A parent explained, *“We sometimes come together to fix the roof or clean the school, but we do not have enough money to do more.”* However, such efforts were often insufficient to meet the scale of infrastructural needs. A school principal highlighted this limitation, saying, *“Community support is helpful, but we still depend on the government for major improvements.”*

Taken together, the findings indicate that infrastructural deficits are deeply embedded in the educational experience of both teachers and students. These challenges not only hinder effective teaching and learning but also contribute to broader issues such as absenteeism, low academic performance, and reduced student well-being. The voices of the informants consistently point to an urgent need for increased investment and coordinated action to improve school infrastructure in the region.

DISCUSSION

Impact of physical infrastructure on learning outcomes

The findings from the field clearly demonstrate that the condition of physical infrastructure plays a decisive role in shaping students' learning outcomes. In many observed schools, inadequate classrooms and overcrowded learning spaces created an environment that was not conducive to concentration or active participation. These observations align with Barrett et al. (2015), who argue that classroom design, including space, lighting, and layout, significantly influences pupils' cognitive engagement and academic progress. Similarly, Barrett et al. (2019) emphasize that the overall quality of school infrastructure is strongly associated with students' learning achievements, particularly in primary education settings.

Overcrowding emerged as a critical issue affecting both teaching and learning processes. Classrooms with excessive numbers of students limited interaction between teachers and learners, reducing opportunities for individualized attention and feedback. This situation reflects the findings of Duarte et al. (2012), who note that high student density in classrooms negatively impacts academic performance by constraining effective pedagogical practices. In addition, Njong et al. (2025) provide empirical evidence that overcrowded and poorly equipped classrooms are associated with lower student achievement levels, reinforcing the patterns observed in the field.

Environmental conditions such as poor ventilation, inadequate lighting, and uncomfortable temperatures were also found to hinder students' ability to focus and engage in classroom activities. These findings are consistent with Wargocki and Wyon (2013), who demonstrate that improved air quality and thermal conditions can significantly enhance students' performance in schoolwork. Furthermore, Espinosa et al. (2024) highlight that well-designed educational spaces foster better interaction, motivation, and learning outcomes, suggesting that the physical environment is a key determinant of educational effectiveness. In the Malagasy context, where many schools lack these basic conditions, the negative impact on learning becomes even more pronounced.

The lack of essential facilities, including desks and teaching materials, further compounds these challenges. Students who are forced to sit on the floor or share limited resources are less likely to participate actively in lessons and may experience difficulties in completing academic tasks. Ruhyana and Aeni (2019) confirm that the availability of educational facilities has a direct positive effect on students' learning outcomes in primary schools. Likewise, Kumar and Sundararajan (2025) show that improvements in school infrastructure contribute to better educational development indicators, underscoring the importance of adequate resources for effective learning.

In addition to academic performance, the physical learning environment also influences students' motivation and psychological well-being. Poorly maintained and unattractive school environments can reduce students' interest in attending school and participating in classroom activities. This observation is supported by Idris et al. (2025), who argue that the quality of the school environment is a key factor in the provision of quality education. Moreover, Melda (2021) emphasizes that appropriate infrastructure is essential for creating inclusive and supportive learning environments, which are necessary for all students to thrive.

The consistency between field findings and existing literature highlights the critical importance of improving school infrastructure to enhance learning outcomes. In the context of Madagascar, where infrastructural deficits remain widespread, addressing

these issues is essential for improving both the quality and equity of education. Without significant investment in physical infrastructure, efforts to improve teaching practices and curriculum delivery may have limited impact, as the learning environment itself remains a fundamental barrier to student success.

Inequality between schools and region

Disparities between rural and peri-urban schools in the Haute Matsiatra region were clearly evident in both observations and interviews, particularly in terms of infrastructure availability and quality. Peri-urban schools generally had relatively better classroom conditions, including more stable buildings, access to basic furniture, and in some cases, improved sanitation facilities. In contrast, rural schools were often characterized by temporary or poorly maintained structures, limited teaching materials, and inadequate sanitation. These findings are consistent with Duarte et al. (2012), who highlight that infrastructural inequalities across regions significantly affect students' access to quality education. Similarly, Kumar and Sundararajan (2025) note that regional disparities in school infrastructure contribute to uneven educational development outcomes.

Such infrastructural gaps directly translate into unequal learning conditions for students. In rural schools, overcrowded classrooms, lack of desks, and insufficient learning materials limit students' ability to engage effectively in academic activities. This situation reinforces the observations of Njong et al. (2025), who found that inadequate infrastructure in disadvantaged areas is closely linked to lower academic performance. Furthermore, Mgimba and Mwila (2022) emphasize that infrastructural challenges in rural schools negatively impact both attendance and achievement, thereby widening the gap between students in different regions. In the Malagasy context, these disparities create a structural barrier that prevents many rural learners from accessing the same quality of education as their peri-urban counterparts.

The unequal distribution of infrastructure also reflects broader socio-economic inequalities. Rural communities often lack the financial and institutional capacity to improve school facilities, relying heavily on limited government support or community contributions. Ayembilla and Ayanwale (2024) argue that insufficient funding and weak management systems are key factors contributing to persistent infrastructural deficits in underserved areas. In addition, Eric et al. (2025) highlight that regional economic disparities in Madagascar further exacerbate differences in educational resources and opportunities. As a result, students in rural areas are disproportionately affected by poor learning environments, which limits their educational prospects.

These inequalities not only affect immediate learning outcomes but also have long-term implications for social equity and development. Michel et al. (2026) suggest that unequal access to quality education perpetuates cycles of poverty and limits opportunities for social mobility. Moreover, Sulla et al. (2026) emphasize that community-based efforts, while valuable, are often insufficient to address systemic disparities without stronger institutional support. The persistence of infrastructural inequalities between rural and peri-urban schools therefore underscores the urgent need for targeted policies and investments aimed at ensuring equitable access to quality education across all regions.

Effects on teacher effectiveness and motivation

The field findings indicate that limited resources and inadequate working conditions significantly constrain teachers' ability to deliver effective lessons. Many

teachers reported a lack of essential instructional materials such as textbooks, chalk, and visual aids, which forced them to rely on improvised teaching methods. This situation often reduced the clarity and depth of lesson delivery, making it difficult for students to fully grasp key concepts. These observations are consistent with Emynorane et al. (2024), who emphasize that teacher professionalism and performance are closely linked to the availability of adequate resources and supportive environments. Similarly, Saripah and Tejawiani (2026) highlight that proper management and provision of school facilities are crucial for enhancing teaching quality and learning effectiveness.

Overcrowded classrooms further complicate the teaching process by limiting interaction between teachers and students. In several schools, teachers struggled to manage large groups of learners, often exceeding recommended class sizes. This reduced opportunities for individualized attention, formative assessment, and active student participation. The findings align with Duarte et al. (2012), who argue that high student density negatively affects teaching efficiency and learning outcomes. In addition, Barrett et al. (2015) demonstrate that classroom conditions, including space and organization, play a critical role in facilitating effective teaching practices. In such constrained environments, teachers are more likely to adopt passive teaching methods, which can reduce student engagement.

Poor physical conditions, including inadequate ventilation, insufficient lighting, and deteriorating classroom structures, also impact teachers' motivation and well-being. Teachers working in uncomfortable and sometimes unsafe environments reported feelings of frustration and fatigue, which affected their enthusiasm and commitment. Wargocki and Wyon (2013) show that poor environmental conditions in classrooms can reduce both student and teacher performance, highlighting the importance of a conducive physical setting. Furthermore, Idris et al. (2025) emphasize that the overall school environment is a key determinant of the quality of education, affecting not only students but also educators.

These challenges collectively contribute to decreased motivation and professional satisfaction among teachers, which in turn influences student engagement. When teachers feel unsupported and constrained by their working conditions, their ability to create dynamic and interactive learning experiences is diminished. Emynorane et al. (2025) note that persistent obstacles in the teaching environment can hinder both teacher effectiveness and student learning outcomes. Moreover, Ayembilla and Ayanwale (2024) argue that addressing infrastructural deficits is essential for improving not only physical conditions but also the morale and performance of educators. Strengthening school infrastructure is therefore a critical step toward enhancing both teacher motivation and the overall quality of education.

Role and limitations of community involvement

Field evidence shows that local communities play an active role in attempting to address infrastructural deficits in elementary schools, often stepping in where formal support is limited. Parents and community members frequently contribute labor, materials, or small financial resources to repair classrooms, build temporary structures, or maintain school environments. These initiatives reflect a strong sense of ownership and commitment to children's education. Maratkyzy (2025) highlights that community involvement can positively influence school success by fostering collaboration and shared responsibility. Similarly, Sulla et al. (2026) emphasize that local governance mechanisms can strengthen educational practices through collective action. However,

while such efforts provide short-term relief, they rarely result in sustainable or large-scale improvements.

Despite their engagement, communities often face significant financial and technical constraints that limit their capacity to address more complex infrastructural needs. Major issues such as constructing permanent classrooms, installing sanitation systems, or ensuring access to water and electricity require resources beyond what local populations can provide. Ayembilla and Ayanwale (2024) argue that infrastructural deficits persist when stakeholder contributions are not supported by adequate institutional frameworks and funding. In addition, Eric et al. (2025) note that broader economic limitations in Madagascar restrict the ability of communities to invest substantially in educational infrastructure. As a result, many community-led initiatives remain partial and insufficient.

The reliance on community support also raises concerns about inequality, as wealthier or more organized communities may be better able to contribute than poorer ones. This creates uneven improvements across schools, reinforcing disparities between regions and socio-economic groups. Michel et al. (2026) suggest that without coordinated state intervention, such disparities can deepen existing educational inequalities. Furthermore, Kumar and Sundararajan (2025) emphasize that equitable educational development requires systematic investment rather than fragmented local efforts. In this context, community involvement, while valuable, cannot substitute for comprehensive public policy and funding.

Sustainable improvement in school infrastructure therefore depends on effective collaboration between communities, government, and institutional stakeholders. While grassroots initiatives demonstrate local commitment, their impact remains limited without structural support and long-term planning. Emynorane et al. (2024) underline the importance of institutional backing in enhancing educational conditions and teacher performance. Likewise, Idris et al. (2025) stress that quality education provision requires well-coordinated systems that integrate environmental, administrative, and financial support. Strengthening partnerships between communities and authorities is thus essential to transform localized efforts into lasting and equitable infrastructural development.

CONCLUSION

The study reveals that infrastructural deficits significantly shape learning conditions in elementary schools in the Haute Matsiatra region of Madagascar. Inadequate classrooms, overcrowded learning spaces, and poor environmental conditions were found to negatively influence students' concentration, participation, and overall academic performance. These challenges are further intensified by clear disparities between rural and peri-urban schools, where unequal distribution of resources leads to unequal access to quality education. The findings also show that teachers are directly affected, as limited resources and unfavorable working environments reduce their effectiveness and lower their motivation to engage students actively. Although local communities attempt to compensate for these shortcomings through collective efforts such as repairs and minor construction work, their contributions remain insufficient to address the scale of infrastructural needs. This limitation highlights the structural nature of the problem, which goes beyond individual or community capacity. Consequently, the study emphasizes that learning conditions,

teaching quality, and educational equity are closely interconnected and are strongly influenced by the state of school infrastructure.

RECOMMENDATION

This study recommends that educational authorities and relevant stakeholders prioritize sustained investment in the improvement of school infrastructure in the Haute Matsiatra region. Special attention should be given to constructing and rehabilitating classrooms, reducing overcrowding, and ensuring access to essential facilities such as desks, sanitation, and clean water. Targeted interventions are particularly needed in rural schools to reduce regional disparities and promote equitable access to quality education. Strengthening coordination between government bodies, local education offices, and communities is also essential to ensure efficient use of resources and long-term maintenance of facilities. In addition, capacity-building programs for school administrators and teachers should be supported to improve the management of available resources. While community participation remains valuable, it should be complemented by stronger institutional and financial support to ensure sustainable improvements in learning environments and educational outcomes.

ACKNOWLEDGEMENT

This study was supported by the “Université de l’Itasy Soavinandriana”, Madagascar.

REFERENCES

- Augustin, R. S., & Emynorane, R. H. (2024). Intercultural Approach in Teaching Indonesian Language to Madagascar Students: Comparative Study between Elementary School and University Learners. *Jurnal Ilmiah PENDAS: Primary Educational Journal*, 5(2), 103-112. <https://doi.org/10.29303/8jebh462>
- Ayembilla, D., & Ayanwale, M. A. (2024). Tackling Infrastructural Deficit in Mission Schools: Stakeholder Perspectives. *Journal of Research Initiatives*, 8(4), Article 9. <https://digitalcommons.uncfsu.edu/jri/vol8/iss4/9>
- Barrett, P., Treves, A., Shmis, T., Ambasz, D., & Ustinova, M. (2019). *The impact of school infrastructure on learning*. <https://doi.org/10.1596/978-1-4648-1378-8>
- Barrett, P., Zhang, Y., Moffat, J., & Kobbacy, K. (2015). A holistic, multi-level analysis identifying the impact of classroom design on pupils’ learning. *Building and Environment*, 89(1), 118–133. <https://doi.org/10.1016/j.buildenv.2015.02.013>
- Duarte, J., Gargiulo, C., & Moreno, M. (2012). *School Infrastructure and Learning in Latin American Elementary Education: An Analysis Based on the SERCE*. <https://doi.org/10.18235/0009016>
- Emynorane, R. H., Urbain, M. J., Giovanni, R., Ratna, H. E., & Léa, S. (2026). Community Involvement and Its Impact on School Success in Madagascar. *Jurnal PAJAR: Pendidikan dan Pengajaran*, 10(1), 119–127. <https://doi.org/10.33578/pjr.v10i1.345>
- Emynorane, R. H., Kazakov, I., & Arrive, J. T. (2025). Obstacles Encountered by the English Department Students in Learning English: Case Study of Universitas Negeri Malang. *NU Madura: Journal of Islamic Studies, Social, and Humanities*, 3(2), 92-99. <https://doi.org/10.58790/jissh.v3i2.38>
- Emynorane, R.H., Huda, M., Degeng, N. S., Supriyanto, A., & Citriadin, Y. (2024).

- Challenges and Supports for Enhancing Teacher Professionalism in Private High Schools of Malang: A Qualitative Study. *Al-Ishlah Jurnal Pendidikan*, 16(2), 1606-1615. Doi.org/10.35445/alishlah.v16i2.5215
- Eric, R. R., Arrive, T. J., & Emynorane, R. H. (2025). Tourism and Educational Progress: Enhancing Schools and Universities in Madagascar. *Global Education Trends*, 3(2), 128–139. <https://doi.org/10.61798/get.v3i2.392>
- Espinosa A. A., Padilla, L., & Carrington, S. J. (2024). Educational spaces: The relation between school infrastructure and learning outcomes. *Heliyon*, 10(19), e38361. <https://doi.org/10.1016/j.heliyon.2024.e38361>
- Idris, M. O. A., Omar, A. M., Mohamed, M. J., Hussein, A. A., & Mohamed, M. M. O. (2025). The effect of the school environment on the provision of quality education: a study of schools in Mogadishu, Somalia. *Frontiers in Education*. 10, 1541502. <https://doi.org/10.3389/educ.2025.1541502>
- Kumar, M. M., & Sundararajan, S. (2025). Educational development indicators: An analysis of school infrastructure and learning outcomes in urban India. *International Journal for Research Trends and Innovation*, 10(9), 145–147.
- Léa, S., Angelo, V. T., Emynorane, R. H., & Urbain, M. J. (2025). Local Perspectives on the Use of Malagasy as a Language of Instruction in Madagascar's Elementary Schools. *Jurnal Pendidikan Tambusai*, 9(3), 35349–35357. <https://doi.org/10.31004/jptam.v9i3.33717>
- Maratkyzy, S. (2025). The Impact of School Infrastructure on Student Learning: A Qualitative Systematic Review of Literature. *Eurasian Science Review An International Peer-Reviewed Multidisciplinary Journal*, 3(7), 202–209. <https://doi.org/10.63034/esr-579>
- Melda, R. R. S. (2021). Conditions of Facilities and Infrastructure for Inclusive School Education Services. *International Journal of Elementary Education*, 10(2), 38-41. <https://doi.org/10.11648/j.ijeeedu.20211002.12>
- Mgimba, A. E., & Mwila, P. M. (2022). Infrastructural challenges influencing academic performance in rural public secondary schools in Iringa District, Tanzania. *Journal Research Innovation and Implications in Education*, 6(2), 17–24.
- Michel, R. N. J., Sulla, R. E. F., & Esmati, S. (2026). Revisiting the Role of Education in Social Transformation: Insights from Fianarantsoa, Madagascar. *International Journal of Teaching*, 3(1), 34–44. <https://doi.org/10.61798/ijt.v3i1.443>
- Njong M. A., Ndamsa, D. T., Abety, P., & Nguena, C.-L. (2025). The impact of school infrastructure on academic performance in Cameroon: Empirical evidence from Cameroon. *Innovation Economics Frontiers*, 28(1), 31–45. <https://doi.org/10.36923/ief.v28i1.285>
- Pauji, A. I., Rida, R., & Emynorane, R. H. (2025). The Effect Of Web-Based Academic Information System Use On Student Satisfaction: A Quantitative Study In Islamic Higher Education. *JoIEM (Journal of Islamic Education Management)*, 6(2), 99–105. <https://doi.org/10.30762/joiem.v6i2.6799>
- Ratna, H. E., Akbar, M., Mau, M., & Emynorane, R. H. (2026). Integrating Career Orientation into High School Education: Preparing Students for Lifelong Success. *International Journal of Research and Community Empowerment*, 4(1), 50–58. <https://doi.org/10.58706/ijorce.v4n1.p50-58>

- Ruhyana, N. F., & Aeni, A. N. (2019). Effect of educational facilities and infrastructure in primary schools on students' learning outcomes. *Mimbar Sekolah Dasar*, 6(1), 43–54. <https://doi.org/10.17509/mimbar-sd.v6i1.15225>
- Saripah, A., & Tejawiani, I. (2026). Management facilities and infrastructure in improving quality learning at elementary school. *Journal of Innovation and Research in Primary Education*, 5(1), 207–217. <https://doi.org/10.56916/jirpe.v5i1.2760>
- Sulla, R. E. F., Ratna, H. E., & Esmati, S. (2026). The Dina as a Community Governance Mechanism for Strengthening Education in Atsimo Andrefana, Madagascar. *Jurnal Strategi Pembelajaran*, 2(2), 89–99. <https://doi.org/10.61798/jsp.v2i2.442>
- Wargocki, P., & Wyon, D. P. (2013). Providing better thermal and air quality conditions in school classrooms improves the performance of schoolwork by children. *Building and Environment*, 59(1), 581–589. <https://doi.org/10.1016/j.buildenv.2012.11.008>