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The effect of the school environment on the provision of quality education: a study of schools in Mogadishu, Somalia

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This study investigates the impact of the school environment, specifically school physical infrastructure (SPI) and school management and leadership (SML), on the provision of quality education (QE) in Mogadishu, Somalia. Guided by the Educational Effectiveness Theory, the research examines the interconnected roles of SPI and SML in fostering an educational framework conducive to academic achievement. A quantitative research design was employed, involving surveys of 238 respondents from secondary schools in Mogadishu, including school principals, teachers, and parents. The study utilized SPSS and R for data analysis, including measurement modeling, reliability testing, and path analysis. The findings reveal that both SPI and SML significantly influence QE, with SPI exerting a stronger impact ($\beta = 0.491$, $p = 0.000$) compared to SML ($\beta = 0.350$, $p = 0.000$). Adequate infrastructure—spanning classrooms, libraries, and laboratories—directly enhances students' learning experiences and academic performance. Simultaneously, effective leadership practices, such as strategic decision-making and resource allocation, foster collaborative school cultures that support educational excellence. Structural models confirmed the reliability and validity of these constructs while underscoring their distinct yet interrelated roles. The study highlights the challenges faced by schools in Mogadishu, including inadequate infrastructure and weak leadership, and proposes targeted recommendations. These include investments in physical infrastructure, capacity-building for school leaders, community collaboration, equity promotion, monitoring mechanisms, and teacher development programs. By addressing these areas, stakeholders can create a holistic and sustainable framework for improving educational quality in Mogadishu.

KEYWORDS

school environment, physical infrastructure, school management and leadership, quality education, educational effectiveness

1 Introduction

Quality education serves as a foundation for both individual growth and social development, equipping individuals with the knowledge, abilities, and skills needed to prosper in an increasingly complex world (Malik, 2018; Shakeel et al., 2021). However, several factors affect the provision of high-quality education, with the environment of the school being one of the most important. The physical layout of the school as well as the management and leadership styles used there are all included in the concept of the school environment. Effective school leadership and the creation of a positive “school environment” play an essential role in

bringing out the individual and communal characteristics that are required in a quality school (Paper and Leu, 2004). A strong school community and strong school leadership are critical in bringing teachers together to produce high-quality teaching and learning as individuals, but more importantly, as a school-wide learning community (Leithwood and Sun, 2018). Good quality schools with high student accomplishment provide secure environments that are organized, conducive to learning, clean, and well-maintained, with students and staff working together to keep the school environment in order (Nduku, 2019).

The school learning environment is a place where students learn and interact with learning facilities to socialize and address societal challenges (Chernyshenko et al., 2018; Kliziene et al., 2021). The term “environment” refers to any physical, biological, and social characteristics that exist around the school and have an impact on its well-being. The school environment has a significant impact on the children’s personality development (Kurniawati, 2017). A suitable and favorable environment is required for beneficial learning in children. The child spends most of his or her time at school, and the environment has a different influence on skills through curricula, teaching approaches, and relationships; therefore, it is critical to maintain a healthy school environment that will improve their education (Hammond and Harvey, 2018). On the quality education is defined as an all-around education that focuses on a child’s holistic development, which includes social, emotional, mental, physical, and cognitive development, regardless of gender, race, ethnicity, socioeconomic status, or geographic location (Nduku, 2019). It prepares the child for life, not just the exam. It is the realization of human potential so that the individual can grow into something more than he was before (Munisi and Werema, 2021). The characteristics of quality education include professional leadership, a common vision, and goals. Other criteria include the presence of a suitable learning environment, high quality learning and teaching, the availability of resources, high student and teacher expectations, positive student development, and positive stakeholder support. These are only feasible with effective school management (Suleiman and Otieno, 2022). School and classroom regulations must be applied fairly and equitably, as agreed upon by teachers and students. Positive behavior is praised, and students and teachers attend lessons on a regular basis, as scheduled. There is compelling evidence that a school environment and teachers who communicate the expectation that all children can and will succeed contribute significantly to positive and successful teaching and learning outcomes (Rubie-Davies et al., 2006).

In many schools, teachers express low expectations, especially for female students (Hollenstein et al., 2024). Newly industrialized Asian nations are excellent examples of the value of educational cultures that set high learning goals and expect students to achieve them. Educators, legislators, and other stakeholders who work to raise educational standards must comprehend how these elements affect student results (Szeto, 2020).

The infrastructure of education in secondary schools in Mogadishu, the capital city of Somalia, has been severely impacted by protracted periods of conflict and instability. Even with initiatives to renovate and enhance the educational system, secondary schools in Mogadishu frequently struggle with poor physical facilities, scarce resources, and issues with administration and leadership. These elements play a crucial role in defining the caliber of education that students get. The physical infrastructure of schools, including

buildings, classrooms, restrooms, and learning resources, is a foundational element of the learning environment (Idris et al., 2025; Yangambi, 2023). Many schools in Mogadishu operate under substandard conditions, with overcrowded classrooms, insufficient lighting, poor ventilation, and limited amenities. Such situations can impair students’ ability to concentrate, actively participate in class, and achieve academic success.

Studies have exhibited that a well-maintained environment can considerably improve students’ learning experiences, leading to higher attendance, engagement, and performance. Inadequate infrastructure, on the other hand, can lead to high dropout rates, poor academic performance, and lower motivation among students and teachers (Yangambi, 2023).

Effective school management and leadership are vital for creating an environment conducive to quality education (Idris et al., 2024; Leithwood and Sun, 2018). School leaders in Mogadishu face the combined difficulty of managing limited resources while also cultivating a positive school culture in the face of external challenges. Leadership practices, such as decision-making, communication strategies, and educational policy implementation, have a direct impact on the overall school environment. Strong leadership can inspire teachers, engage students, and foster a collaborative community committed to achieving academic excellence (Bush et al., 2022). In contrast, ineffective management can result in disorganization, low morale, and inadequate teaching practices, exacerbated by the challenges faced by schools in Mogadishu.

This study intends to investigate how the physical infrastructure of schools, as well as their management and leadership, affect the delivery of high-quality education. The goal of the study is to determine how these two crucial elements either support or impede the provision of high-quality education. Comprehending these processes is essential to formulating strategies and measures that can enhance academic achievements, especially in areas where schools can encounter challenges related to insufficient facilities or incompetent management.

1.1 Problem of statement

Delivering high-quality education in Mogadishu, Somalia, is significantly hindered by deficiencies within the school environment, which adversely affect student development and academic success. These challenges primarily stem from inadequate physical infrastructure and ineffective school management and leadership, both of which play critical roles in the educational process.

The physical state of schools in Mogadishu is dire, with issues such as overcrowded classrooms, poor ventilation, insufficient natural light, and a lack of essential resources, including textbooks and technological aids. Furthermore, the absence of critical facilities like libraries and laboratories not only disrupts the teaching and learning process but also poses health and safety risks for both students and staff. These conditions exacerbate educational disparities, limiting students’ academic potential and creating an urgent need for infrastructural improvement.

Equally significant is the role of school management and leadership in fostering a conducive learning environment. Many school leaders in Mogadishu lack the necessary skills and resources to implement effective management strategies, resulting in poor resource allocation, limited professional development opportunities for

teachers, and inadequate community engagement. Weak leadership often leads to unclear direction, ineffective policy implementation, and a decline in educational quality, compounding the challenges faced by schools.

Despite these pressing issues, there remains a notable research gap in understanding how the school environment, including physical infrastructure and leadership practices—directly impacts student learning outcomes in Mogadishu. Addressing this gap is essential for formulating evidence-based strategies to improve educational quality. This study aims to assess both the physical and administrative conditions of schools in Mogadishu. By identifying specific barriers and opportunities within these environments, the research seeks to provide actionable insights for educators, policymakers, and stakeholders. The goal is to establish a supportive school environment that promotes academic achievement and fosters equitable educational opportunities for all students in Mogadishu, through a thorough investigation of the effects of school physical infrastructure on quality education and the role of school management and leadership practices in fostering a conducive learning environment.

1.2 Research questions

What is the effect of school physical infrastructure on the provision of quality education?

What roles do school management and leadership practices play on fostering an environment conducive to quality education?

1.3 Research hypothesis

1.3.1 Hypothesis 1

H1: There is a significant positive relationship between the quality of school physical infrastructure and the provision of quality education.

H2: There is no significant relationship between the quality of school physical infrastructure and the provision of quality education.

1.3.2 Hypothesis 2

H1: Effective school management and leadership significantly foster a positive educational environment.

H2: Effective school management and leadership do not significantly affect the educational environment.

1.4 Conceptual framework

Physical infrastructure, including classrooms, libraries, laboratories, and sanitation, is essential for a conducive learning environment. Well-maintained facilities enhance student engagement, concentration, and performance, while inadequate infrastructure hinders retention and achievement, exacerbating educational disparities.

Effective school management and leadership ensure optimal resource utilization, discipline enforcement, and a collaborative educational culture. Strong leadership boosts teacher morale, student engagement, and policy implementation, fostering a dynamic and resilient school environment.

Socio-economic conditions, such as household income, parental education, and community resources, significantly influence education quality. Schools in low-income areas often face resource constraints, affecting student performance and access to learning opportunities. Addressing these challenges requires target policies and community support to ensure equitable educational access.

Teacher-student dynamics are fundamental to learning. Positive interactions foster trust, motivation, and engagement, enhancing cognitive development. Student-centered teaching and mentorship improve academic outcomes, whereas poor relationships contribute to disengagement and absenteeism.

This framework highlights the interplay between infrastructure, leadership, socio-economic factors, and interpersonal dynamics in shaping education quality. A holistic approach ensures improvements in one area and reinforces others, promoting a sustainable and equitable education system.

Figure 1 illustrates the interconnected relationship between School Physical Infrastructure, School Management and Leadership, Socio-Economic Conditions, and Teacher-Student Dynamics, and their collective impact on Quality of Education.

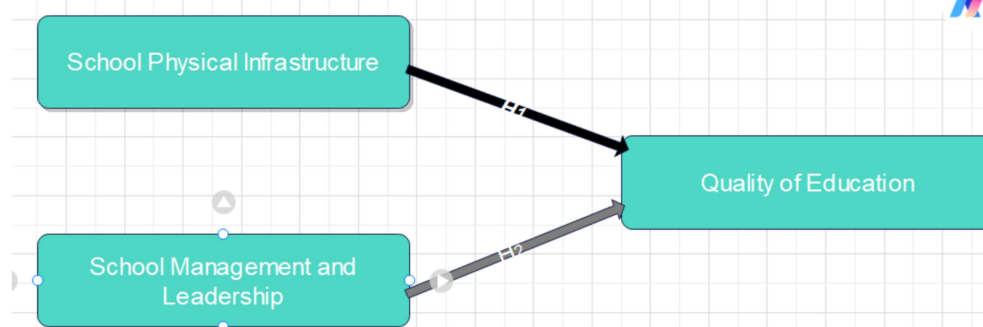


FIGURE 1
Conceptual frameworks.

2 Literature review

2.1 The effect of school physical infrastructure on the provision of quality education

School infrastructure encompasses physical buildings such as classrooms, libraries, laboratories, and recreational areas, alongside essential services such as sanitation, lighting, and ventilation. High-quality infrastructure is fundamental in fostering a conducive learning environment, directly influencing students' academic performance, attendance, and overall well-being (Yangambi, 2023). Well-maintained and well-equipped facilities ensure safety and comfort for students, facilitating engagement in learning activities. Conversely, inadequate infrastructure can hinder educational processes, leading to detrimental outcomes such as reduced student engagement and increased dropout rates (De La Cruz et al., 2023). Global studies have demonstrated the critical role of school infrastructure in shaping educational outcomes. Research in sub-Saharan Africa indicates that schools with modernized facilities, including functional laboratories and digital resources, report higher student performance levels compared to those with minimal infrastructure (Oyelere et al., 2020). Similarly, in developed countries, schools investing in sustainable infrastructure improvements, such as eco-friendly classrooms and technology-integrated learning spaces, have observed positive impacts on student motivation and learning efficiency (Barrett et al., 2019).

Regionally, disparities in school infrastructure across low- and middle-income countries remain a challenge. In Latin America, for instance, inadequate access to electricity and water supply in rural schools has been linked to lower student retention rates (Tapia-Fonllem et al., 2020). In contrast, urban schools with advanced infrastructure continue to attract higher enrollment rates, showcasing the pressing need for equitable resource allocation in education policy (Century School Fund, 2009). This study aims to address the gaps in infrastructure quality and its implications for equitable education access, thereby contributing to strategies for enhancing learning environments.

2.2 The role of school management and leadership practices on fostering a conducive environment for quality education

Effective school management and leadership are pivotal in creating a sustainable educational environment that enhances student learning and teacher effectiveness (Zhang, 2023). School leaders, including principals and administrators, are responsible for strategic planning, resource allocation, and fostering a culture of collaboration and inclusivity. Their role extends to policy implementation, discipline maintenance, and ensuring the overall safety and suitability of the learning environment (Solly, 2021).

Leadership approaches that emphasize continuous professional development, teacher empowerment, and student-centered policies contribute to a positive school climate (Starkey, 2023). Schools with strong leadership structures often experience improved academic outcomes, higher student satisfaction, and reduced dropout rates (Dinsdale, 2017). For instance, a study in East Asia found that

leadership practices emphasizing collaborative decision-making and staff mentoring resulted in significant improvements in student engagement and teacher retention (Zhang, 2023).

Regionally, challenges in school leadership vary, with disparities existing in policy execution and leadership training opportunities. In Africa, limited administrative training for school leaders has been cited as a barrier to effective school governance, affecting resource management and teaching quality (Abdi et al., 2024; Solly, 2021). In contrast, European models of school leadership prioritize participatory governance, where school leaders work alongside educators and parents to co-develop policies, thereby ensuring more inclusive and responsive educational environments (Starkey, 2023).

2.3 Theoretical framework

2.3.1 Educational effectiveness theory

Educational Effectiveness Theory (EET) is a paradigm for understanding and analyzing the factors that contribute to the effectiveness of educational institutions (Maag Merki et al., 2015). According to the theory, educational quality is influenced by a combination of contextual factors such as resources and infrastructure and procedural factors like teaching methods and management practices. EET stresses the role of both input and process variables to achieve educational goals (Zamir, 2020). The Educational Effectiveness Theory (EET) is applied to this study to examine how contextual and procedural factors influence the schools in the provision of quality education in Mogadishu, Somalia. It also aids in understanding the relationship between physical infrastructure, school management, and educational outcomes, giving a solid foundation for the study.

Application of Educational Effectiveness Theory to Research Objectives.

2.3.2 School physical infrastructure and quality education

According to EET, the physical infrastructure of a school is a vital contextual aspect that has a significant impact on educational quality. A well-designed and properly maintained infrastructure creates a safe and comfortable learning environment, which is essential for effective teaching and learning.

2.3.3 School management and leadership in fostering a conducive environment

EET emphasizes the relevance of school management and leadership as procedural variables influencing the entire educational environment. Effective leadership techniques promote a positive school climate, inspire teachers, and ensure that resources are used efficiently to improve student learning.

3 Research methodology

This study investigates the effect of school physical infrastructure and school management and leadership practices on the provision of quality education in Mogadishu, Somalia. By examining these two critical components, the research aims to determine how they support or hinder the delivery of high-quality education. The methodology was carefully designed to address the research objectives and

hypotheses effectively, ensuring a rigorous and systematic approach to data collection and analysis.

To explore these relationships, the study employed a quantitative research design, utilizing a survey-based approach with structured questionnaires to collect primary data. This design was chosen for its ability to systematically analyze data from a large sample, enabling the drawing of statistically valid conclusions regarding the interplay between school infrastructure, management practices, and educational outcomes.

The target population included school principals, teachers, and parents from private and public secondary schools in the Benadir region, Mogadishu. These stakeholders were selected due to their pivotal roles in influencing and experiencing the quality of education in their respective schools. A probability sampling technique was employed to ensure that every member of the population had an equal chance of being included in the study (Wang and Cheng, 2020). This approach, rooted in the principle of randomization, enhances the reliability and generalizability of the findings. A total sample size of 238 respondents was selected, ensuring a representative and diverse set of perspectives on the school environment and its impact on educational quality.

The primary data collection instrument was a structured questionnaire, which was divided into two parts. The first section gathered demographic information about respondents, such as their roles in the school, years of experience, and school type (public or private). The second section focused on key study variables, comprising eight items on school physical infrastructure (e.g., classroom conditions and availability of facilities like libraries and laboratories) and seven items on school management and leadership practices (e.g., resource allocation, leadership effectiveness, and teacher motivation). A five-point Likert scale, ranging from “strongly disagree” to “strongly agree,” was used to capture respondents’ perceptions comprehensively.

To analyze the data, SPSS 26 and R programming were utilized. SPSS facilitated statistical analysis, including descriptive statistics, reliability tests, and hypothesis testing, while R programming was employed for data visualization and statistical validation. This combination ensured robust and thorough analysis. To validate the questionnaire’s reliability and consistency, Cronbach’s alpha was calculated for each construct. A Cronbach’s alpha value above 0.7 was deemed acceptable, confirming the internal consistency of the questionnaire items (Abdi and Abdi Idris, 2024; Taber, 2018).

This study examined the role of school physical infrastructure and school management in shaping education quality. The findings provide strong empirical support for both hypotheses, revealing the significant influence of these factors. The results contribute to educational development discussions and offer insights into policymakers and stakeholders.

The first hypothesis (H_1) posited that school physical infrastructure positively impacts education quality. Statistical analysis confirmed this, demonstrating that well-maintained facilities, including adequate classrooms, ventilation, and sanitation, play a critical role in student performance and engagement (Magwaga and Kikechi, 2024). The findings aligned with prior research show that poor infrastructure lowers academic performance, increases absenteeism, and diminishes morale (Arjanto and Telussa, 2024). This study reinforces the need for targeted infrastructure

investments, particularly in resource-constrained settings like Mogadishu, as inadequate facilities can hinder learning and teaching effectiveness.

The second hypothesis (H_2) proposed that effective school management and leadership foster a positive educational environment. The findings confirmed this, demonstrating that strategic planning, teacher support, and stakeholder engagement contribute to education quality. Effective management enhances institutional efficiency, promotes teacher motivation, and fosters collaboration, ultimately benefiting student outcomes. These results align with the Educational Effectiveness Theory, which highlights governance as a crucial determinant of school performance. Additionally, the study illustrates that in fragile educational systems, strong leadership can mitigate infrastructural deficiencies, underscoring the complementary role of managerial effectiveness (Agyei et al., 2024).

The study supports the Systems Theory of Education, which suggests that school inputs, including infrastructure and leadership, interact to shape outcomes. The findings reinforce that schools operate as ecosystems where physical and managerial resources must align to optimize student achievement. By confirming this framework, the study advances discussions on the interconnectedness of school environment factors in shaping learning outcomes.

The practical implications are significant for policymakers, administrators, and development organizations. The confirmation of H_1 underscores the urgency of infrastructure development in schools. Policymakers should allocate resources to improve facilities, ensuring students have safe, well-equipped learning environments. Public-private partnerships could help address infrastructural deficits, promoting sustainable improvements.

Similarly, the confirmation of H_2 highlights the need for leadership capacity-building programs. Educational institutions should invest in training initiatives that equip administrators with skills to enhance institutional performance. Leadership programs should focus on strategic decision-making, resource management, and instructional leadership to drive improvements. The study also emphasizes teacher empowerment and professional development as essential components of effective school management.

In a broader context, these findings contribute to global educational policy discussions, particularly those aligned with the United Nations Sustainable Development Goal 4 (SDG 4), which aims to ensure inclusive and equitable quality education (Wu, 2024). The study underscores the need for holistic reform strategies integrating infrastructure development with leadership enhancement. Policymakers should adopt an approach combining physical investments with governance mechanisms to create sustainable learning environments.

Furthermore, the findings highlight the role of international organizations in supporting educational initiatives in regions facing infrastructural and administrative challenges. Financial and technical assistance from these organizations can bridge gaps between policy aspirations and practical implementation, ensuring effective reforms.

By integrating ethical safeguards such as confidentiality and triangulation techniques, the study enhances result reliability. These measures strengthened participant trust and engagement. Future research should explore the long-term impact of infrastructural and managerial interventions on student outcomes, using diverse methodologies to deepen understanding of effective school improvement strategies.

In conclusion, the study provides compelling evidence that school infrastructure and management leadership significantly influence education quality. The confirmation of these hypotheses reinforces educational effectiveness models while offering actionable insights for policymakers and practitioners. Sustainable educational improvements require a comprehensive approach integrating infrastructure development with leadership enhancement. Future research should continue examining these dynamics to inform policy decisions and strengthen educational systems globally. Table 1.1 below shows the demographics of respondents.

The demographic profile of the respondents, as outlined in Table 1, reveals a predominantly young, male, and highly educated sample. Most respondents are male (74.8%), indicating a significant gender disparity, with females representing 25.2%. In terms of age, 74.8% of the respondents are within the 18–29 age group, reflecting a predominantly youthful population, while 24.4% fall within the 30–39 age group, and only 0.8% are aged 40–49, indicating limited representation of older individuals.

Educational qualifications highlight a well-educated sample, with 74.4% holding a bachelor's degree and 13.0% possessing a master's degree. Meanwhile, 7.1% have a diploma, and 5.5% have completed secondary education. This data underscores the dominance of respondents with higher levels of education.

4 Findings and results

The results of the measurement model, as presented in Table 2, confirm the reliability and validity of the constructs—School Physical Infrastructure (SPI), School Management and Leadership (SML), and Quality of Education (QE)—through detailed assessment of their measurement items. All item loadings exceed the acceptable threshold of 0.60, indicating that they significantly contribute to their respective constructs. The loadings for SPI range from 0.684 to 0.816, while those for SML and QE range from 0.627 to 0.838 and 0.812 to 0.884, respectively, with QE demonstrating particularly robust item loadings. The reliability analysis further supports these findings, with Cronbach's Alpha values above 0.70 for all constructs, ensuring internal consistency. SPI records Cronbach's Alpha of 0.817, SML achieves 0.759, and QE demonstrates the highest reliability at 0.898. Similarly, Composite Reliability (CR) values for SPI (0.872), SML (0.835), and QE (0.924) all exceed the recommended threshold of 0.70, reinforcing the constructs' consistency and reliability. Furthermore, the Average

Variance Extracted (AVE) values—SPI at 0.578, SML at 0.507, and QE at 0.710—meet or exceed the standard of 0.50, confirming adequate convergent validity. Thus, the measurement model is strongly validating the constructs as well-represented by their respective items and suitable for further analysis within the study.

The Figure 2 shows the Structural Equation Model of the Influence of School Physical Infrastructure and School Management and Leadership on Quality Education.

- School Physical Infrastructure (SPI):
 - a Independent variable representing resources such as classrooms, libraries, and sanitation facilities.
 - b Linked to eight indicators (SPI1–SPI8) with factor loadings (e.g., 0.765, 0.813) showing their contribution to SPI.
- School Management and Leadership (SML):
 - a Independent variable reflecting leadership practices like decision-making and resource management.
 - b Measured through eight indicators (SML1–SML8) with corresponding factor loadings (e.g., 0.778, 0.874).
- Quality Education (QE):
 - a Dependent variable capturing outcomes like student performance and engagement.
 - b Assessed using five indicators (QE1–QE5) with factor loadings (e.g., 0.912, 0.856).
- Path Coefficients:
 - a SPI → QE: Stronger impact (0.496).
 - b SML → QE: Moderate impact (0.342).

The structural model depicted in Figure 2 above examines the relationships between School Physical Infrastructure (SPI), School Management and Leadership (SML), and their combined impact on Quality Education (QE). Each construct is measured by multiple items with standardized loadings, reflecting the reliability and validity of the measurement model. For SPI, the loadings range from 0.684 to 0.814, while for SML, the range is between 0.627 and 0.838, and QE exhibits particularly strong loadings, ranging from 0.812 to 0.884. The structural relationships reveal that SPI has a moderate positive effect on QE, with a path coefficient of 0.342, suggesting that improvements in infrastructure, such as classrooms and facilities, positively influence education quality. In contrast, SML has a stronger positive effect on QE, with a path coefficient of 0.486, highlighting the critical role of effective leadership and management in enhancing educational outcomes. These findings underscore the importance of addressing both physical and administrative factors to improve the quality of education, with SML exerting a greater influence. The model offers a robust foundation for further analysis and provides valuable insights for educational policymakers and administrators in making strategic decisions to optimize educational quality.

The discriminant validity results presented in Table 3 evaluate the distinctiveness of the constructs—School Physical Infrastructure (SPI), School Management and Leadership (SML), and Quality Education (QE)—within the measurement model. Discriminant validity is determined by comparing the correlations between constructs to ensure that each measures a unique aspect of the framework and does not overlap significantly with others. The

TABLE 1 Demographics of respondents.

Variable	Response type	Frequency	Percent (%)
Gender	Male	178	74.8
	Female	60	25.2
Age	18–29	178	74.8
	30–39	58	24.4
	40–49	2	0.8
Educational level	Secondary	13	5.5
	Diploma	17	7.1
	Bachelor	177	74.4
	Master	31	13.0

TABLE 2 Measurement model (loading).

	Items	Loadings	Cronbach's Alpha	Composite reliability	The average variance extracted (AVE)
School physical infrastructure	SPI ₁	0.721	0.817	0.872	0.578
	SPI ₂	0.684			
	SPI ₃	0.816			
	SPI ₄	0.808			
	SPI ₅	0.763			
	SPI ₆	0.813			
	SPI ₇	0.814			
	SPI ₈	0.765			
School management and leadership	SML ₁	0.777	0.759	0.835	0.507
	SML ₂	0.653			
	SML ₃	0.838			
	SML ₄	0.638			
	SML ₅	0.627			
	SML ₆	0.786			
	SML ₇	0.657			
	SML ₈	0.805			
Quality education	QE1	0.812	0.898	0.924	0.710
	QE2	0.856			
	QE3	0.884			
	QE4	0.825			
	QE5	0.846			

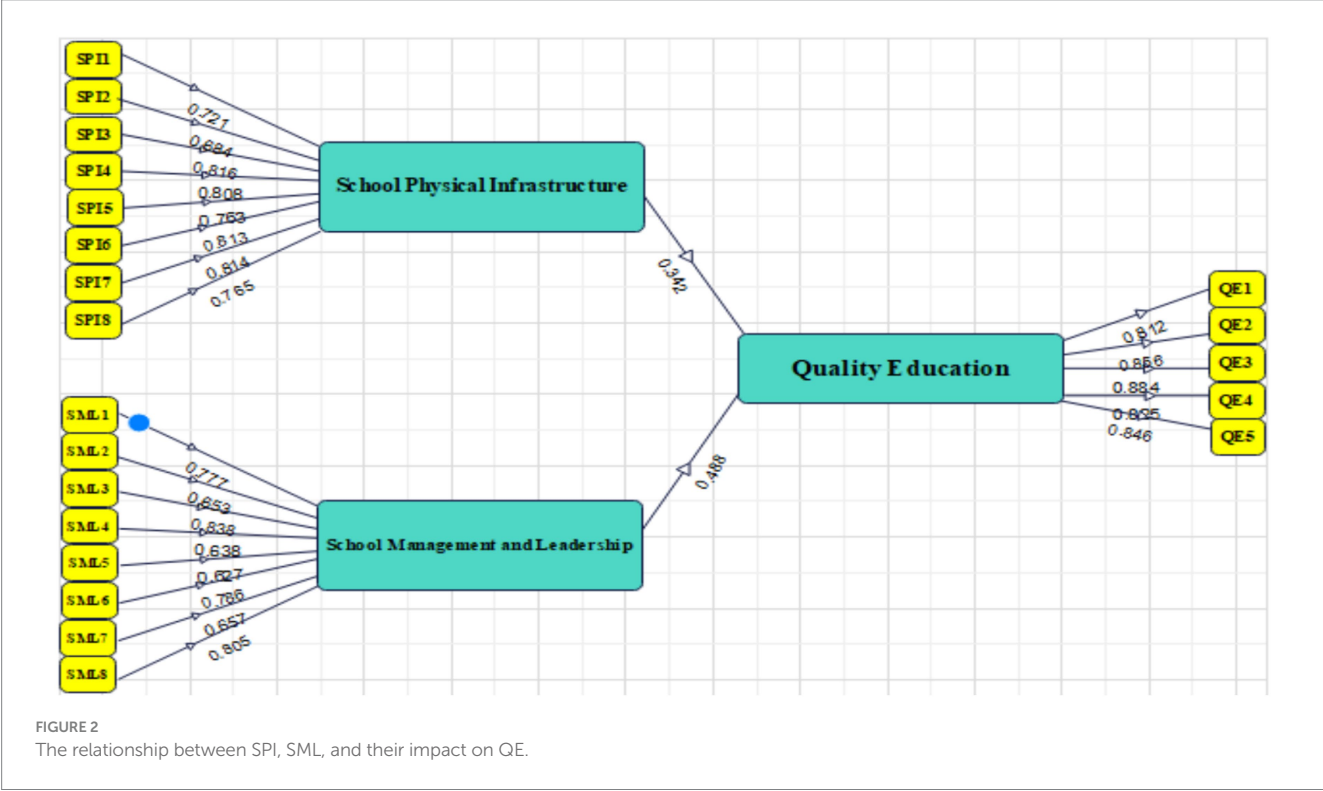


FIGURE 2 The relationship between SPI, SML, and their impact on QE.

correlation between SPI and SML is 0.658, indicating a moderate relationship, while the correlation between SPI and QE is higher at 0.778, suggesting a stronger association between physical infrastructure and quality education. Similarly, the correlation between SML and QE is 0.701, reflecting a moderate to strong relationship and emphasizing the influence of effective leadership and management on educational outcomes.

Despite these correlations, the constructs remain sufficiently distinct, satisfying the criteria for discriminant validity. This demonstrates that each construct captures a unique dimension of the educational framework, enhancing the reliability and precision of the model. These findings highlight the importance of considering SPI, SML, and QE as separate yet interrelated factors, providing a nuanced understanding of their roles in shaping educational quality and reinforcing the strength of the model for further analysis and interpretation.

Table 4 demonstrates the Heterotrait-Monotrait Ratio (HTMT) as a measure of discriminant validity, with all values below the accepted threshold of 0.85, confirming that the constructs—School Physical Infrastructure (SPI), School Management and Leadership (SML), and Quality Education (QE)—are sufficiently distinct. The HTMT values between SPI and SML (0.529), SPI and QE (0.676), and SML and QE (0.610) indicate low to moderate relationships, validating their independence. Additionally, the internal consistency values for each construct, shown on the diagonal, are within acceptable ranges (SPI: 0.760, SML: 0.712, QE: 0.843), further supporting the reliability of the model. These findings confirm the robustness of the measurement model in accurately capturing unique aspects of the educational framework, ensuring valid and interpretable results.

Table 5 above, summarizes the path analysis results, confirming the significant influence of School Physical Infrastructure (SPI) and School Management and Leadership (SML) on Quality Education (QE). For Hypothesis 1 (H_1), the path from SPI to QE demonstrates a strong positive relationship, with a beta coefficient of 0.491, a t-value of 6.468, and a statistically significant p -value of 0.000, underscoring the substantial impact of physical infrastructure on education quality. Similarly, Hypothesis 2 (H_2) shows a moderately positive relationship

between SML and QE, with a beta coefficient of 0.350, a t-value of 4.733, and a p -value of 0.000, indicating the critical role of effective management and leadership in enhancing educational outcomes. These results validate the importance of both physical infrastructure and leadership practices in improving the quality of education, with SPI having a stronger influence. The findings highlight the need for strategic investments in both areas to achieve meaningful and sustainable improvements in educational outcomes.

5 Discussion

This study underscores the critical role of the school environment, particularly physical infrastructure and management practices, shaping the quality of education. Drawing from established theoretical frameworks and empirical evidence, the findings highlight the interconnected influence of School Physical Infrastructure (SPI) and School Management and Leadership (SML) on Quality Education (QE). While both SPI and SML significantly contribute to educational outcomes, their impacts vary in magnitude. The path analysis results indicate that SPI exerts a stronger positive influence ($\beta = 0.491$, $p = 0.000$) on QE, underscoring the necessity of well-maintained classrooms, adequate facilities, and conducive learning environments to enhance student engagement and academic performance. This aligns with previous studies, which have established that high-quality physical learning environments foster student motivation and reduce absenteeism (Barrett et al., 2015).

Similarly, SML plays an essential role in fostering a supportive educational atmosphere, demonstrating a significant positive relationship with QE ($\beta = 0.350$, $p = 0.000$). Effective leadership, characterized by strategic resource allocation, evidence-based decision-making, and collaborative school culture, emerges as a fundamental determinant of educational quality. These findings are congruent with the Educational Effectiveness Theory which posits that both contextual factors (e.g., infrastructure) and procedural factors (e.g., leadership) must operate in concert to optimize educational outcomes. Supporting literature highlights that strong school leadership is a key driver of teacher effectiveness and student success, particularly in resource-limited educational settings (Creemers and Kyriakides, 2007; Patterns, 2023).

The implications of these findings are especially pertinent in Mogadishu, where schools grapple with persistent challenges such as inadequate infrastructure and limited administrative capacity. Overcrowded classrooms, poor ventilation, and insufficient facilities undermine student learning experiences, while ineffective leadership further exacerbates these issues, leading to institutional disorganization and diminished morale. Addressing these deficiencies requires targeted interventions, including strategic investments in school infrastructure and comprehensive leadership training programs. Research suggests that leadership development initiatives can substantially improve school performance and student learning

TABLE 3 Discriminant validity.

	SPI	SML	QE
SPI			
SML	0.658		
QE	0.778	0.701	

TABLE 4 Heteotrait Monotrait Ratio (HTMT).

	SPI	SML	QE
SPI	0.760		
SML	0.529	0.712	
QE	0.676	0.610	0.843

TABLE 5 Results of path analysis/summary of hypothesis testing.

Hypothesis	Path	Relation	Beta	T values	p value	Decision
H_1	SPI - > QE	0.490695818	0.327418	6.467513	0	Accepted
H_2	SML - > QE	0.350267168	0.212253	4.7334	0	Accepted

outcomes (Bush and Glover, 2003; Dirie, 2024). Therefore, adopting a dual-pronged approach that integrates infrastructural advancements with leadership capacity-building is essential for fostering a sustainable educational environment that enhances both teaching effectiveness and student achievement.

Beyond its local significance, this study contributes to the broader discourse on educational quality by reinforcing the necessity of holistic school improvement strategies. International evidence suggests that the simultaneous enhancement of physical infrastructure and leadership capacity leads to long-term gains in school performance (Emmanuel and Omole, 2023). Policymakers and educational stakeholders should consider implementing comprehensive strategies that address both physical and administrative components to ensure sustainable educational progress.

Despite the valuable insights derived from self-reported data from educators and administrators, potential biases such as social desirability bias, recall bias, and response exaggeration may affect the reliability of the findings. To mitigate these biases, survey questions were meticulously designed for clarity and neutrality, reducing the likelihood of leading responses. Furthermore, triangulation techniques incorporating secondary data and observational reports were employed to validate the findings, while assurances of confidentiality encouraged candid responses. Statistical methodologies, including outlier detection and consistency checks, further bolstered data reliability, ensuring the study's findings offer a robust contribution to understanding the impact of school environments on educational quality. By integrating these methodological safeguards, this study strengthens the empirical foundation for improving educational environments through infrastructural and administrative enhancements.

These findings underscore the necessity of holistic interventions that combine physical infrastructure improvements with leadership development to create sustainable, high-quality educational systems that support student achievement and institutional effectiveness. Future research should explore longitudinal studies to examine the sustained impact of infrastructural and managerial improvements on educational outcomes, offering a more comprehensive perspective on effective school development strategies.

6 Conclusion

This study underscores the pivotal role of the school environment—specifically, School Physical Infrastructure (SPI) and School Management and Leadership (SML)—in shaping the provision of quality education in Mogadishu, Somalia. The findings confirm that both SPI and SML significantly influence Quality Education (QE), though SPI exerts a stronger impact. Adequate physical infrastructure, including well-maintained classrooms, libraries, and laboratories, directly enhances students' learning experiences, fostering higher engagement, improved performance, and greater academic success. Simultaneously, effective school management and leadership practices, encompassing strategic decision-making, resource allocation, and the promotion of a collaborative school culture, contribute significantly to the creation of a conducive learning environment.

The study's results also highlight the importance of maintaining distinct yet interrelated constructs in the educational framework, as evidenced by the robust measurement model, which confirmed the reliability, validity, and discriminant independence of SPI, SML, and QE. Hypothesis testing further validated the strong positive

relationships between these constructs, emphasizing that improving both physical infrastructure and leadership practices is essential for achieving sustainable improvements in educational outcomes.

The findings from this study can be generalized to broader educational contexts, particularly in regions facing similar infrastructural and managerial challenges including Urban and Rural Disparities, Post-Conflict and Fragile State Education Systems and Developing Nations and Low-Resource Educational Systems.

7 Recommendation

To address deficiencies in school infrastructure and management practices and improve educational quality in Mogadishu, the following targeted actions are recommended:

- (a) Invest in physical infrastructure: Prioritize the construction and renovation of classrooms, libraries, laboratories, and sanitation facilities. Resolving issues like overcrowding, poor ventilation, and inadequate resources will create a learning environment conducive to student engagement and academic success.
- (b) Enhance school leadership and management: Implement capacity-building programs to equip school leaders with skills in strategic planning, resource management, and community engagement. Effective leadership is crucial for fostering collaboration, motivating staff, and implementing policies that enhance educational outcomes.
- (c) Foster community and stakeholder collaboration: Encourage active involvement of parents, communities, and stakeholders to build a shared commitment to educational improvement. Such collaboration can improve resource mobilization and create a supportive ecosystem for students and teachers.
- (d) Promote equity and inclusivity: Address disparities in access to education by focusing on marginalized groups, particularly female students. Initiatives should ensure equitable learning opportunities, foster inclusivity, and adopt gender-sensitive approaches to promote fairness in education.
- (e) Develop monitoring and evaluation mechanisms: Establish regular assessment systems for school infrastructure and leadership effectiveness. These evaluations will provide insights into timely interventions and effective resource allocation.
- (f) Strengthen teacher development: Offer professional development programs to enhance pedagogical skills, incorporate modern teaching tools, and foster collaborative practices. Well-trained and motivated teachers are critical to delivering quality education.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies were approved by the Center research development Ethics committee. The studies were conducted in accordance with the

local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the owners for the participation of their animals in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MI: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AO: Writing – original draft, Writing – review & editing. MJM: Writing – original draft, Writing – review & editing. AH: Writing – original draft, Writing – review & editing. MMOM: Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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