

Learning Environment, Accessibility to Teaching, Learning Facilities, and Academic Performance of Secondary School Students: A Review of Theoretical and Empirical Evidence

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Abstract

The quality of the school learning environment and the accessibility of teaching and learning facilities are widely regarded as fundamental determinants of secondary school students' academic performance, yet debate persists over the size and consistency of their effect once other factors are taken into account. This paper undertakes an integrative review of the theoretical and empirical literature on the relationship between learning environment, facility accessibility and academic performance among secondary school students. The review is anchored in the education production function, which conceptualises schooling as a process converting educational inputs into learning outputs, and in Fraser's classroom and school learning environment framework, which specifies the physical, psychological, social and instructional dimensions through which the school setting shapes student engagement and achievement. Empirical evidence is drawn from studies conducted in Nigeria, Ghana and other jurisdictions, including large administrative-data studies and school-level surveys, to evaluate the strength and consistency of the relationship between

infrastructure, learning environment quality and academic outcomes. The review finds that classroom and learning-space adequacy, seating and writing facilities, and equitable distribution of infrastructure are consistently associated with academic performance, while also noting that some inputs, such as class size, show more complex, non-linear relationships with outcomes, and that infrastructure effects operate partly through continuous instructional time and partly through student motivation and engagement. The paper concludes with recommendations for school administrators and policymakers on strengthening the learning environment and equitable access to teaching and learning facilities as a foundation for improved academic performance.

Keywords: learning environment, teaching and learning facilities, accessibility, academic performance, secondary school students, education production function

1.0 Introduction

1.1 Background to the Study

The academic performance of secondary school students is shaped not only by individual ability and effort but also by the physical, psychological, social and instructional conditions under which learning takes place. The concept of the learning environment captures this wider set of conditions, encompassing classroom facilities, school climate, teacher-student and peer relationships, and the instructional strategies through which teaching and learning occur (Fraser, 1998). A substantial body of theory and evidence indicates that where these conditions are inadequate, students' capacity to engage with and benefit from instruction is correspondingly diminished, regardless of the quality of the curriculum being delivered.

Closely related to the learning environment is the accessibility of teaching and learning facilities, including classrooms, seating and writing places, libraries, laboratories, and instructional materials. Economists of education have long conceptualised schooling as a production process in which such facilities function as inputs that combine with teaching quality and student effort to generate academic

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achievement as an output (Coleman, 1966; Hanushek, 1998). This education production function tradition, while contested in its details, has generated a large empirical literature investigating whether, and under what conditions, investment in school infrastructure and facilities translates into measurable gains in student performance.

In Nigeria and other West African countries, concerns about the adequacy of school infrastructure remain acute. Recent Nigerian empirical studies report continuing shortfalls in classroom space, seating and writing facilities, and instructional materials across public secondary schools (Olaleye et al., 2025), while research in Ghana has documented substantial inequality in the distribution of educational infrastructure across districts, with measurable consequences for academic performance in national examinations (Agyei et al., 2024). These findings echo a wider international literature, including evidence from the United States, showing that facility conditions are systematically related to school-level academic outcomes (Beauregard & Ayer, 2018).

Despite this substantial body of research, important questions remain about the precise mechanisms through which the learning environment and facility accessibility influence academic performance, about the relative importance of different categories of infrastructure, and about the conditions under which investment in facilities yields the greatest returns. This paper undertakes a systematic theoretical and empirical review of these questions, with particular attention to the Nigerian and West African evidence read against the wider international literature.

Within the Nigerian policy landscape, responsibility for secondary school infrastructure is distributed across federal, state and local government tiers, alongside individual school-based management committees, resulting in considerable variation in the pace and consistency of infrastructure investment from one state to another. Universal Basic Education Commission interventions and state-level capital projects periodically address specific infrastructure deficits, but the absence of a uniformly enforced national minimum standard for classroom, seating and library provision means that the adequacy of the learning environment available to secondary school students in Nigeria can differ substantially depending

on their state and local government area of residence. This variability itself constitutes part of the rationale for a systematic review that draws together the available evidence across contexts so that school administrators and policymakers operating in differently resourced settings can draw on a common evidence base.

1.2 Statement of the Problem

Although the intuitive case for investing in school infrastructure is strong, the empirical literature on the relationship between facility accessibility and academic performance is not uniformly conclusive. Some studies find robust positive relationships between infrastructure and performance, while others, reviewed within the education production function tradition, have historically questioned whether school resources exert an effect independent of family and social background once such factors are properly accounted for (Coleman, 1966). This creates a genuine problem for school administrators and policymakers operating under conditions of scarce resources; without clarity on which dimensions of the learning environment and which categories of facility most reliably predict academic performance, investment decisions risk being made on the basis of general intuition rather than a rigorous reading of the evidence. This paper addresses this problem by systematically reviewing the theoretical and empirical literature on learning environment, facility accessibility and academic performance, with a view to clarifying where the evidence is strong, where it is mixed, and what this implies for the design of school infrastructure policy in Nigeria and comparable settings.

The problem is compounded, within the Nigerian context specifically, by the coexistence of severe infrastructure deficits in many public secondary schools with limited systematic data on the precise relationship between specific facility categories and subject-level academic outcomes. Where such data exist, they are frequently confined to single local government areas, limiting their generalisability, while national and state-level infrastructure planning decisions must nonetheless be made in the absence of a comprehensive evidence base of the kind that has informed infrastructure policy debates in better-documented contexts such as Ghana and the United States. This paper's integrative review, drawing together Nigerian, Ghanaian

and international evidence, is intended as one contribution towards closing that evidence gap for policy purposes.

1.3 Objectives of the Study

The broad objective of this paper is to examine the relationship between learning environment, accessibility to teaching and learning facilities, and academic performance among secondary school students. The specific objectives are to:

- i. examine the theoretical foundations that explain how the learning environment and the accessibility of teaching and learning facilities influence students' academic performance;
- ii. evaluate the empirical evidence on the relationship between the quality of the school learning environment, the accessibility of teaching and learning facilities, and academic performance among secondary school students; and
- iii. identify the structural and policy factors that constrain or strengthen equitable access to a conducive learning environment and adequate teaching and learning facilities in secondary schools.

1.4 Research Questions

The paper is guided by the following research questions:

- i. What theoretical frameworks explain how the learning environment and the accessibility of teaching and learning facilities influence students' academic performance?
- ii. What does the empirical evidence reveal about the relationship between the quality of the school learning environment, the accessibility of teaching and learning facilities, and academic performance among secondary school students?
- iii. What structural and policy factors constrain or strengthen equitable access to a conducive learning environment and adequate teaching and learning facilities in secondary schools?

1.5 Research Hypotheses

Drawing on the theoretical and empirical literature reviewed in this paper, the following hypotheses are proposed as testable propositions for future primary empirical research; they are not tested with new primary data in the present review-based paper.

- i. There is no significant relationship between the quality of the school learning environment and the academic performance of secondary school students.
- ii. There is no significant relationship between the accessibility of teaching and learning facilities and the academic performance of secondary school students.
- iii. The equity of the distribution of educational infrastructure across schools has no significant effect on disparities in academic performance among secondary school students.

1.6 Significance of the Study

This paper is significant for a range of stakeholders in secondary education.

- i. For students, the paper clarifies how the quality of their physical and instructional surroundings shapes their capacity to learn, providing a rationale for their engagement with efforts to improve school conditions.
- ii. For teachers and school administrators, the paper offers an evidence-informed basis for prioritising specific dimensions of the learning environment and facility provision within constrained school budgets.
- iii. For ministries of education and policymakers, the paper provides comparative evidence on the returns of infrastructure investment and on the specific problem of inequitable distribution of facilities across schools and districts.
- iv. For parents and communities, the paper underscores the shared responsibility for advocating adequate school facilities as a foundation for their children's academic success.
- v. For researchers, the paper identifies specific gaps in the literature, particularly the need for further Nigerian studies employing rigorous

designs capable of isolating the independent effects of infrastructure from other correlated factors, and proposes testable hypotheses to guide future research.

1.7 Scope of the Study

The paper is a theoretical and empirical review focused on the relationship between the school learning environment, the accessibility of teaching and learning facilities, and academic performance among secondary school students. It draws primarily on Nigerian and Ghanaian empirical studies, supplemented by international evidence, particularly from the United States, to situate the West African experience within a broader comparative context. The review does not extend to higher education or to purely pedagogical questions of curriculum and teaching method that are unrelated to the physical and infrastructural learning environment.

2.0 Conceptual Clarification

2.1 Concept of the Learning Environment

The learning environment refers to the physical, psychological, social and instructional conditions within which teaching and learning take place, including classroom facilities, school climate, teacher-student and peer relationships, and the pedagogical strategies employed by teachers (Fraser, 1998). Fraser's programme of research on classroom environments has demonstrated that students' perceptions of their learning environment are systematically associated with their attitudes, motivation and, ultimately, their academic achievement, establishing the learning environment as a legitimate object of empirical measurement and policy attention in its own right, rather than a vague background condition.

2.2 Concept of Teaching and Learning Facilities

Teaching and learning facilities refer to the physical infrastructure and instructional resources that support the delivery of education, including classrooms, seating and writing places, libraries, laboratories, textbooks and other instructional materials, and information and communication technology resources. Within the education

production function tradition, such facilities are treated as inputs to the schooling process, alongside teacher quality and student characteristics, that combine to generate academic performance as a measurable output (Hanushek, 1998).

2.3 Concept of Accessibility

Accessibility, in the context of teaching and learning facilities, refers to the extent to which students are able to reach, use and benefit from available educational infrastructure and resources, encompassing both the physical availability of facilities within a school and their equitable distribution across schools and districts. A facility that exists but is unevenly distributed, for instance, concentrated in urban or better-resourced schools, produces disparities in accessibility even where aggregate national provision appears adequate (Agyei et al., 2024).

2.4 Concept of Academic Performance

Academic performance refers to the measurable level of a student's achievement in educational activities, commonly assessed through examination results, continuous assessment scores, and pass rates in standardised or public examinations. Within the education production function tradition, academic performance is conceptualised as the output of the schooling process, generated through the interaction of educational inputs, including facilities and the learning environment, with student effort and teacher quality (Coleman, 1966; Agyei et al., 2024).

2.5 Learning Environment, Facility Accessibility and Academic Performance: The Conceptual Nexus

The conceptual link between these constructs rests on the proposition that academic performance is not solely a function of individual student ability but is jointly produced by the interaction of student characteristics with the material and psychosocial conditions of schooling. A well-designed curriculum delivered by a competent teacher can be substantially undermined by overcrowded classrooms, inadequate seating, or the absence of basic instructional materials, just as an excellent physical environment cannot by itself compensate for poor teaching. The learning environment and facility accessibility should therefore be understood as

necessary, though not sufficient, conditions for the translation of teaching effort into academic achievement.

3.0 Theoretical Framework

Two theoretical frameworks are particularly relevant to explaining how the learning environment and facility accessibility influence academic performance: the education production function and Fraser's learning environment framework. Both are reviewed below, followed by a discussion of the integrated framework adopted for this paper.

3.1 The Education Production Function

The education production function, drawn from microeconomic theory, conceptualises schooling as a process in which a combination of inputs, such as school infrastructure, class size, instructional materials and teacher quality, is transformed into measurable outputs, typically operationalised as test scores or examination pass rates. The tradition traces its origins to the Coleman Report (Coleman, 1966), an influential large-scale United States study of educational opportunity, which controversially found that school resources explained comparatively little of the variation in student achievement once family and social background were accounted for, a finding that has generated decades of subsequent research either refining, qualifying or contesting the original conclusion (Hanushek, 1998). Contemporary applications of the education production function, including recent West African studies, have found more robust and consistent effects of specific infrastructure inputs, such as classroom and seating adequacy, than the earliest studies in this tradition suggested (Agyei et al., 2024).

3.2 Fraser's Learning Environment Framework

Fraser's (1998) learning environment framework, developed through several decades of classroom environment research, specifies that the school and classroom setting can be understood along physical, psychological, social and instructional dimensions, each of which is measurable through validated survey instruments capturing students' and teachers' perceptions of their environment. Unlike the

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education production function, which treats inputs largely as objective, countable quantities, Fraser's framework emphasises the mediating role of subjective perception: it is not simply the objective presence of a facility but students' and teachers' experience of the environment it creates that shapes engagement, motivation and, ultimately, achievement. This perceptual dimension helps to explain why the relationship between infrastructure and performance in the empirical literature is not always mechanically linear.

3.3 Complementary Perspective: Ecological Systems Theory

A further perspective relevant to understanding the learning environment is Bronfenbrenner's (1979) ecological systems theory, which conceptualises individual development, including academic development, as shaped by nested layers of environmental influence, ranging from the immediate microsystem of the classroom to broader institutional and societal systems. Applied to the present review, ecological systems theory usefully situates the school-level learning environment and facility accessibility within a wider set of influences, including family, community and national education policy, cautioning against treating school infrastructure as the sole determinant of academic performance even as this paper focuses specifically on that dimension of the broader ecology of student achievement.

3.4 Theoretical Framework Adopted for the Study

Table 1: Summary of the Theoretical Framework. Source: Author's compilation (2026).

Theory	Core Proposition	Relevance to Learning Environment and Facility Accessibility
Education Production Function (Coleman, 1966; Hanushek, 1998)	Academic performance is an output generated by combining measurable educational inputs, including infrastructure, with teacher quality and student effort.	Provides the framework for empirically estimating the effect of specific facilities, such as classrooms and seating places, on measurable performance outcomes.
Learning Environment Framework (Fraser, 1998)	The physical, psychological, social and instructional dimensions of the school setting shape student engagement and achievement, partly through subjective perception.	Explains why facility effects on performance are mediated by students' and teachers' experience of the environment, and not solely by objective input quantities.

This paper adopts an integrative framework combining the education production function and Fraser's learning environment framework. The production function perspective supplies the empirical logic for treating facilities as measurable inputs whose relationship to performance outputs can be estimated and compared, while Fraser's framework supplies the psychosocial mechanism, namely perceived environmental quality and engagement, through which those inputs translate into student effort and, ultimately, achievement. Read together, the two frameworks suggest that policy attention should extend beyond the mere physical provision of facilities to encompass how such facilities are experienced and used by students and teachers in the everyday life of schools.

4.0 Review of Related Literature

This section reviews thematic strands of the literature relevant to the learning environment, facility accessibility and academic performance of secondary school students.

4.1 Classroom and Seating Adequacy

A recurring finding across the literature is that the adequacy of basic classroom infrastructure, including classroom space and, more specifically, seating and writing places, is among the most consistently significant predictors of academic performance, often more consistently significant than more elaborate categories of infrastructure. Agyei et al. (2024) found that the quality of seating and writing place provision was the primary driver of the positive relationship between aggregate infrastructure quality and examination performance across Ghanaian districts, a finding they attribute to the direct role such facilities play in enabling sustained concentration and participation during lessons.

4.2 Class Size and the Pupil-Teacher Ratio

Class size, commonly proxied in large-scale studies by the pupil-to-teacher ratio, has a more complex relationship with academic performance than simple linear models suggest. While smaller classes are conventionally associated with better performance, recent evidence indicates that this relationship may be non-monotonic, with performance initially declining and then improving as class size increases beyond a certain threshold. This pattern is attributed to teachers switching from individualised to peer-based instructional strategies as classes grow larger (Agyei et al., 2024). This finding cautions against treating class-size reduction as an automatically superior policy lever independent of the instructional strategies teachers adopt in response.

4.3 Equity in the Distribution of Educational Infrastructure

Beyond the aggregate relationship between infrastructure and performance, a growing strand of literature examines the equity of infrastructure distribution across schools and districts. Agyei et al. (2024) found substantial disparities in

infrastructure quality across Ghanaian districts, with districts in the higher infrastructure quintiles recording significantly better academic performance than those in the lowest quintile, indicating that aggregate national infrastructure statistics can obscure significant within-country disparities that themselves become drivers of unequal academic outcomes across regions.

4.4 Facility Management and Maintenance

The literature also distinguishes between the initial provision of facilities and their ongoing management and maintenance, arguing that poorly maintained facilities can fail to deliver the expected performance benefits even where initial infrastructure investment was adequate. Beauregard and Ayer (2018), in a study of facility management practices in schools in the state of Arizona in the United States, found that the quality of ongoing facility management, and not merely the initial condition of school buildings, was systematically related to school-level academic performance, underscoring maintenance and management as a distinct policy lever from initial capital investment.

4.5 Teacher Quality as a Complementary Input

The education production function literature consistently emphasises that facility quality does not operate in isolation from teacher quality and that the two inputs are best understood as complementary rather than substitutable. Darling-Hammond's (2000) review of state-level policy evidence found that measures of teacher quality were among the strongest predictors of student achievement in the United States context, a finding that qualifies any interpretation of the infrastructure literature as suggesting that facilities alone can drive performance improvements independent of the quality of instruction delivered within them.

4.6 The Psychosocial Dimension of the Learning Environment

Consistent with Fraser's (1998) framework, the literature indicates that the psychosocial dimensions of the learning environment, including school climate, teacher-student relationships, and students' sense of safety and belonging, mediate the relationship between physical infrastructure and academic outcomes. Lackney's

(1994) synthesis of research on the physical environment of schools argued that the built environment influences student achievement partly through direct effects on comfort and concentration and partly through indirect effects on morale, attendance and behaviour, a dual pathway that helps explain why infrastructure effects in empirical studies are not always straightforwardly proportional to capital investment.

4.7 Libraries, Laboratories and ICT Resources

Beyond core classroom infrastructure, the literature also considers the role of specialised facilities, including libraries, science laboratories and information and communication technology resources, in supporting academic performance, particularly in subjects with strong practical or research components. While the empirical evidence on these specialised categories is generally less extensive than that on classrooms and seating, the underlying logic of the education production function suggests that their absence constrains the range of instructional strategies available to teachers and the range of independent learning activities available to students, even where core classroom infrastructure is adequate. Fraser's (1998) framework similarly suggests that the instructional dimension of the learning environment, which encompasses the variety and quality of learning activities a school can support, depends substantially on the presence of such specialised facilities.

5.0 Empirical Review

This section reviews specific empirical studies relevant to learning environment, facility accessibility and academic performance, organised by geographical focus.

5.1 Nigerian Empirical Studies

Olaleye et al. (2025), in a study published in the International Journal of Research and Innovation in Social Science, examined the impact of school facilities and class size on students' academic performance in English language in public secondary schools in Ibadan North Local Government Area, Oyo State, Nigeria, using a descriptive survey design with a sample of four hundred senior secondary three

students drawn from a population of over thirteen hundred students across ten schools. The study found low academic performance in English language associated with a poor state of school facilities and class size, with both factors research questions confirming students' generally negative assessment of the adequacy of infrastructure available to support their learning.

The Ibadan North study is illustrative of a broader pattern in the Nigerian literature: single-locality, cross-sectional survey studies, typically covering a handful of schools within one local government area, consistently report perceived facility inadequacy alongside comparatively low subject-specific academic performance, but are rarely designed to formally isolate the independent statistical contribution of facilities from other plausible explanatory factors such as teacher qualification, home background or prior attainment. This methodological pattern strengthens the case, developed further in section six, for future Nigerian studies to adopt the kind of multi-school, panel or administrative-data designs that have allowed researchers in Ghana and the United States to more confidently attribute performance differences to specific infrastructure categories.

5.2 Ghanaian Empirical Studies

Agyei et al. (2024), in a large-scale study published in Heliyon, examined education infrastructure inequality and academic performance in Ghana using seven years of district-level administrative data covering two hundred and fifteen districts, drawing on principal component analysis and dynamic panel estimation techniques. The study found that infrastructure quintile, an aggregate measure of infrastructure quality, was positively and significantly associated with performance in mathematics, English and integrated science, with the quality of seating and writing places identified as the primary drivers of this relationship, and further found a statistically significant, non-monotonic relationship between pupil-to-teacher ratio and academic performance, alongside evidence that previous academic performance was itself a significant positive predictor of current performance, consistent with a dynamic, path-dependent process of school improvement.

5.3 International Empirical Evidence

Beauregard and Ayer (2018), in a study published in the journal *Facilities*, examined the relationship between facility management practices and academic performance across K-12 schools in the state of Arizona, United States, and found that schools with stronger facility management practices, encompassing both the condition and the ongoing maintenance of buildings, recorded measurably better academic performance, providing evidence from a well-resourced national context that the effects of facilities on performance are not confined to developing-country settings with severe infrastructure shortfalls.

Darling-Hammond (2000), in a review of state-level policy evidence published in *Education Policy Analysis Archives*, examined the relationship between teacher quality measures and student achievement across United States and found that indicators of teacher preparation and qualification were more strongly associated with student achievement than most other schooling inputs studied, including class size and per-pupil expenditure. This finding contextualises the infrastructure literature by demonstrating that facility investment is best understood as one input among several rather than a stand-alone determinant of academic performance.

5.4 Synthesis of the Empirical Evidence

Taken together, the empirical studies reviewed above indicate a reasonably consistent relationship between core classroom infrastructure, particularly seating and writing facilities, and academic performance, replicated across Nigerian, Ghanaian and United States contexts using markedly different research designs, from small-sample school-level surveys (Olaleye et al., 2025) to large-scale administrative panel data (Agyei et al., 2024) and facility-management case studies (Beauregard & Ayer, 2018). At the same time, the evidence consistently cautions against treating infrastructure as a sufficient condition for improved performance in isolation from teacher quality (Darling-Hammond, 2000) and from the equity of infrastructure distribution across schools and districts (Agyei et al., 2024) and indicates that some inputs, notably class size, exhibit more complex, non-linear relationships with performance than simple policy heuristics assume.

A further observation from the synthesis is that the scale and design of a study appear to shape the strength and clarity of the infrastructure-performance relationship that is detected: the Ghanaian study, benefiting from seven years of district-level panel data across two hundred and fifteen districts, was able to detect statistically robust and disaggregated effects for individual infrastructure categories that smaller, single-locality Nigerian surveys are not designed to isolate. This methodological observation is not a criticism of the smaller-scale Nigerian studies, which remain valuable for capturing localised, context-specific detail, but it does suggest that Nigerian infrastructure policy would benefit from complementary investment in the kind of longitudinal, multi-district data infrastructure that has proved valuable in Ghana.

6.0 Summary of the Review

The theoretical and empirical literature reviewed in this paper converges on several conclusions. First, the education production function and Fraser's learning environment framework together provide a coherent account of how school infrastructure and the broader learning environment shape academic performance, combining an input-output logic with attention to the mediating role of subjective perception and engagement. Second, the empirical evidence, spanning Nigeria, Ghana and the United States, lends consistent support to the proposition that core classroom infrastructure, particularly adequate seating, writing places and classroom space, is significantly associated with academic performance, even though the earliest education production function studies were more sceptical of school-resource effects generally. Third, the relationship between infrastructure and performance is neither uniform nor mechanically linear: class size shows a non-monotonic pattern, teacher quality operates as a complementary rather than substitutable input, and facility management and maintenance matter alongside initial capital provision. Fourth, the equitable distribution of infrastructure across schools and districts, rather than aggregate national provision alone, is an important determinant of disparities in academic performance, a theme most fully developed in the Ghanaian evidence but with clear relevance to the Nigerian context given

similarly documented disparities in facility provision across states and local government areas.

A significant gap in the reviewed literature is the relative scarcity of Nigerian studies employing the kind of large-scale panel or administrative-data designs that have allowed Ghanaian and United States researchers to isolate the effects of specific infrastructure categories and to address concerns about confounding with family and social background. Much of the available Nigerian evidence, including Olaleye et al. (2025), is drawn from single local government areas using cross-sectional survey designs, which, while valuable, cannot fully replicate the causal inference strategies available to studies using multi-year administrative panels. This points to a clear direction for future primary research within the Nigerian context, and underlines the value of the testable hypotheses proposed in section 1.5 of this paper.

7.0 Structural and Policy Constraints on Learning Environment and Facility Accessibility

The literature identifies several structural and policy factors that constrain equitable access to a conducive learning environment and adequate teaching and learning facilities in Nigerian and comparable secondary school systems.

7.1 Inadequate and Unequal Public Funding

Public funding for secondary education infrastructure in many developing countries, including Nigeria, remains inadequate relative to enrolment growth and is frequently distributed unevenly across states, local government areas and urban-rural divides, reproducing the kind of infrastructure inequality documented empirically by Agyei et al. (2024) in the Ghanaian context.

7.2 Deferred Maintenance and Weak Facility Management

Even where initial infrastructure investment occurs, many schools lack the recurrent budget and institutional capacity for ongoing maintenance, leading to the gradual deterioration of classrooms, furniture and instructional facilities, a dynamic

that Beauregard and Ayer's (2018) findings suggest can erode the performance benefits of earlier capital investment over time.

7.3 Large and Growing Enrolment Pressures

Rapid growth in secondary school enrolment, without commensurate expansion of classroom space, has in many contexts produced overcrowding that strains existing seating, writing and instructional facilities, complicating efforts to isolate the specific effects of class size from those of broader facility inadequacy.

7.4 Weak Data Systems for Infrastructure Planning

In contrast to the district-level administrative data available for the Ghanaian study reviewed in this paper (Agyei et al., 2024), many Nigerian states lack comprehensive, regularly updated data systems tracking the condition and distribution of school infrastructure, limiting the capacity of ministries of education to plan equitable infrastructure investment or to evaluate its impact rigorously over time.

7.5 Limited Community and Private-Sector Participation

In many under-resourced districts, community associations, alumni bodies and private philanthropic actors provide a meaningful supplementary source of infrastructure funding and maintenance support, yet mechanisms for coordinating such contributions with government infrastructure planning remain weak in much of Nigeria, resulting in duplication in some schools and continued neglect in others, a pattern that further compounds the equity concerns documented empirically by Agyei et al. (2024) in the Ghanaian context.

7.6 Limited Alignment between Infrastructure Planning and Curriculum Demands

A further constraint, less frequently discussed in the literature but evident from the pattern of findings reviewed in this paper, is the tendency for infrastructure planning to proceed somewhat independently of evolving curriculum demands, particularly the growing emphasis on practical, laboratory-based and digitally

mediated instruction in many national curricula. Where new curriculum requirements are introduced without corresponding infrastructure investment, schools can find themselves formally compliant with a revised curriculum while lacking the physical facilities, such as functioning laboratories or reliable information and communication technology access, needed to deliver it as intended, a mismatch that risks widening rather than narrowing the gap between curriculum aspiration and actual classroom practice.

8.0 Limitations of the Review

As a theoretical and empirical review rather than a primary data-collection study, this paper is subject to certain limitations. First, the Nigerian empirical literature specifically addressing the relationship between learning environment, facility accessibility and academic performance remains more limited in scale and methodological sophistication than the Ghanaian and United States evidence reviewed, requiring some caution in generalising findings across these contexts. Second, the review is narrative and integrative rather than a formal systematic review with pre-registered search protocols and quantitative meta-analysis. Third, how academic performance is measured across studies, from public examination pass rates to continuous assessment scores, complicates direct comparison of effect sizes in the reviewed studies.

9.0 Conclusion and Recommendations

The learning environment and the accessibility of teaching and learning facilities are consistently associated with the academic performance of secondary school students across the Nigerian, Ghanaian and international literature reviewed in this paper, even though the relationship is neither uniform across infrastructure categories nor independent of complementary inputs such as teacher quality. Core classroom infrastructure, particularly seating and writing facilities, emerges as a particularly robust predictor of performance, while class size demonstrates a more complex, non-linear relationship that cautions against simplistic policy heuristics. The equitable distribution of infrastructure across schools and districts, and not

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merely its aggregate national provision, is a further critical determinant of disparities in academic outcomes.

Based on the review, the following recommendations are made:

- i. Ministries of education and school governing bodies should prioritise the provision and maintenance of core classroom infrastructure, particularly adequate seating and writing facilities, given the consistency with which this category of investment is associated with academic performance across the reviewed studies.
- ii. Education planners should pursue the equitable distribution of infrastructure investment across schools, states and local government areas, rather than concentrating investment in already well-resourced urban schools, to address the disparities in academic outcomes linked to unequal facility distribution.
- iii. School authorities should invest in facility management and maintenance systems, and not only in initial capital construction, given the evidence that ongoing management quality independently predicts academic performance.
- iv. Policymakers should approach class-size policy with attention to its interaction with teaching strategy, recognising the non-monotonic relationship between pupil-teacher ratio and performance identified in the empirical literature, rather than treating class-size reduction as a universally superior intervention.
- v. Infrastructure investment should be pursued alongside, rather than as a substitute for, investment in teacher quality, consistent with the evidence that facilities and teaching quality function as complementary rather than substitutable inputs to academic performance.

- vi. State and federal education authorities should develop and maintain comprehensive administrative data systems tracking school infrastructure condition and distribution to support the kind of rigorous, large-scale empirical evaluation that has informed infrastructure policy in comparable contexts such as Ghana.

10.0 Suggestions for Further Studies

Ultimately, the evidence reviewed in this paper suggests that a conducive learning environment and accessible teaching and learning facilities function as a necessary, though not sufficient, foundation for academic performance. School administrators and policymakers who invest deliberately and equitably in this foundation, while sustaining parallel investment in teacher quality and facility maintenance, are best positioned to translate infrastructure spending into measurable and durable gains in student achievement.

For school-level administrators specifically, the practical implication of this review is that even modest, well-targeted improvements to core classroom infrastructure, such as ensuring an adequate ratio of seating and writing places to enrolled students, may yield performance returns that are disproportionate to their cost relative to more expensive but less consistently evidenced categories of investment, such as elaborate technology deployments introduced without corresponding attention to basic classroom adequacy. This does not diminish the long-term value of libraries, laboratories and information and communication technology resources, which remain important for a rounded and modern secondary education, but it does suggest a sequencing logic: securing the foundational classroom environment first, before layering on more specialised facilities, is likely to be the more defensible use of constrained infrastructure budgets in resource-limited school systems.

More broadly, the review suggests that debates over whether school resources matter for academic performance, a question that has recurred in the education production function literature since the Coleman Report, are best resolved not by treating infrastructure as either universally decisive or universally irrelevant but by disaggregating the question: some categories of infrastructure,

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particularly core classroom, seating and writing facilities, show consistent and robust associations with performance across the Nigerian, Ghanaian and international evidence reviewed here, while others show more conditional or complex relationships that depend on complementary factors such as teacher quality, facility management and the equity of distribution across schools. A disaggregated, evidence-led approach of this kind offers school administrators and policymakers a more actionable guide to infrastructure investment than either blanket scepticism or blanket enthusiasm about the value of school facilities.

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