



Impact of classroom environment on senior secondary school students in selected public secondary schools in South-East Nigeria

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Abstract

This study examined the impact of classroom environment on senior secondary school students in selected public secondary schools in South-East Nigeria, with particular emphasis on the mediating role of student academic engagement in the relationship between classroom environment and academic performance. The study conceptualized classroom environment in terms of physical environment, psychosocial climate, and availability of instructional resources, while academic engagement comprised behavioral, emotional, and cognitive engagement. A quantitative cross-sectional correlational design was adopted. The study involved 850 Senior Secondary Two (SS2) students drawn from 85 public secondary schools across Abia, Anambra, Ebonyi, Enugu, and Imo States. Data on classroom environment and student engagement were measured using structured scales adapted from established classroom-environment and engagement instruments, while academic performance was assessed using students' mock examination scores. Attendance rate was incorporated as an additional indicator of participation in schooling. Data were analyzed using descriptive statistics, Pearson product-moment correlation, multiple regression, and mediation analysis with bootstrap estimation. The hypothesized model specified classroom environment as the independent variable, student academic engagement as the mediator, and academic performance as the principal outcome variable, while gender, class size, and teacher qualification were treated as control variables. The analytical framework indicated positive relationships among classroom environment, academic engagement, and academic performance. Improvements in classroom physical conditions, supportive teacher-student and peer relationships, and access to appropriate instructional resources were associated with stronger behavioral, emotional, and cognitive engagement, which in turn was associated with improved academic achievement. The study underscores the importance of viewing classroom environment as a multidimensional educational condition capable of influencing students' participation, motivation, learning experiences, and academic outcomes.

Keywords: Classroom environment, academic engagement, academic performance, psychosocial climate, instructional resources, public secondary schools, South-East Nigeria

Introduction

Education remains one of the most important instruments for human-capital development, social mobility, economic transformation, citizenship formation, and sustainable national development. However, the educational benefits expected from schooling do not arise merely because students are enrolled in schools or physically present in classrooms. The quality of the environment in which teaching and learning occur substantially shapes students' motivation, participation, emotional adjustment, persistence, and academic outcomes. Contemporary educational research increasingly conceptualizes the classroom as an interactive ecological system in which physical facilities, instructional resources, teacher-student relationships, peer interactions, classroom organization, safety, and psychological support combine to influence learning. Consequently, improving student achievement requires attention not only to curriculum content and teacher competence, but also to the environmental conditions under which students encounter teaching and learning activities (OECD, 2023a, 2023c; UNESCO, 2023)^[17].

The concept of classroom environment is multidimensional. It extends beyond the physical structure of the classroom to include the psychological, social, instructional, and organizational circumstances within which students learn.

Earlier classroom-environment scholarship, particularly the work associated with Moos and Fraser, demonstrated that classroom experiences can be examined through students' perceptions of relationships, personal development, organization, teacher support, cooperation, involvement, and task orientation (Fraser, 1998, 2012; Moos, 1979)^[6, 7, 10]. Contemporary applications commonly distinguish between the physical environment, psychosocial climate, and instructional-resource environment. These components interact rather than operate independently, making classroom environment an integrated condition capable of either facilitating or constraining learning.

Physical classroom conditions are particularly significant because learning is both a cognitive and environmentally situated activity. Students who study in overcrowded, poorly ventilated, inadequately illuminated, noisy, or uncomfortable classrooms may experience distraction, fatigue, reduced concentration, discomfort, and lower motivation to participate in lessons. In contrast, appropriately organized classrooms with sufficient space, adequate lighting, ventilation, functional furniture, and reasonable class sizes can facilitate attention, communication, interaction, movement, and effective instructional management. UNESCO (2023) emphasizes the importance of safe, accessible, adequately equipped

educational environments. In Nigeria, infrastructure shortages and high learner-to-classroom ratios continue to place pressure on the quality of public education (Federal Ministry of Education, 2026; UNICEF, 2024) ^[5].

Within Nigeria, empirical evidence increasingly associates inadequate physical learning conditions with poor student outcomes. Takwate and Iranda (2023) ^[17] reported that inadequate classroom spaces, poor ventilation, insufficient laboratories, limited instructional materials, and shortages of qualified teachers negatively affected senior secondary school students' academic performance. Recent Nigerian studies have similarly emphasized the importance of classroom facilities, classroom organization, teacher preparation, and environmental conditions for effective learning (Fregene Jennifer Tonye-Suobo *et al.*, 2024; Jebose-Ebom *et al.*, 2025) ^[8, 9]. These findings suggest that physical circumstances should not be treated as peripheral administrative matters; they form part of the instructional architecture through which learning outcomes are produced. Nevertheless, classroom environment cannot be adequately understood through physical facilities alone. The psychosocial climate of the classroom is equally important because students learn within networks of relationships. Teacher encouragement, respect, responsiveness, fairness, peer acceptance, cooperation, disciplinary consistency, and freedom from intimidation can influence whether students perceive the classroom as psychologically safe and academically supportive. Positive teacher-student relationships can encourage students to ask questions, seek clarification, participate in discussions, attempt difficult tasks, and persist when confronted with academic challenges. Conversely, hostility, ridicule, bullying, peer exclusion, and disorder may reduce participation and increase withdrawal or absenteeism (OECD, 2023c; Wang & Degol, 2016) ^[20].

The importance of classroom climate is supported by quantitative evidence. Erdem and Kaya (2024) ^[4] found significant relationships between classroom and school climate and academic achievement across K-12 educational settings. Wang *et al.* (2020) ^[21] similarly demonstrated that classroom climate is related to students' academic and psychological outcomes. Such evidence challenges narrow explanations of academic performance that attribute achievement primarily to individual intelligence or effort. Academic outcomes emerge partly from the interaction between learner characteristics and environmental opportunities for meaningful participation.

Another critical dimension is the availability of instructional resources. Contemporary secondary education requires relevant textbooks, laboratories, teaching aids, digital technologies, libraries, multimedia resources, and other materials capable of translating curriculum objectives into meaningful learning experiences. Instructional resources may improve comprehension by transforming abstract ideas into observable or interactive experiences. They can also support differentiated instruction, collaborative learning, independent inquiry, experimentation, feedback, and learner-centred pedagogy. Resource availability alone is insufficient, however; effective pedagogical integration is equally important (OECD, 2023a; World Bank, 2024) ^[22].

The influence of classroom environment on achievement may not be entirely direct. One of the most important mechanisms through which environmental conditions can

influence performance is student academic engagement. Academic engagement represents the degree to which learners participate actively, emotionally, and cognitively in educational activities. Behavioural engagement involves attendance, participation, persistence, compliance with classroom expectations, and completion of assignments. Emotional engagement reflects students' interest, enjoyment, sense of belonging, enthusiasm, and affective responses toward teachers, classmates, subjects, and school. Cognitive engagement relates to strategic thinking, self-regulation, deep processing, persistence with complex material, and willingness to expend intellectual effort.

This mediating perspective is important because students exposed to similar curricular content may achieve different outcomes depending on how strongly they engage with that content. A supportive classroom environment may improve academic performance partly because it increases students' willingness and capacity to engage. Good lighting and ventilation can enhance concentration; accessible learning materials can encourage participation and independent study; supportive teachers can strengthen confidence and persistence; positive peer relationships can reinforce belonging; and orderly classroom management can protect instructional time. These conditions may stimulate behavioural participation, emotional attachment, and cognitive investment, which subsequently enhance academic performance.

The issue is particularly significant in Nigerian public secondary schools, where variations in class size, teacher qualification, infrastructure, resource availability, location, administrative effectiveness, and socioeconomic circumstances may expose students to markedly different learning environments. These differences can influence instructional interaction, classroom management, individualized feedback, seating comfort, student participation, and ultimately learning outcomes. Improving secondary education therefore requires evidence about both the environmental conditions students experience and the processes through which those conditions affect achievement.

Despite growing literature, important gaps remain. Much Nigerian research has examined classroom infrastructure, school environment, teacher-student relationships, instructional materials, classroom management, or academic performance separately. Comparatively fewer studies have simultaneously conceptualized classroom environment as a combination of physical environment, psychosocial climate, and instructional resources while investigating student academic engagement as a mechanism through which classroom conditions influence academic performance. Evidence covering public senior secondary schools across all five South-East states also remains limited.

Accordingly, the present study investigates the impact of classroom environment on senior secondary school students in selected public secondary schools in South-East Nigeria, using a framework in which classroom environment influences student academic engagement, which in turn influences academic performance. Classroom environment is examined through physical environment, psychosocial climate, and instructional resources, while academic engagement is assessed through behavioural, emotional, and cognitive engagement. By examining 850 SS2 students drawn from 85 public secondary schools across the five

South-East states and incorporating relevant characteristics such as gender, class size, and teacher qualification, the study seeks to provide an integrated empirical explanation of how classroom conditions translate into educational outcomes.

Review of Related Literature

Concept of Classroom Environment

Classroom environment refers to the totality of physical, social, psychological, instructional, and organizational conditions within which teaching and learning occur. It represents the immediate learning context experienced by students and teachers during instructional activities. Contemporary literature treats classroom environment as multidimensional, incorporating material conditions, interpersonal relationships, instructional organization, safety, resources, and behavioural expectations. Erdem and Kaya (2024) ^[4] demonstrated that classroom climate is significantly associated with academic achievement, while Costa *et al.* (2024) ^[8] emphasized that academic outcomes reflect interactions between personal and contextual factors. For the present study, classroom environment is conceptualized through three major dimensions: physical environment, psychosocial climate, and instructional resources. These dimensions collectively represent the conditions under which senior secondary school students experience daily teaching and learning.

Physical Classroom Environment

The physical classroom environment encompasses lighting, ventilation, temperature, classroom size, seating arrangement, furniture, noise levels, cleanliness, safety, classroom density, and related infrastructural conditions. Appropriate physical conditions can support attention and communication, whereas overcrowding and discomfort can increase distraction, fatigue, noise, and classroom-management difficulties. Nigerian evidence has repeatedly identified classroom facilities and organization as important conditions for academic effectiveness (Fregene Jennifer Tonye-Suobo *et al.*, 2024; Takwate & Iranda, 2023) ^[8, 17].

Psychosocial Classroom Climate

The psychosocial climate includes teacher support, peer cohesion, participation, fairness, respect, cooperation, discipline, interpersonal safety, belonging, and the emotional tone surrounding learning. Positive psychosocial environments encourage students to ask questions, cooperate, persist, and take intellectual risks. Hostile or unpredictable environments may produce anxiety, withdrawal, avoidance, and reduced motivation. Meta-analytic evidence links classroom climate with achievement, engagement, motivation, social competence, and psychological adjustment (Erdem & Kaya, 2024; Wang *et al.*, 2020) ^[4, 21].

Instructional Resources

Instructional resources include textbooks, charts, laboratory equipment, computers, internet connectivity, audiovisual materials, projectors, libraries, practical materials, models, and other teaching aids. These resources help translate abstract curricular content into concrete learning experiences and can support inquiry, experimentation, collaboration, feedback, and independent learning. Their educational value depends not only on availability but also

on accessibility, relevance, quality, and appropriate pedagogical use.

Student Academic Engagement

Student academic engagement refers to the quality and intensity of students' involvement in learning activities. It captures the extent to which students participate behaviourally, invest emotionally, and apply cognitive effort to academic tasks. Behavioural engagement includes attendance, participation, persistence, assignment completion, and compliance with classroom expectations. Emotional engagement concerns interest, enjoyment, enthusiasm, belonging, and positive affective connection with school. Cognitive engagement concerns strategic learning, concentration, critical thinking, self-regulation, deep processing, and willingness to expend intellectual effort.

Engagement is a proximal mechanism through which educational opportunities become learning outcomes. Students may be physically present without being meaningfully engaged. Consequently, the quality of participation, emotional connection, and cognitive investment can explain substantial variation in achievement.

Academic Performance

Academic performance refers to measurable educational outcomes reflecting how effectively students have acquired expected knowledge and competencies. It may be assessed through classroom tests, continuous assessment, standardized examinations, mock examinations, subject grades, or composite achievement scores. Contemporary research recognizes that performance reflects interactions among personal, family, peer, teacher, school, and environmental influences (Costa *et al.*, 2024) ^[2].

Relationship among Classroom Environment, Engagement and Performance

The central proposition of the study is that students are more likely to engage academically when the classroom provides supportive conditions for learning. Favourable physical conditions reduce distraction and discomfort; positive psychosocial climates enhance safety, belonging, and motivation; and instructional resources create opportunities for active participation. Nigerian evidence indicates that classroom-management practices, teacher-student relationships, and interactive teaching methods predict student engagement and learning outcomes (Onwukwe Onyimonyi *et al.*, 2025) ^[15].

Research also supports a positive relationship between classroom environment and academic performance. Erdem and Kaya (2024) ^[4] confirmed a statistically significant association between classroom climate and achievement. Engagement, in turn, is widely regarded as a strong predictor of academic success because active participation, persistence, emotional connection, and self-regulated cognitive effort increase students' opportunities to master curricular content.

The mediation perspective therefore proposes that classroom conditions provide opportunities and motivational signals, while engagement determines the extent to which students use those opportunities. The process can be summarized as: Classroom Environment -> Student Academic Engagement -> Academic Performance.

Theoretical Framework

Moos' Social Climate Theory provides a principal foundation for the study. The framework proposes that social environments can be understood through interpersonal relationships, personal development, and system maintenance or change. Applied to classrooms, it suggests that the quality of relationships, opportunities for involvement, and organization of classroom activities shape students' experiences and outcomes (Moos, 1979) ^[10].

Bronfenbrenner's Ecological Systems Theory further explains the classroom as part of the student's immediate microsystem. Students interact repeatedly with teachers, peers, learning materials, and institutional expectations, and these interactions shape developmental and educational outcomes. Costa *et al.* (2024) ^[2] used an ecological perspective to organize evidence on academic-achievement determinants.

Self-Determination Theory is also relevant because supportive classrooms can satisfy students' needs for autonomy, competence, and relatedness. Teacher encouragement and respectful relationships enhance relatedness; appropriate challenges and feedback strengthen competence; and opportunities for participation and independent learning can enhance autonomy (Deci & Ryan, 1985; Ryan & Deci, 2020) ^[3, 16].

Empirical Review and Gap in the Literature

International evidence generally supports relationships among learning environments, engagement, and achievement. Erdem and Kaya (2024) ^[4] established significant relationships between learning climate and academic achievement, while Costa *et al.* (2024) ^[2] showed that achievement among middle- and secondary-school students is influenced by interacting personal and contextual determinants. Nigerian studies have likewise emphasized classroom management, facilities, teacher-student relationships, instructional organization, and teacher preparation as relevant to engagement and achievement (Fregene Jennifer Tonye-Suobo *et al.*, 2024; Jebose-Ebom *et al.*, 2025; Onwukwe Onyimonyi *et al.*, 2025) ^[8, 9, 15].

Several gaps remain. Many previous studies investigate individual dimensions of classroom environment rather than integrating physical conditions, psychosocial climate, and instructional resources. Fewer Nigerian studies explicitly test academic engagement as a mediator between classroom environment and performance. Existing studies also tend to focus on single states, local government areas, subjects, or teacher perceptions. The present study addresses these gaps through a five-state South-East sample and a mediation framework incorporating behavioural, emotional, and cognitive engagement.

Methodology

Research Design

The study adopted a quantitative cross-sectional correlational research design. The design was appropriate because the study examined naturally occurring relationships among classroom environment, student academic engagement, and academic performance without manipulating classroom conditions. Student academic engagement was specified as a mediator, while gender, class size, and teacher qualification were treated as control variables.

Area of the Study

The study was conducted in South-East Nigeria, comprising Abia, Anambra, Ebonyi, Enugu, and Imo States. The sampled schools covered selected local government areas across the five states, with an overall sampling framework of approximately 25 LGAs.

Population and Sample

The target population consisted of students enrolled in public senior secondary schools in South-East Nigeria. The accessible population comprised SS2 students. A sample of 850 SS2 students was drawn from 85 public secondary schools: Anambra, 200 students from 20 schools; Enugu, 180 from 18 schools; Imo, 170 from 17 schools; Abia, 150 from 15 schools; and Ebonyi, 150 from 15 schools.

Sampling Technique

A multistage sampling procedure was adopted. The five South-East states were included, selected LGAs were covered within the states, public secondary schools were selected from participating LGAs, and eligible SS2 students were selected within schools. Approximately ten students were sampled from each participating school.

Instrument for Data Collection

Data were collected using a structured questionnaire and students' academic-performance records. Classroom environment was measured through physical environment, psychosocial climate, and instructional resources. Student academic engagement was measured through behavioural, emotional, and cognitive engagement. Items were primarily rated on a five-point Likert-type scale.

Validity and Reliability

Content and construct validity procedures were applied through expert assessment in educational management, measurement and evaluation, and educational psychology. Internal consistency was assessed using Cronbach's alpha. The Physical Environment scale yielded approximately $\alpha = .84$, Psychosocial Climate $\alpha = .88$, and Instructional Resources $\alpha = .82$, indicating satisfactory reliability.

Measurement of Academic Performance

Academic performance was assessed using mock examination scores, including Mathematics, English Language, and other core-subject scores. Relevant subject scores were averaged to obtain a composite Academic Performance Index ranging from 0 to 100. Attendance rate was retained as an additional indicator of school participation.

Method of Data Analysis

Data were analysed using frequencies, percentages, means, standard deviations, Pearson product-moment correlations, multiple regression, and mediation analysis. The mediation model specified Overall Classroom Environment as X, Student Academic Engagement as M, and Academic Performance as Y. The indirect effect was assessed using 5,000 bootstrap resamples and a 95% confidence interval. Statistical significance was evaluated at $p < .05$. Because students were clustered within schools, cluster-robust standard errors or multilevel sensitivity analysis are appropriate for final inferential estimation.

Ethical Considerations

Participation was voluntary and confidentiality was protected through coded identifiers. Permission was obtained from relevant educational and school authorities. Appropriate consent and assent procedures were required for participating minors, and academic records were treated confidentially.

Results and Discussion

Important analytical note: the complete 850-row dataset was not available in the supplied material. Accordingly, the inferential coefficients presented in this section are model-consistent values derived from the correlation pattern supplied for the study and should be replaced by exact SPSS/STATA output before journal submission.

Distribution of Respondents by State

State	Schools	Students	Percentage
Anambra	20	200	23.5
Enugu	18	180	21.2
Imo	17	170	20.0
Abia	15	150	17.6
Ebonyi	15	150	17.6
Total	85	850	100.0

Correlation Analysis

The supplied correlation pattern indicates a strong positive relationship between overall classroom environment and student academic engagement ($r = .62, p < .01$), a strong positive relationship between student academic engagement and academic performance ($r = .71, p < .01$), and a moderate positive relationship between overall classroom environment and academic performance ($r = .48, p < .01$). All relationships are in the hypothesized direction.

Variable	1	2	3
1. Overall Classroom Environment	1.00		
2. Student Academic Engagement	.62**	1.00	
3. Academic Performance	.48**	.71**	1.00

Regression and Mediation Results

Based on the supplied standardized relationships, classroom environment explained approximately 38.4% of the variance in student academic engagement ($R^2 = .384$), with a standardized effect of $\beta = .62$. The total standardized effect of classroom environment on academic performance was $\beta = .48$, corresponding to approximately 23.0% explained variance in the bivariate model.

When classroom environment and academic engagement were simultaneously entered into the prediction of academic performance, the standardized coefficient for engagement was approximately $\beta = .67$, while the direct coefficient for classroom environment was reduced to approximately $\beta = .065$. The combined model explained approximately 50.7% of the variance in academic performance. The standardized indirect effect was approximately .415 ($.62 \times .67$), indicating a pattern consistent with substantial mediation, subject to confirmation by the stipulated 5,000-bootstrap PROCESS Model 4 analysis.

Discussion of Findings

The first major finding indicates a strong positive relationship between classroom environment and student

academic engagement. Students experiencing better physical classroom conditions, stronger psychosocial support, and greater availability of instructional resources were more likely to participate actively, demonstrate interest and belonging, and invest cognitively in academic activities. This finding is consistent with the ecological conception of learning and with Nigerian evidence showing that classroom-management practices, teacher-student relationships, and interactive instructional approaches predict student engagement (Onwukwe Onyimonyi *et al.*, 2025)^[15].

The study also indicates a significant positive relationship between overall classroom environment and academic performance. This supports the argument that educational achievement is partly context dependent. Favourable physical conditions may improve concentration and reduce discomfort; supportive psychosocial climates may encourage questioning, participation, and persistence; and instructional resources may enrich comprehension and practice. The result agrees with Erdem and Kaya (2024)^[4], whose meta-analysis confirmed a significant association between classroom climate and academic achievement.

Student academic engagement showed the strongest relationship with academic performance. This suggests that what students actually do behaviourally, emotionally, and cognitively within their learning environment is especially important in determining achievement. Behavioural engagement increases exposure to instruction and feedback; emotional engagement strengthens attachment to learning; and cognitive engagement promotes deep processing, strategic learning, self-regulation, and persistence.

The mediation pattern is the central contribution of the study. The reduction of the direct classroom-environment coefficient after engagement entered the model suggests that classroom environment may influence academic performance predominantly through the engagement it generates. Better classroom conditions can foster stronger engagement, and stronger engagement can translate those environmental opportunities into improved achievement. This provides a more explanatory account than a simple direct correlation between facilities and examination scores. The findings have important implications for public secondary schools in Abia, Anambra, Ebonyi, Enugu, and Imo States. School improvement initiatives should not focus exclusively on examination preparation. Improving classroom infrastructure, reducing excessive congestion, providing instructional materials, strengthening teacher-student relationships, promoting peer cooperation, and employing engaging teaching strategies may collectively produce stronger academic outcomes.

Conclusion and Recommendations

Conclusion

The study concludes that classroom environment is an important component of educational quality and that student academic engagement constitutes a critical mechanism linking classroom conditions with academic performance. Favourable physical conditions, supportive psychosocial relationships, and adequate instructional resources are associated with stronger behavioural, emotional, and cognitive engagement. Engagement, in turn, is strongly associated with academic performance. The overall evidence supports the conceptual pathway: Improved

Classroom Environment -> Stronger Student Academic Engagement -> Better Academic Performance. Educational improvement strategies that focus only on curriculum coverage or examination preparation without addressing the environment in which students learn may therefore produce limited outcomes.

Recommendations

1. State governments and education authorities should prioritize rehabilitation and improvement of public secondary-school classrooms, with attention to lighting, ventilation, space, furniture, sanitation, safety, and general physical comfort.
2. Ministries of Education and secondary-school management authorities should progressively reduce excessive classroom overcrowding through additional classrooms, teacher recruitment, and more effective student distribution.
3. Teachers should establish psychosocial environments characterized by respect, fairness, encouragement, emotional safety, and positive teacher-student relationships.
4. Schools should promote cooperative learning, peer mentoring, group projects, academic clubs, and effective anti-bullying mechanisms to strengthen peer cohesion and belonging.
5. Governments, school administrators, communities, PTAs, and development partners should provide sufficient textbooks, libraries, science laboratories, ICT facilities, teaching aids, computers, and other instructional materials.
6. Teachers should receive continuous professional development on integrating laboratories, ICT, audiovisual materials, textbooks, and learner-centred resources into everyday instruction.
7. Teachers should adopt engagement-oriented methods such as discussion, problem-based learning, cooperative learning, inquiry, demonstrations, projects, practical activities, questioning, and appropriate technology-supported instruction.
8. School administrators should regularly monitor behavioural, emotional, and cognitive indicators of engagement alongside examination scores.
9. Students showing persistent absenteeism, withdrawal, poor assignment completion, low motivation, or reduced academic effort should receive early, coordinated support from teachers, counsellors, parents, and administrators.
10. State education authorities should institute regular classroom-environment audits covering infrastructure, instructional resources, class size, teacher support, safety, student perceptions, and classroom-management practices.
11. Educational planners should prioritize equitable resource allocation so that rural and underserved public secondary schools are not disadvantaged.
12. Future studies should use longitudinal and multilevel designs and examine additional mediators or moderators such as self-efficacy, socioeconomic status, school belonging, parental involvement, digital access, leadership, and psychological well-being.

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