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Research Article

Users' Perceptions of the Influence of Material Selection on Perceived Sound Insulation Performance in Educational Facilities in Lagos State, Nigeria

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Abstract

Educational facilities require acoustically comfortable environments to support effective teaching, learning, and communication. However, many Nigerian universities continue to experience classroom noise due to inadequate consideration of acoustic performance during material selection and building design. This study examined users' perceptions of the influence of material selection on perceived sound insulation performance in educational facilities in Lagos State, Nigeria. Specifically, it investigated the effects of Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE) on Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). A quantitative descriptive and explanatory research design, underpinned by the Acoustic Theory of Sound Transmission and Environmental Comfort Theory, was adopted. Data were collected through structured questionnaires administered to 200 lecturers, final-year students, facility managers, and technical staff selected from six public and private universities using stratified random sampling. Descriptive statistics and multiple regression analysis were performed using SPSS and EViews at a 5% significance level. The findings revealed that MDT, PD, and CE exerted weak and statistically insignificant influences on PNRL and PSTL, although PD demonstrated a marginal positive effect on PSTL. The study contributes perception-based evidence on sound insulation performance in Nigerian educational buildings. The findings are limited by reliance on users' perceptions and the geographical focus on Lagos State. Practically, the study highlights the need to integrate material selection with architectural design, construction quality, and noise-control strategies. The findings guide professionals and policymakers in developing sustainable learning environments that improve acoustic comfort, student well-being, and educational outcomes.

Keywords: Material selection; Material Density and Thickness (MDT); Porosity and Durability (PD); Cost Effectiveness (CE); Perceived Noise Reduction Level (PNRL); Perceived Sound Transmission Loss (PSTL)

Highlights

- Material selection alone did not significantly improve perceived acoustic performance.
- Integrated acoustic design is essential for effective classroom noise control.
- User perceptions provide evidence for better educational facility design.

1. Introduction

Educational facilities are expected to provide environments that promote teaching, learning, communication, and cognitive development. Beyond providing classrooms and instructional resources, the physical characteristics of educational buildings influence learning quality, user satisfaction, and educational outcomes (Frontczak & Wargocki, 2011; Zhang et al., 2021). Among these characteristics, indoor acoustic quality has become an increasingly important aspect of educational building performance because it affects speech intelligibility, concentration, cognitive processing, memory retention, and academic achievement (Zhang et al., 2021; Mealings, 2023). Recent studies indicate that excessive environmental noise reduces students' comprehension, increases mental fatigue, and weakens teaching effectiveness within higher education institutions where large lecture halls accommodate substantial student populations (Zhang et al., 2021; Mealings, 2023; Lee & Haan, 2024). Consequently, improving classroom acoustic conditions has become an important consideration in educational facility planning and sustainable building design.

Rapid urbanisation has intensified acoustic challenges across many university campuses worldwide. Modern universities are located within densely developed urban environments characterised by heavy traffic, commercial activity, construction operations, and other environmental noise sources that penetrate classrooms and interfere with teaching and learning (WHO, 2018; Zhang et al., 2024). Internal noise generated by student movement, public address systems, mechanical equipment, air-conditioning systems, and standby electricity generators further compounds these acoustic challenges. Reviews by Zhang et al. (2021) and empirical investigations by Shield et al. (2015) demonstrate that poor classroom acoustics reduce speech intelligibility, impair attention and memory, and ultimately diminish learning outcomes. Similar concerns have been reported in recent educational acoustic studies, which emphasise that maintaining acceptable indoor acoustic conditions remains a challenge for educational infrastructure worldwide (Cai et al., 2024; Arjunan et al., 2024).

One widely adopted strategy for improving indoor acoustic quality is effective sound insulation (Hopkins, 2007; Cox & D'Antonio, 2017). Sound insulation refers to the ability of building elements, including walls, ceilings, floors, windows, doors, and partitions, to resist the transmission of unwanted airborne and impact sound between adjoining spaces (Hopkins, 2007). Effective sound insulation contributes to quieter learning environments by reducing external noise intrusion and limiting sound transmission between adjacent classrooms. Traditionally, acoustic performance has been evaluated using objective laboratory and field measurements such as Sound Transmission Loss (STL) and Noise Reduction (NR). However, contemporary building performance research increasingly recognises that occupants' perceptions provide an important dimension of acoustic evaluation because users experience buildings through comfort, communication quality, and satisfaction rather than through technical measurements alone (Frontczak & Wargocki, 2011; Altomonte et al., 2020).

Material selection is an important consideration in building acoustic performance. Construction materials vary considerably in density, thickness, porosity, durability, and structural composition, all of which influence their capacity to absorb, reflect, or block sound energy (Hopkins, 2007; Cox & D'Antonio, 2017; Arjunan et al., 2024). Recent studies have demonstrated that multilayer wall systems, engineered composites, porous absorbers, and innovative acoustic materials significantly improve sound insulation when appropriately incorporated into building envelopes (Mealings, 2023; Arjunan et al., 2024). Nevertheless, evidence remains inconclusive regarding the extent to which material properties alone

determine acoustic performance in occupied educational buildings (Zhang et al., 2024; Arjunan et al., 2024). While experimental investigations generally report improvements in sound insulation through enhanced material properties, field studies suggest that architectural layout, construction quality, installation practices, building maintenance, room geometry, and surrounding environmental noise frequently moderate or even outweigh the effects of material selection (Long, 2014; Zhang et al., 2024). These contrasting findings indicate that satisfactory acoustic performance depends on an integrated combination of material properties and overall building design rather than on material characteristics alone.

Within the Nigerian context, these challenges are particularly evident. Most universities operate in rapidly urbanising environments where traffic congestion, commercial activities, power-generating sets, construction works, and large student populations contribute to persistent classroom noise (WHO, 2018; Oluwatayo & Adele, 2024). Despite these realities, existing Nigerian studies have largely focused on physical acoustic measurements, laboratory experiments, or computational modelling, with limited attention to how building users perceive the effectiveness of construction materials in controlling noise in learning environments. This represents an important knowledge gap because users' perceptions provide evidence regarding whether selected materials achieve satisfactory acoustic performance during everyday teaching and learning activities.

Against this background, this study examines users' perceptions of the influence of material selection on perceived sound insulation performance in educational facilities in Lagos State, Nigeria. Specifically, the study investigates the influence of Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE) on Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL), representing users' perceptions of noise reduction and sound transmission control. Using a quantitative descriptive and explanatory research design based on questionnaire data collected from lecturers, final-year students, facility managers, and technical staff across selected public and private universities, the study provides empirical evidence on users' assessment of acoustic performance in occupied educational buildings. The findings contribute to the understanding of perception-based acoustic performance in educational facilities and guide architects, builders, university administrators, and policymakers seeking to improve acoustic comfort and integrate material selection with sustainable educational facility design (Chibueze et al., 2026).

2. Literature Review

2.1 Material Selection

Material selection is widely recognised as a strategic decision-making process that influences the performance, durability, sustainability, and long-term value of buildings. Within construction, the concept extends beyond structural adequacy to include economic efficiency, environmental performance, occupant comfort, and lifecycle considerations. Ding (2008) describes material selection as a process of balancing technical, economic, and environmental requirements to achieve optimal building performance throughout a facility's life cycle. Similarly, Akadiri, Chinyio, and Olomolaiye (2012) describe it as a multi-criteria process involving structural performance, cost, environmental sustainability, and user requirements.

Although these definitions originate from construction management, building acoustics literature places greater emphasis on material properties that influence indoor environmental quality, particularly sound control. From an acoustic perspective, the

physical characteristics of construction materials influence their capacity to absorb, reflect, or resist sound transmission. Hopkins (2007) explains that material density and thickness contribute to resistance against airborne sound transmission, while Cox and D'Antonio (2017) note that material composition, layering, and installation affect sound insulation performance. Recent studies further demonstrate that porous and composite materials can improve sound absorption and reduce reverberation, thereby enhancing acoustic comfort in occupied spaces (Mealings, 2023; Arjunan et al., 2024). These findings indicate that material selection has technical and environmental implications, making it an important consideration in educational facilities where communication and concentration are essential. In practice, material selection involves choosing walls, ceilings, floors, partitions, doors, and windows that satisfy structural, economic, environmental, and acoustic requirements. However, budget constraints, material availability, and construction practices may influence these decisions and affect the acoustic performance achieved. Within this study, material selection is operationalised through Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost-Effectiveness (CE). MDT and PD represent performance-related characteristics of selected materials, while CE represents the economic criterion considered when selecting materials for educational facilities. These dimensions are examined in relation to users' perceptions of Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). This operational definition distinguishes material properties from the economic considerations involved in material selection while aligning the concept with the study's objectives and a perception-based assessment of acoustic performance.

2.2 Noise Sources in Educational Facilities

Noise sources in educational facilities refer to internal and external sounds that interfere with teaching, learning, communication, and occupants' acoustic comfort. In building acoustics, noise is generally understood as unwanted sound that disrupts normal activities or reduces the quality of an indoor environment (Kang & Schulte-Fortkamp, 2016). Within educational settings, noise is an environmental factor affecting students' concentration, speech intelligibility, academic performance, and lecturers' instructional effectiveness. Unlike controlled laboratory environments, universities experience multiple simultaneous noise sources that collectively shape users' perceptions of acoustic performance.

Previous studies classify noise sources into external and internal categories. External noise originates from traffic congestion, railway operations, aircraft movements, construction activities, commercial centres, and industrial operations located near educational institutions (World Health Organization [WHO], 2018). Such noise may penetrate classrooms through walls, windows, doors, roofs, and ventilation openings, particularly where the building envelope provides inadequate sound insulation. Internal noise, on the other hand, arises from student conversations, movement along corridors, public address systems, mechanical and electrical equipment, heating, ventilation and air-conditioning (HVAC) systems, standby electricity generators, and activities occurring in adjacent classrooms (Shield et al., 2015). Recent classroom-acoustics research similarly emphasises the effects of background noise and reverberation on speech communication, listening effort, and learning conditions (Mealings, 2023).

The relative importance of these noise sources varies according to the physical location, architectural layout, occupancy level, and surrounding land use of educational buildings. In many Nigerian universities, persistent electricity shortages have increased reliance on power-generating sets, while rapid urban development has exposed campuses to heavy traffic, commercial activities, and construction noise. Consequently, classroom acoustic

conditions are influenced not only by the sound insulation characteristics of building materials but also by the intensity and proximity of surrounding noise sources.

Within the context of this study, noise sources are conceptualised as contextual environmental factors that influence respondents' perceptions of Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). Although they are not treated as independent variables in the regression model, understanding noise sources provides important context for interpreting users' assessments of sound insulation performance in educational facilities. This distinction is important because the study evaluates material selection through users' perceptions within occupied educational environments, where acoustic experiences result from interactions among material characteristics, building configuration, activities, and environmental conditions.

2.3 Noise Control and Sound Insulation Strategies

Noise control refers to the deliberate application of architectural, engineering, and material-based interventions aimed at reducing unwanted sound and improving the acoustic quality of indoor environments. In building acoustics, effective noise control involves controlling sound generation, interrupting sound transmission pathways, and minimising the effects of noise on building occupants (Long, 2014). Within educational facilities, noise control is particularly important because it enhances speech intelligibility, promotes concentration, improves teaching effectiveness, and creates environments conducive to learning. Consequently, contemporary educational building design increasingly incorporates acoustic performance as a fundamental component of indoor environmental quality rather than as a secondary design consideration (Zhang et al., 2024).

Scholars generally identify three principal approaches to noise control: control at the source, control along the transmission path, and control at the receiver. Source control seeks to reduce noise generation through quieter mechanical equipment, relocation of standby generators, regulation of public address systems, and operational measures that minimise unnecessary noise (Long, 2014). Transmission-path control focuses on limiting sound movement through building elements using dense walls, insulated partitions, double-glazed windows, acoustic ceilings, resilient floor systems, and effective sealing around doors and windows (Hopkins, 2007; Cox & D'Antonio, 2017). Receiver control involves improving occupants' acoustic comfort through appropriate classroom layouts, strategic seating arrangements, and sound-absorbing finishes that reduce reverberation and improve speech clarity (Mealings, 2023).

Recent studies demonstrate that integrated acoustic strategies can produce better outcomes than reliance on material selection alone. Arjunan et al. (2024) reported that multilayer acoustic systems and engineered composite materials improve sound insulation in occupied buildings, while Cai et al. (2024) found that porous sound-absorbing materials reduce reverberation when incorporated into comprehensive acoustic designs. Similarly, Zhang et al. (2024) emphasised that successful classroom acoustics depend on interactions among material properties, architectural configuration, construction quality, and environmental noise management.

Within the context of this study, noise control and sound insulation strategies provide the practical framework through which selected building materials contribute to Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). The study therefore recognises that effective acoustic performance in practice is achieved not merely through appropriate material selection, where classrooms are exposed to multiple simultaneous noise sources, but through its integration with sound architectural planning, quality construction practices, and effective environmental noise management in educational facilities.

2.4 Perceived Sound Insulation Performance

Perceived sound insulation performance refers to occupants' subjective evaluation of how effectively a building limits unwanted sound transmission between adjoining spaces and provides an acoustically comfortable indoor environment. Unlike objective acoustic performance, which is determined through standardised laboratory measurements such as Sound Transmission Class (STC), Weighted Sound Reduction Index (Rw), or field measurements conducted in accordance with ISO 16283-1:2014 and ISO 10140-1:2021, perceived sound insulation performance reflects users' experiences of acoustic conditions during normal occupancy (Hopkins, 2007; Cox & D'Antonio, 2017). This perception-based approach is important because occupants' satisfaction with indoor acoustic environments may differ from physical acoustic performance predicted through engineering measurements (Frontczak & Wargocki, 2011).

Previous studies have conceptualised perceived acoustic performance from various disciplinary perspectives. Building acoustics research emphasises measurable sound insulation characteristics, including airborne and impact sound insulation (Hopkins, 2007), whereas environmental psychology views acoustic performance as an aspect of indoor environmental quality that influences comfort, well-being, and task performance (Frontczak & Wargocki, 2011). Educational research further considers acoustic performance in terms of speech intelligibility, concentration, learning effectiveness, and user satisfaction with classroom environments (Shield et al., 2015; Mealings, 2023). These perspectives demonstrate that acoustic performance is multidimensional, encompassing technical building characteristics and occupants' subjective experiences. Research on acoustic comfort similarly indicates that objective acoustic measurements do not fully represent users' perceptions of their acoustic environment (Vardaxis & Bard, 2018).

Within the context of this study, perceived sound insulation performance is operationalised through two complementary indicators: Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). PNRL captures respondents' perceptions of how effectively construction materials and building elements reduce external and internal noise within lecture halls and classrooms. PSTL captures users' perceptions of how effectively walls, partitions, doors, ceilings, and floors limit sound transmission between adjacent learning spaces. These indicators are appropriate because the study examines users' perceptions rather than laboratory acoustic measurements. Accordingly, PSTL should be interpreted as a perceptual assessment of sound transmission control, not as an objective measurement of Sound Transmission Loss. In practical terms, occupants may perceive effective sound insulation when conversations in adjacent classrooms are less audible, external traffic noise is reduced, and teaching activities proceed with minimal acoustic interference. Consequently, PNRL and PSTL provide appropriate indicators for assessing how building users evaluate material selection and acoustic performance in educational environments.

2.2 Existing Theories and Frameworks

2.2.1 Acoustic Theory of Sound Transmission (Mass Law Principle)

The Acoustic Theory of Sound Transmission provides the principal scientific explanation of how sound propagates through building elements and how construction materials influence sound insulation performance. Developed from the pioneering work of Lord Rayleigh (1877) and subsequently advanced through architectural acoustics research, the theory is founded on the Mass Law Principle, which posits that the sound insulation capacity of a homogeneous building element generally increases with its surface mass. Consequently, denser and thicker walls, floors, ceilings, and partitions tend to provide

greater resistance to airborne sound transmission because more acoustic energy is required to induce vibration (Hopkins, 2007; Cox & D'Antonio, 2017). Contemporary studies further demonstrate that sound insulation is influenced not only by material mass but also by factors such as porosity, multilayer construction, damping properties, and installation quality (Arjunan et al., 2024; Cai et al., 2024).

The theory has been widely applied in architectural acoustics, building engineering, and materials science to evaluate the effectiveness of construction materials in controlling environmental noise and improving indoor acoustic quality. Its major strength lies in providing a scientific basis for understanding sound transmission behaviour and guiding the selection of appropriate building materials. In particular, the Mass Law Principle provides a direct theoretical basis for examining Material Density and Thickness (MDT), since increased surface mass generally improves resistance to airborne sound transmission. However, its principal limitation is that it primarily explains the physical behaviour of sound transmission and does not fully account for other material, construction, architectural, and environmental factors that influence acoustic performance in occupied buildings. Actual performance may be affected by porosity, material interfaces, joints, openings, workmanship, installation quality, room geometry, building services, and external environmental noise.

Within the present study, the Acoustic Theory of Sound Transmission therefore provides the primary theoretical basis for understanding the relationship between Material Density and Thickness (MDT) and perceived sound insulation performance. The theory also provides supporting acoustic principles for understanding the relevance of Porosity and Durability (PD), although these characteristics involve material behaviour that extends beyond the explanatory scope of the Mass Law Principle. Cost Effectiveness (CE), in contrast, represents an economic consideration in material selection rather than a physical mechanism of sound transmission. Its inclusion in the study reflects the practical requirement for educational facilities to balance acoustic requirements with affordability and material availability. Thus, while the theory does not directly explain the economic dimension of material selection, it provides the physical foundation for understanding how selected material characteristics may influence Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). The theory consequently provides an important engineering foundation for the study, while its limitations demonstrate the need for a complementary theory that accounts for occupants' perceptions of acoustic conditions.

2.2.2 Environmental Comfort Theory

Environmental Comfort Theory explains how the quality of indoor environments influences occupants' satisfaction, health, productivity, and overall performance. The theory originated from Fanger's (1970) work on thermal comfort and has subsequently evolved into broader approaches to indoor environmental quality encompassing thermal conditions, lighting, ventilation, indoor air quality, and acoustics (Frontczak & Wargocki, 2011). The theory assumes that occupants perform more effectively when environmental conditions minimise physical discomfort and psychological stress, making it particularly relevant to buildings designed for learning and knowledge exchange. Within educational facilities, acoustic conditions constitute an important component of environmental comfort because students and lecturers depend on clear verbal communication, concentration, and sustained attention during teaching and learning activities.

Previous studies have demonstrated that poor acoustic conditions reduce speech intelligibility, increase listening effort, impair concentration, and negatively affect learning outcomes (Shield et al., 2015; Mealings, 2023). Similarly, Bhandari et al. (2024) reported that

classroom acoustic quality influences communication effectiveness, students' attention, and overall learning satisfaction. These findings demonstrate that acoustic performance cannot be understood solely through the physical characteristics of construction materials because occupants ultimately experience building performance through their perceptions of comfort and environmental quality. Unlike the Acoustic Theory of Sound Transmission, which primarily explains the physical mechanisms through which sound interacts with building elements, Environmental Comfort Theory emphasises occupants' responses to the resulting indoor environmental conditions. Its relevance to the present study therefore lies in providing a theoretical basis for examining users' perceptions of sound insulation performance within occupied educational facilities.

However, Environmental Comfort Theory provides a broad explanation of occupants' environmental experiences and does not specifically identify the physical mechanisms through which sound is transmitted or controlled by building materials. It therefore cannot independently explain how Material Density and Thickness (MDT), Porosity and Durability (PD), or Cost Effectiveness (CE) relate to acoustic performance. Its explanatory value is instead complementary to the Acoustic Theory of Sound Transmission because it provides the user-centred perspective required to understand why the effectiveness of building materials should ultimately be considered in relation to occupants' experiences. This distinction is particularly important in educational buildings where acoustic conditions are affected by material characteristics, architectural configuration, construction quality, occupancy, and surrounding environmental noise.

For the present study, Environmental Comfort Theory provides the behavioural and perceptual foundation for interpreting respondents' assessments of Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). It explains why users' perceptions constitute a relevant dimension of building performance even where objective acoustic measurements are unavailable. When combined with the Acoustic Theory of Sound Transmission, the theory supports an integrated framework that connects the physical characteristics of selected materials with occupants' experiences of acoustic comfort. The combined theoretical perspective therefore provides an appropriate foundation for examining how material selection relates to perceived sound insulation performance in educational facilities while recognising that acoustic comfort is shaped by both material properties and the broader built environment.

2.3 Knowledge Gaps and Research Opportunities

Despite extensive research on building acoustics, several gaps remain in understanding how material selection influences perceived sound insulation performance in educational facilities. Existing studies have predominantly examined acoustic performance through objective measurements, laboratory testing, simulations, or controlled experiments, with comparatively less attention given to how building users perceive the effectiveness of selected materials during normal educational activities. Recent reviews indicate that educational acoustic research has expanded considerably, but important gaps remain regarding assessment approaches, interactions among acoustic and other environmental conditions, and methods for understanding occupants' experiences of acoustic quality (Mealings, 2023; Zhang et al., 2024). This distinction is important because objective acoustic performance and occupants' perceptions may not always correspond, particularly in occupied educational environments where room configuration, activity levels, environmental noise, and user expectations interact with material characteristics.

A second gap concerns the treatment of material selection as a multidimensional decision rather than as an isolated acoustic property. Previous research has established the importance of material characteristics such as density, thickness, porosity, absorption, and

composite construction in controlling sound transmission and reverberation (Hopkins, 2007; Cox & D'Antonio, 2017; Arjunan et al., 2024). However, the economic dimension of material selection has received comparatively less attention within perception-based studies of educational acoustic performance. In practice, architects, facility managers, and institutional decision-makers must balance acoustic performance with affordability, durability, availability, maintenance requirements, and construction feasibility. The omission of these considerations may limit the practical relevance of purely technical acoustic studies. A more integrated understanding is therefore required to determine whether users' perceptions of acoustic performance are associated with material characteristics, as well as with the economic considerations that influence material selection.

A third gap relates to the context of higher education facilities in Nigeria. Although studies have examined noise pollution, classroom acoustics, and environmental conditions in Nigerian educational institutions, much of the available evidence has focused on measured noise levels, specific environmental conditions, or individual acoustic interventions. For example, studies in Nigerian tertiary institutions have identified generators, automobiles, and noise from adjacent buildings as important sources of disturbance to learning, while recent research in Lagos has demonstrated the relevance of acoustic design strategies and user satisfaction in other public-use buildings (Oluwatayo & Adele, 2024). However, limited evidence exists regarding how users of university educational facilities in Lagos perceive the relationship between material selection considerations and sound insulation performance across different institutional settings. This contextual gap is significant because the acoustic conditions of Nigerian universities are shaped by urban density, generator dependence, building configuration, occupancy, and local construction practices that may differ from conditions examined in studies conducted elsewhere.

The present study addresses these gaps by examining users' perceptions of Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE) in relation to Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL) in selected educational facilities in Lagos State. By adopting a perception-based quantitative approach, the study complements objective acoustic research rather than claiming to replace physical measurement. It further integrates material characteristics with economic considerations and the contextual realities of occupied university buildings. The study therefore provides an opportunity to connect architectural material-selection decisions with users' experiences of acoustic performance and to generate evidence that can inform more integrated acoustic design, material specification, construction, and facility-management decisions within the built environment (Auwalu, 2026)

2.4 Proposed Conceptual Model

The proposed conceptual model provides the analytical framework for examining the relationship between material selection and perceived sound insulation performance in educational facilities in Lagos State, Nigeria. The model was developed by synthesising insights from the Acoustic Theory of Sound Transmission (Mass Law Principle) and Environmental Comfort Theory, together with empirical findings from the literature.

Material selection is operationalised through three independent variables: Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE). These independent variables are hypothesised to influence two dependent variables that represent perceived sound insulation performance: Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL).

The model posits that higher levels of MDT and PD will be positively associated with both PNRL and PSTL, while CE is expected to show a positive but potentially weaker relationship,

reflecting the practical trade-offs between acoustic performance and affordability in Nigerian educational buildings. The conceptual model therefore guides the formulation of the research hypotheses and the subsequent multiple regression analyses.

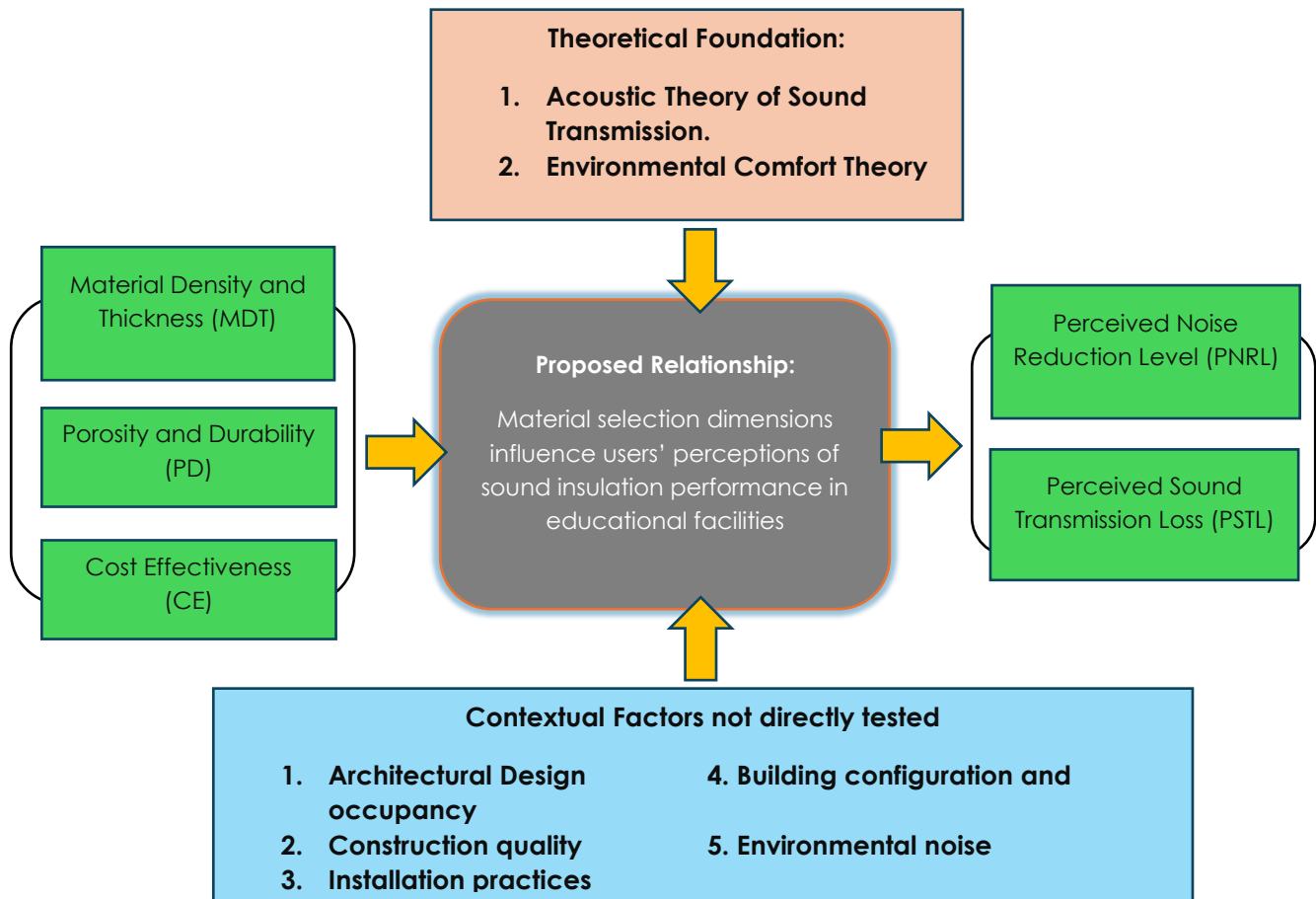


Figure 1: Conceptual model linking Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE) to Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL).

Source: Author's Conceptualisation (2026)

Figure 1 illustrates the proposed conceptual model, showing the hypothesised relationships between the three dimensions of material selection and the two indicators of perceived sound insulation performance, while recognising the contextual influence of broader built-environment conditions.

2.5 Research Hypotheses

Based on the theoretical perspectives, conceptual model, and empirical relationships specified in the study, the following null hypotheses were formulated:

H₀1: Material Density and Thickness (MDT) has no significant relationship with Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL) in selected educational facilities in Lagos State, Nigeria.

H₀2: Porosity and Durability (PD) has no significant relationship with Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL) in selected educational facilities in Lagos State, Nigeria.

H₀₃: Cost Effectiveness (CE) has no significant relationship with Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL) in selected educational facilities in Lagos State, Nigeria.

3. Methodology

3.1 Research Approach and Design

This study adopted a quantitative research approach and a descriptive-explanatory research design to examine the relationship between material selection and perceived sound insulation performance in selected educational facilities in Lagos State, Nigeria. The quantitative approach was appropriate because the study sought to obtain measurable responses from educational facility users and statistically examine the relationships between Material Density and Thickness (MDT), Porosity and Durability (PD), Cost Effectiveness (CE), and the perceived sound insulation performance indicators of Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). The descriptive component was used to summarise respondents' assessments of the study variables, while the explanatory component provided the basis for examining the statistical relationships specified in the conceptual model and research hypotheses. The methodological approach was guided by the Acoustic Theory of Sound Transmission and Environmental Comfort Theory, which jointly provide the theoretical basis for examining material characteristics and users' acoustic experiences in educational environments.

3.2 Population and Sampling Procedure

The study population comprised lecturers, final-year students, facility managers, and technical staff who regularly used or managed classroom environments within the selected universities. These respondent groups were considered appropriate because they had direct experience of the acoustic conditions of educational facilities and were therefore capable of providing informed assessments of perceived sound insulation performance. The study was conducted in six selected accredited public and private universities in Lagos State, namely the University of Lagos, Lagos State University, Pan-Atlantic University, Caleb University, Anchor University, and Augustine University. The inclusion of these institutions provided coverage of both public and private university settings within the highly urbanised Lagos environment. At the institutional level, a census approach was adopted by including all six selected universities, while stratified sampling was used at the respondent level to ensure representation of the major respondent categories, followed by simple random sampling to select individual participants. A total of 200 respondents participated in the study, comprising approximately 40% lecturers, 45% final-year students, and 15% facility managers and technical staff. This approach provided representation of the principal users and managers of educational facilities and ensured that the respondents had relevant experience of classroom acoustic conditions.

3.3 Data Collection and Research Instrument

Primary data were collected through a structured questionnaire developed to measure respondents' perceptions of material selection and perceived sound insulation performance in educational facilities. The questionnaire comprised two sections, with the first obtaining demographic information relating to respondents' institution, occupational category, years of experience or study, and frequency of classroom use, while the second contained measurement items relating to the study variables. Material selection was operationalised through three dimensions: Material Density and Thickness (MDT), Porosity

and Durability (PD), and Cost Effectiveness (CE), while Perceived Sound Insulation Performance was assessed through Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). Responses were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The perception-based instrument was appropriate because the study examined occupants' experiences of acoustic performance rather than direct physical sound insulation measurements obtained using acoustic instruments. Content validity was established through expert evaluation by specialists in architecture, building technology, and construction management, and recommendations from the validation exercise were incorporated into the final instrument. Reliability was assessed using Cronbach's alpha, with all constructs exceeding the recommended threshold of 0.70, indicating satisfactory internal consistency for statistical analysis (Hair et al., 2019).

3.4 Data Analysis Procedures

The completed questionnaires were coded and analysed using IBM SPSS Statistics Version 27 and EViews 13. Descriptive statistics, including frequencies, percentages, mean scores, and standard deviations, were used to summarise respondents' characteristics and describe the distribution of the study variables.

Multiple linear regression was subsequently employed to examine the statistical relationships between MDT, PD, and CE and the two indicators of perceived sound insulation performance, PNRL and PSTL. Two regression models were estimated, with PNRL serving as the dependent variable in the first model and PSTL serving as the dependent variable in the second, while MDT, PD, and CE constituted the explanatory variables in both models. Before the regression analyses, the distributional properties of the variables were assessed using skewness, kurtosis, and the Jarque–Bera statistic. Model explanatory power was assessed using R-squared and adjusted R-squared, while the F-statistic was used to assess the overall significance of each regression model, and the regression coefficients were evaluated at the 5% significance level. The findings were interpreted in relation to the study objectives, hypotheses, conceptual model, and theoretical framework.

3.5 Methodological Framework

The methodological framework establishes a logical connection between the research problem, theoretical foundations, conceptual model, research hypotheses, data collection procedures, statistical analysis, and interpretation of findings.

The study commenced with the identification of the research problem and review of relevant literature, which informed the development of the conceptual model and research hypotheses. This was followed by questionnaire design and validation, sampling and data collection, data coding and statistical analysis, and interpretation of the empirical findings. The framework therefore provides a coherent methodological pathway for examining the relationship between material-selection characteristics and perceived sound insulation performance in educational facilities. Although the methodology was appropriate for addressing the study objectives, certain limitations should be acknowledged. The study relied on respondents' perceptions rather than objective acoustic measurements, which means that the findings reflect users' assessments of acoustic conditions and may be subject to perceptual bias. The investigation was also limited to selected universities in Lagos State, which restricts the generalisability of the findings to other educational contexts. In addition, the cross-sectional design captured perceptions at a particular point in time and therefore did not account for possible seasonal or temporal variations in environmental noise.

3.5 Ethical Considerations

Ethical principles were observed throughout the study. The research was conducted under the academic oversight of the Department of Architecture, Caleb University, Imota, Lagos. Participation was voluntary, and respondents were informed of the purpose of the research before completing the questionnaire. Informed consent was obtained from all participants, and confidentiality was maintained by ensuring that no personally identifiable information was collected or disclosed. Responses were used solely for academic purposes, and participants were free to withdraw from the study at any stage without consequence.

4. Results

This section presents the study's empirical findings in relation to the research objectives and hypotheses. The results are organised into descriptive and inferential analyses. Descriptive statistics summarise respondents' assessments of the study variables, while inferential analysis examines the statistical relationships between the material selection dimensions and Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL).

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the material-selection dimensions—Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE)—and the perceived sound insulation performance indicators, namely Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL).

Table 1 Descriptive Statistics of Material Selection Variables and Perceived Sound Insulation Performance Indicators

	MDT	PD	CE	PNRL	PSTL
Mean	3.001500	3.000500	3.001500	2.980000	2.968000
Median	3.000000	3.000000	3.000000	3.000000	3.000000
Maximum	4.100000	4.200000	4.100000	4.100000	4.100000
Minimum	1.900000	2.000000	1.800000	1.800000	1.700000
Std. Dev.	0.392579	0.398804	0.439675	0.448448	0.468909
Skewness	-0.008744	0.226958	-0.099344	-0.182058	-0.100702
Kurtosis	3.296229	3.152248	2.656633	2.690981	2.712282
Jarque-Bera	0.733812	1.910159	1.311485	1.900611	1.027876
Probability	0.692875	0.384782	0.519057	0.386623	0.598136
Sum	600.3000	600.1000	600.3000	596.0000	593.6000
Sum Sq. Dev.	30.66955	31.64995	38.46955	40.02000	43.75520
Observations	200	200	200	200	200

Source: Researcher's EViews Output (2026).

Table 1 presents the descriptive statistics for the study variables, comprising the material-selection dimensions—Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE)—and the perceived sound insulation performance indicators, namely Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). The mean scores for MDT (3.00), PD (3.00), and CE (3.00) are approximately equal to the midpoint of 3.00 on the five-point Likert scale, while PNRL (2.98) and PSTL (2.97) are slightly below the midpoint. The median value of 3.00 across all variables indicates that responses were generally concentrated around the center of the measurement scale. Standard deviation values ranging from 0.39 to 0.47 indicate relatively limited dispersion and suggest reasonable consistency in respondents' assessments.

The skewness coefficients range from -0.182 to 0.227, indicating that the distributions are approximately symmetric, with no substantial evidence of skewness. Kurtosis values range from 2.66 to 3.30, suggesting distributions reasonably close to the conventional normality benchmark. The Jarque-Bera probability values range from 0.385 to 0.693, all exceeding the 0.05 significance level. Thus, the null hypothesis of normality cannot be rejected for any of the variables. The results therefore indicate that the variables exhibit acceptable distributional properties for the subsequent parametric regression analyses.

4.2 Regression Analysis of Material Selection and Perceived Noise Reduction Level (PNRL)

The first regression model examined the relationship between Material Density and Thickness (MDT), Porosity and Durability (PD), Cost Effectiveness (CE), and respondents' Perceived Noise Reduction Level (PNRL). Multiple linear regression was used to assess whether the three material-selection dimensions jointly and individually explained variations in respondents' perceived noise reduction within the sampled educational facilities.

Table 2 Model Summary for Perceived Noise Reduction Level (PNRL)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.073 ^a	.005	-.010	.451
a. Predictors: (Constant), CE, PD, MDT				

Source: Researcher's SPSS Output (2026).

Table 2 shows a very weak positive association between the combined material-selection dimensions and PNRL, as indicated by the multiple correlation coefficient ($R = 0.073$). The coefficient of determination ($R^2 = 0.005$) indicates that MDT, PD, and CE jointly explain approximately 0.5% of the variation in respondents' perceived noise reduction levels. The adjusted R^2 of -0.010 further indicates that the model has very limited explanatory capacity after accounting for the number of predictors included. The standard error of the estimate (0.451) indicates the average magnitude of deviation between the observed and predicted PNRL values. Overall, the model explains only a very small proportion of variation in perceived noise reduction, indicating that factors beyond the three material-selection dimensions are likely to account for most differences in respondents' perceptions.

Table 3 ANOVA Results for Perceived Noise Reduction Level (PNRL)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.216	3	.072	.354	.786 ^b
	Residual	39.804	196	.203		
	Total	40.020	199			
a. Dependent Variable: PNRL						
b. Predictors: (Constant), CE, PD, MDT						

Source: Researcher's SPSS Output (2026).

Table 3 presents the ANOVA results for the regression model. The model produced an F-statistic of 0.354 with a corresponding probability value of 0.786, which exceeds the 0.05 significance level. The regression model is therefore not statistically significant at the 5% level. This indicates that MDT, PD, and CE, when considered jointly, do not provide sufficient statistical evidence for explaining variation in respondents' PNRL. The result is consistent with the very low R^2 value reported in Table 2 and suggests that the combined material-selection dimensions have limited explanatory power for perceived noise reduction within the sampled educational facilities.

Table 4 Regression Coefficients for Perceived Noise Reduction Level (PNRL)

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.819	.391		7.214	.000
	MDT	.017	.082	.015	.209	.835
	PD	-.030	.081	-.026	-.365	.716
	CE	.066	.073	.065	.901	.369

a. Dependent Variable: PNRL

Source: Researcher's SPSS Output (2026).

Table 4 presents the individual regression coefficients for the relationship between the material-selection dimensions and PNRL. MDT recorded a positive but statistically insignificant coefficient ($B = 0.017$, $p = 0.835$), indicating that increases in perceived material density and thickness were associated with only a very small increase in perceived noise reduction. PD recorded a negative and statistically insignificant coefficient ($B = -0.030$, $p = 0.716$), indicating that perceived porosity and durability did not have a statistically meaningful relationship with PNRL. CE recorded a positive but statistically insignificant coefficient ($B = 0.066$, $p = 0.369$), suggesting that perceived cost effectiveness had no significant association with perceived noise reduction. Among the three predictors, CE had the largest standardized coefficient ($\beta = 0.065$), although its effect remained statistically insignificant. Since all probability values exceed the 0.05 significance level, none of the three material-selection dimensions significantly predicts PNRL. The first regression model therefore provides no statistically significant evidence that MDT, PD, or CE individually or jointly explains respondents' perceived noise reduction levels in the sampled educational facilities.

4.3 Regression Analysis of Material Selection and Perceived Sound Transmission Loss (PSTL)

The second regression model examined the relationship between Material Density and Thickness (MDT), Porosity and Durability (PD), Cost Effectiveness (CE), and respondents' Perceived Sound Transmission Loss (PSTL). Multiple linear regression was used to assess whether the three material-selection dimensions jointly and individually explained variations in respondents' perceptions of sound transmission control within the sampled educational facilities.

Table 5 Model Summary for Perceived Sound Transmission Loss (PSTL)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.154a	.024	.009	.467

a. Predictors: (Constant), CE, PD, MDT

Source: Researcher's SPSS Output (2026).

Table 5 indicates a weak positive association between the combined material-selection dimensions and PSTL, as reflected by the multiple correlation coefficient ($R = 0.154$). The coefficient of determination ($R^2 = 0.024$) indicates that MDT, PD, and CE jointly account for approximately 2.4% of the variation in respondents' perceived sound transmission loss. Although this finding represents a greater explanatory contribution than the 0.5% recorded for PNRL in the first regression model, the proportion remains small. The adjusted R^2 of 0.009 indicates that the explanatory capacity of the model remains limited after accounting for the number of predictors. The standard error of the estimate (0.467) indicates the average magnitude of deviation between the observed and predicted PSTL values. Overall, the model explains only a small proportion of variation in perceived sound transmission loss, suggesting that other factors beyond the three material-selection dimensions may account for differences in respondents' perceptions.

Table 6 ANOVA Results for Perceived Sound Transmission Loss (PSTL)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.035	3	.345	1.583	.195b
	Residual	42.720	196	.218		
	Total	43.755	199			
a. Dependent Variable: PSTL						
b. Predictors: (Constant), CE, PD, MDT						

Source: Researcher's SPSS Output (2026).

Table 6 presents the ANOVA results for the regression model. The model produces an F-statistic of 1.583 with a corresponding probability value of 0.195, which exceeds the 0.05 significance level. Therefore, the overall regression model is not statistically significant at the 5% level. This indicates that MDT, PD, and CE do not jointly explain a statistically significant proportion of the variation in respondents' PSTL. Although the model accounts for 2.4% of the observed variation, the significance test indicates that this explanatory contribution is insufficient to establish a statistically significant overall relationship between the material-selection dimensions and perceived sound transmission loss. The result suggests that factors beyond the selected material characteristics may play a greater role in shaping respondents' perceptions of sound transmission control within the sampled educational facilities.

Table 7 Regression Coefficients for Perceived Sound Transmission Loss (PSTL)

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.505	.405		6.187	.000
	MDT	-.084	.085	-.070	-.980	.328
	PD	.156	.084	.133	1.862	.064
	CE	.082	.076	.076	1.076	.283
a. Dependent Variable: PSTL						

Source: Researcher's SPSS Output (2026).

Table 7 presents the individual regression coefficients for the relationship between the material-selection dimensions and PSTL. MDT recorded a negative but statistically insignificant coefficient ($B = -0.084$, $p = 0.328$), indicating that higher perceived material density and thickness were associated with a small decrease in perceived sound transmission loss, although the relationship was not statistically significant. PD recorded a positive coefficient ($B = 0.156$, $p = 0.064$), indicating a positive association with PSTL; however, the relationship does not attain statistical significance at the conventional 5% level. Although the p-value is relatively close to 0.05 and may indicate a marginal relationship at a 10% threshold, the study adopts a 5% significance criterion and therefore does not regard PD as statistically significant. CE recorded a positive but statistically insignificant coefficient ($B = 0.082$, $p = 0.283$), indicating no statistically significant association with PSTL. Among the predictors, PD recorded the largest standardised coefficient ($\beta = 0.133$), suggesting the strongest relative contribution to PSTL within the model, although its effect remains statistically insignificant at the adopted 5% level. Overall, the results provide insufficient evidence to conclude that MDT, PD, or CE significantly predicts perceived sound transmission loss in the sampled educational facilities.

5 Discussion

5.1 Effect of Material Density and Thickness (MDT) on PNRL and PSTL

The findings indicate that Material Density and Thickness (MDT) has a positive but statistically insignificant relationship with Perceived Noise Reduction Level (PNRL) and a negative but statistically insignificant relationship with Perceived Sound Transmission Loss (PSTL). Thus, the first objective is not supported at the 5% significance level. The finding differs from the Mass Law Principle, which suggests that increased material mass generally improves resistance to airborne sound transmission (Hopkins, 2007; Cox & D'Antonio, 2017), and contrasts with studies reporting improved acoustic performance from dense materials (Arjunan et al., 2024). However, it is consistent with Zhang et al. (2024), who emphasised that classroom acoustic conditions are influenced by architectural and environmental factors beyond material properties alone. The insignificant relationship may therefore reflect the influence of construction quality, joints, openings, building configuration, occupancy, and surrounding noise on users' acoustic perceptions. The implication for the built environment is that architects should not rely on material density and thickness alone but integrate material selection with appropriate spatial planning, detailing, sealing, and broader noise-control strategies. The finding suggests that MDT alone is insufficient to guarantee perceived acoustic comfort in educational facilities.

In practical terms, architects and builders in Lagos universities should not rely solely on increasing the density or thickness of walls and partitions. Instead, they should specify wall assemblies with a minimum surface density of approximately 200–250 kg/m² combined with continuous airtight sealing at all junctions, perimeter edges, and service penetrations. Double-leaf (cavity) walls with resilient connections and acoustic isolation strips are particularly recommended for lecture halls located next to noisy corridors, generator houses, or external roads. Proper detailing and supervision during construction are essential; otherwise, the theoretical benefits of high-density materials will not be realised in occupied buildings.

5.2 Effect of Porosity and Durability (PD) on PNRL and PSTL

The results show that Porosity and Durability (PD) have a negative and statistically insignificant relationship with Perceived Noise Reduction Level (PNRL), but a positive relationship with Perceived Sound Transmission Loss (PSTL) that is marginal at the 10% significance level. Thus, PD does not significantly predict perceived noise reduction at the 5% level, although its association with perceived sound transmission loss warrants careful consideration. The finding differs from Mealings (2023) and Cai et al. (2024), who reported improved acoustic absorption from porous materials under controlled conditions, but is consistent with Arjunan et al. (2024), who emphasised that material performance in buildings can be affected by installation, construction, and service conditions. The result suggests that porosity alone produces improved perceived acoustic performance only when material durability, detailing, installation quality, and building configuration are adequate. For the built environment, porous materials should therefore be integrated with appropriate construction detailing and broader acoustic design strategies rather than specified solely based on their absorption characteristics. The finding also supports the need for further research combining users' perceptions with objective acoustic measurements.

For practical application, porous acoustic materials (such as mineral wool, acoustic foam, or perforated panels) should only be specified when they are protected by durable, cleanable facings and when edge sealing and correct installation can be guaranteed. Facility managers should include regular inspection and maintenance of these finishes in

their annual maintenance schedules, because degradation of porous materials over time (due to dust, moisture, or physical damage) significantly reduces their absorption performance. In Nigerian educational buildings, where budgets for frequent replacement are limited, selecting durable porous systems with robust protective layers offers better long-term acoustic value than cheaper, unprotected alternatives.

5.3 Effect of Cost Effectiveness (CE) on PNRL and PSTL

The findings indicate that Cost Effectiveness (CE) has a positive but statistically insignificant relationship with both Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). This suggests that respondents' perceptions of the affordability or economic value of materials do not, by themselves, provide sufficient evidence of improved perceived sound insulation performance. The finding is consistent with Nakhaeipour et al. (2022), who emphasised that the performance of sustainable building materials depends substantially on their design, application, and suitability for specific building requirements rather than on material characteristics considered in isolation.

The finding also provides an important qualification to the broader literature on sustainable and alternative acoustic materials. Recent research has demonstrated that porous and specially engineered materials can achieve useful sound-absorption or sound-insulation characteristics when their acoustic properties are appropriately designed and applied (Cai et al., 2024; Arjunan et al., 2024). However, the present study did not find a statistically significant relationship between perceived cost-effectiveness and either PNRL or PSTL. This difference may reflect the distinction between the technical acoustic performance of a material and the occupants' perceptions of material performance within an actual educational environment. A material may therefore offer favourable acoustic characteristics while its perceived effectiveness remains influenced by installation quality, room configuration, openings, construction detailing, background noise, and other environmental conditions.

From a built-environment perspective, the finding suggests that cost should not be used as a stand-alone criterion when selecting materials for acoustic performance in educational facilities. Architectural specifications should instead consider cost-effectiveness alongside material acoustic properties, spatial configuration, construction detailing, installation quality, durability, and the acoustic requirements of individual spaces. In practice, this implies that designers and project teams should evaluate materials according to their overall performance value rather than selecting the least expensive option. Cost-effective acoustic design should therefore be understood as achieving an appropriate balance between economic feasibility, material performance, construction requirements, durability, and the intended acoustic quality of the educational environment.

University estates departments and design teams should therefore evaluate materials on a whole-life cost basis rather than on initial purchase price alone. Specifying moderately pricier but higher-performing and more durable acoustic materials can reduce the need for later expensive remedial works, generator relocation, or repeated installation of temporary noise barriers. A practical approach is to prepare a simple life-cycle cost comparison during the material selection stage that includes initial cost, expected maintenance, replacement intervals, and the potential cost of poor acoustic performance (reduced teaching effectiveness and student concentration). This approach aligns cost-effectiveness with real long-term value for educational facilities in Lagos State.

6 Conclusion

This study examined the relationship between material selection and perceived sound insulation performance in selected educational facilities in Lagos State, Nigeria. Material selection was assessed through Material Density and Thickness (MDT), Porosity and Durability (PD), and Cost Effectiveness (CE), while performance was measured through Perceived Noise Reduction Level (PNRL) and Perceived Sound Transmission Loss (PSTL). The findings indicate that none of the three material-selection dimensions had a statistically significant relationship with PNRL or PSTL at the 5% significance level. Although porosity and durability showed a positive association with PSTL at the 10% level, this did not meet the study's primary significance criterion. The findings, therefore, suggest that material characteristics considered in isolation provide a limited explanation of perceived acoustic performance in occupied educational facilities. The study contributes perception-based evidence from Nigerian university facilities and highlights the importance of treating acoustic performance as an integrated building-design outcome. For architects, builders, and facility managers, material selection should therefore be considered alongside architectural configuration, construction detailing, installation quality, maintenance, and environmental noise control. Cost-effectiveness should similarly be assessed in relation to acoustic requirements, durability, and overall building performance rather than as an isolated selection criterion.

The study's limitations stem from its reliance on perception-based data, the selection of universities in Lagos State, and its cross-sectional design. Future research should combine user perceptions with objective acoustic measurements and examine different educational settings longitudinally. Overall, the findings support a systems-based approach in which material selection is coordinated with architectural design, construction practice, environmental control, and user experience to achieve more effective acoustic environments in educational buildings.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflict of interest.

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