

Acoustic Comfort in Hostel Spaces: Nigerian Design Challenges

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Abstract- Rapid growth in student enrolment across Nigerian tertiary institutions has increased the demand for hostel accommodation, often resulting in the development of residential facilities that inadequately address acoustic comfort requirements. Excessive noise levels, poor sound insulation, overcrowding, and inappropriate spatial planning can negatively affect students' concentration, sleep quality, well-being, and overall academic performance. This review examined the design challenges influencing acoustic comfort in hostel spaces within the Nigerian context. The study synthesized evidence from existing literature on major determinants of acoustic comfort, including internal and external noise sources, building materials, occupancy density, spatial organization, and environmental conditions surrounding hostel facilities. Design related challenges identified include the use of materials with poor sound insulating properties, inadequate separation of noisy and quiet functions, limited consideration of acoustic principles during the design process, and exposure to external noise from traffic, commercial activities, power generating sets, and social interactions. Findings indicate that these challenges contribute significantly to reduced residential satisfaction and compromised learning environments among hostel occupants. The study concludes that improving acoustic comfort in Nigerian hostel spaces requires the integration of acoustic considerations into architectural design decisions from the early stages of project development. The study recommends the adoption of appropriate building materials, improved space planning strategies, effective noise control measures, and the establishment of design guidelines that prioritize acoustic comfort in student housing developments.

Keywords: Acoustic Comfort, Hostel Spaces, Environmental Acoustics, Student Housing, Noise Pollution, Architectural Design.

I. INTRODUCTION

1.1 Background to the Study

Accommodation plays a vital role in supporting students' health, well-being, and academic success in

tertiary institutions. Hostel spaces function not only as sleeping quarters but also as environments for studying, social interaction, and personal development. The quality of these environments directly influences student satisfaction and educational performance.

Acoustic comfort refers to the degree to which occupants perceive the sound environment within a space as acceptable and supportive of intended activities. It is influenced by noise levels, sound insulation, reverberation, and spatial privacy (Schulte-Fortkamp & Fiebig, 2006). In hostel environments, appropriate acoustic conditions are essential for sleep quality, concentration, and psychological well-being.

In Nigeria, increasing student enrolment has intensified demand for hostel accommodation, leading to rapid development of high-density residential facilities. Many of these developments prioritise cost efficiency and capacity over environmental performance, resulting in inadequate acoustic design. Overcrowding, poor spatial planning, and low-quality materials further worsen acoustic conditions in student housing (Oyedepo et al., 2018). External noise from traffic, commercial activity, and generators compounds the problem in urban campus environments.

Despite its importance, acoustic comfort remains under researched in Nigerian housing studies, which have largely focused on thermal comfort and energy efficiency. This highlights the need to examine design-related acoustic challenges in hostel spaces.

1.2 Statement of the Problem

The expansion of student populations in Nigerian tertiary institutions has led to increased development

of hostel facilities that often prioritise occupancy over environmental quality. As a result, acoustic comfort is frequently neglected during design and construction.

Many hostel environments are characterised by overcrowding, inadequate spatial organisation, and the use of materials with poor sound insulation properties. These conditions expose students to continuous noise disturbances that affect sleep, concentration, and academic performance.

Internal noise from occupants, combined with external environmental noise from traffic, commercial activities, religious events, and electricity generators, further worsens acoustic conditions. Despite existing knowledge of acoustic design strategies, their implementation in Nigerian hostel developments remains limited due to cost constraints and weak regulatory enforcement.

1.3 Aim and Objectives

This study aims to examine design challenges affecting acoustic comfort in hostel spaces in Nigeria through a review of existing literature.

Objectives:

- To examine factors influencing acoustic comfort in hostel spaces
- To identify design related challenges affecting acoustic conditions in Nigerian hostels
- To evaluate implications of poor acoustic comfort on student well-being and academic performance
- To propose design recommendations for improving acoustic comfort

1.4 Research Questions

- What factors influence acoustic comfort in hostel spaces?
- What design challenges contribute to poor acoustic conditions in Nigerian hostels?
- How does poor acoustic comfort affect students?
- What design strategies can improve acoustic comfort?

II. LITERATURE REVIEW

2.1 Concept of Acoustic Comfort

Acoustic comfort refers to the perception of a satisfactory sound environment that supports human activities. It is a key component of indoor environmental quality and is influenced by noise levels, sound insulation, and spatial design (ISO 3382-1, 2009). In residential environments, poor acoustic conditions negatively affect rest, concentration, and overall well-being (WHO, 2018).

2.2 Acoustic Comfort in Residential and Educational Settings

Excessive noise exposure in residential settings is associated with sleep disturbance, stress, reduced cognitive performance, and impaired learning outcomes (Stansfeld & Matheson, 2003). In student hostels, where high occupancy and shared spaces are common, these effects are more pronounced.

2.3 Determinants of Acoustic Comfort

Acoustic comfort is influenced by architectural and environmental factors. Architectural factors include spatial layout, material selection, occupancy density, and building configuration. Environmental factors include traffic noise, commercial activity, and generator noise. These combined factors determine the acoustic quality of residential buildings (Berglund et al., 1999).

2.4 Acoustic Challenges in Hostel Environments

Hostel environments face challenges such as overcrowding, poor zoning of spaces, and inadequate acoustic separation. Internal noise from occupants and external urban noise significantly reduces comfort levels (Oyedepo et al., 2018).

2.5 Nigerian Context

In Nigeria, rapid urbanisation and inadequate enforcement of building regulations have contributed to poor hostel design quality. Cost driven construction practices often result in neglect of acoustic considerations, particularly in student accommodation facilities.

2.6 Research Gap

Existing Nigerian studies focus mainly on thermal comfort and energy efficiency, with limited attention to acoustic performance in hostel environments. This gap highlights the need for focused research on acoustic design challenges.

III. METHODOLOGY

3.1 Research Design

This study adopts a systematic narrative review approach to synthesise existing literature on acoustic comfort in hostel environments within the Nigerian context. A systematic narrative review is particularly appropriate for architectural and environmental design research where the objective is to integrate findings from diverse empirical and theoretical studies rather than generate primary data or conduct statistical meta-analysis.

The approach enables a structured examination of published studies on acoustic performance, student housing conditions, and building design strategies, with the aim of identifying recurring patterns, relationships, and gaps in knowledge. It also allows for the interpretation of findings within the broader context of indoor environmental quality and residential design in high density urban environments.

This methodological approach is suitable for addressing the research objectives of this study, which focus on understanding design related challenges affecting acoustic comfort and synthesising evidence to support improved hostel design practices in Nigeria.

3.2 Data Sources

Data for this study were obtained from multiple secondary sources in order to ensure a comprehensive and multidisciplinary understanding of acoustic comfort in hostel environments. These sources include peer reviewed journal articles, conference proceedings, institutional research reports, and relevant international standards related to building acoustics and indoor environmental quality.

Academic literature was sourced from recognised databases such as Scopus, Web of Science, and Google Scholar using key search terms including acoustic comfort, hostel environments, student housing, building acoustics, noise pollution, and residential environmental quality. The inclusion of multiple databases was intended to enhance the breadth and reliability of the reviewed literature.

In addition to academic publications, institutional reports and grey literature were included to provide contextual insights into housing conditions, urban noise exposure, and student accommodation challenges in Nigeria. International standards and guidelines on environmental noise and acoustic performance were also reviewed to provide a benchmark for evaluating acceptable acoustic conditions in residential environments.

3.3 Data Analysis

The collected literature was analysed using a thematic analysis approach to identify, organise, and interpret recurring patterns related to acoustic comfort in hostel environments. Thematic analysis was selected due to its suitability for synthesising qualitative and mixed-method findings across diverse studies while allowing for structured interpretation of complex environmental factors.

The analysis focused on identifying key themes including internal noise sources, external noise exposure, architectural and material design factors, spatial organisation, and the implications of acoustic conditions on student well-being and academic performance. These themes were developed through iterative reading and coding of the literature, enabling the grouping of similar findings and the identification of consistent patterns across studies.

Furthermore, the analysis involved comparing and contrasting findings from different contexts in order to highlight areas of agreement, divergence, and research gaps. This process allowed for a comprehensive synthesis of existing knowledge and supported the development of design-oriented conclusions relevant to improving acoustic comfort in Nigerian hostel environments.

IV. RESULTS AND DISCUSSION

4.1 Overview of Acoustic Conditions

Studies indicate that acoustic conditions in Nigerian hostel environments are generally poor, largely due to high occupancy density, limited spatial control, and inadequate attention to acoustic performance during design and construction (Oyedepo et al., 2018). In many cases, hostel buildings are designed primarily to maximise student capacity rather than to ensure environmental comfort. This results in densely populated living spaces where sound transmission is uncontrolled and privacy is significantly reduced.

The combination of hard internal finishes, compact room layouts, and shared circulation spaces further intensifies noise build up within hostel environments. As a result, students are frequently exposed to continuous background noise, which undermines the acoustic quality of living spaces and reduces their suitability for rest and academic activities. The literature consistently suggests that these conditions are widespread across Nigerian tertiary institutions, particularly in urban campuses where student demand for accommodation exceeds available supply.

4.2 Internal Noise

Internal noise is one of the most significant contributors to poor acoustic comfort in hostel environments. It arises primarily from occupant activities such as conversations, movement within rooms and corridors, use of electronic devices, and social interactions within shared facilities. In high density hostel settings, these activities often occur simultaneously, leading to overlapping sound sources and increased overall noise levels.

The absence of adequate spatial separation between functional areas such as sleeping zones, study areas, and circulation routes further exacerbates internal noise transmission. In many Nigerian hostels, multiple occupants share confined rooms without acoustic partitions or buffering elements, making it difficult to control sound propagation. This situation is worsened by behavioural factors, where limited awareness of acoustic etiquette contributes to unnecessary noise generation.

Over time, repeated exposure to such internal noise environments can result in chronic discomfort among students, particularly during nighttime periods when rest and recovery are expected to occur.

4.3 External Noise

External noise intrusion significantly contributes to the degradation of acoustic comfort in hostel environments. According to the World Health Organization (2018), environmental noise from transport systems, industrial activities, and urban infrastructure can have substantial impacts on human health and well-being, particularly in residential settings.

In Nigerian contexts, hostels are often located near major roads, commercial centres, and densely populated urban areas, exposing students to continuous traffic noise and human activity. Additionally, the widespread reliance on electricity generators due to unstable power supply introduces intermittent but high intensity noise sources that further elevate ambient sound levels.

Religious activities, outdoor social events, and informal commercial activities also contribute to external noise exposure, particularly in mixed use urban neighbourhoods. The cumulative effect of these sources creates a persistent acoustic burden that significantly reduces the quality of the hostel living environment.

4.4 Design Issues

Architectural and material-related design decisions play a critical role in determining acoustic performance in hostel buildings. Poor material selection, particularly the use of lightweight partitions, unlined masonry, and hard reflective surfaces, contributes to excessive sound reflection and prolonged reverberation within enclosed spaces. Furthermore, the lack of proper acoustic zoning is a recurring design limitation. Many hostel layouts fail to distinguish between quiet and noisy functions, resulting in the proximity of sleeping areas to high activity zones such as staircases, corridors, and communal facilities. This lack of functional separation increases noise transmission and reduces the effectiveness of spatial buffering.

In addition, insufficient consideration of building orientation and site planning reduces the potential for natural acoustic shielding from external noise sources. Collectively, these design deficiencies reflect a broader prioritisation of cost efficiency and spatial maximisation over environmental quality in hostel development.

4.5 Implications

The consequences of poor acoustic environments in hostel spaces extend beyond physical discomfort and directly affect students' health, well-being, and academic performance. Research has shown that prolonged exposure to environmental noise is associated with sleep disturbance, elevated stress levels, reduced concentration, and impaired cognitive function (Stansfeld & Matheson, 2003).

In hostel settings, these effects are particularly significant due to the dual role of the environment as both a living and academic support space. Poor sleep quality resulting from nighttime noise exposure can reduce daytime productivity and learning efficiency. Similarly, persistent background noise during study periods can impair information processing and reduce academic performance.

Over time, these conditions contribute to lower residential satisfaction and may negatively influence students' overall educational experience within tertiary institutions.

4.6 Design Gaps

Despite the availability of established acoustic design principles, their application in Nigerian hostel development remains limited. One of the primary reasons for this gap is the prioritisation of cost efficiency and rapid construction over environmental performance in student housing projects.

In addition, there is limited awareness among some stakeholders, including developers and planners, regarding the importance of acoustic comfort as a component of indoor environmental quality. Regulatory frameworks also tend to place greater emphasis on structural safety and spatial provision rather than acoustic performance standards.

As a result, acoustic considerations are often omitted during both the design and post occupancy evaluation stages, allowing poorly performing buildings to remain in use without corrective intervention.

4.7 Synthesis

The synthesis of findings from the reviewed literature indicates that acoustic discomfort in Nigerian hostel environments is the result of a complex interaction between internal behavioural noise, external urban noise, and design related deficiencies.

Internal noise is primarily driven by occupant density and shared living arrangements, while external noise arises from the surrounding urban environment. These conditions are intensified by inadequate architectural planning, poor material selection, and limited implementation of acoustic zoning principles. Collectively, these factors highlight the need for an integrated design approach that addresses acoustic comfort from the earliest stages of hostel planning. Such an approach should combine spatial organisation, material optimisation, and environmental noise control strategies in order to create more supportive and functional student residential environments.

V. CONCLUSION AND RECOMMENDATIONS

Conclusion

This paper examined acoustic comfort in hostel spaces within the Nigerian context through a systematic review of secondary literature. The reviewed evidence reveals that many student hostel environments in Nigeria experience poor acoustic conditions characterised by excessive internal and external noise, inadequate sound insulation, overcrowding, and limited spatial zoning. These conditions are primarily attributable to poor building design, cost driven construction practices, and the limited integration of acoustic considerations into hostel planning and development.

The literature consistently establishes that acoustic design strategies including effective spatial zoning, improved room configuration, use of sound insulating and absorptive materials, control of occupancy

density, and strategic separation of noisy and quiet functions significantly improve acoustic conditions in residential buildings. The evidence further demonstrates that appropriate acoustic planning can reduce noise transmission, improve sleep quality, enhance concentration, and support better academic performance among students residing in hostel environments.

The paper concludes that integrating acoustic design principles into hostel development is essential for achieving supportive, healthy, and functional student residential environments in Nigeria.

Recommendations

A. Adoption of Acoustic Design Standards in Hostel Development

Government agencies, university authorities, and planning bodies should incorporate acoustic performance requirements into building regulations and hostel development guidelines. Minimum standards for noise control, spatial organisation, and acoustic insulation should be established for student accommodation projects.

B. Improved Spatial Organisation and Functional Zoning

Architects and developers should prioritise clear separation between quiet zones such as sleeping and study areas and high activity zones such as corridors, social spaces, and communal facilities. Proper spatial planning will reduce internal noise transmission and improve acoustic comfort.

C. Use of Sound Insulating and Absorptive Materials

Hostel designs should incorporate materials with appropriate acoustic properties, including insulated wall systems, acoustic ceilings, and floor finishes that reduce impact noise. The use of hard reflective surfaces in high occupancy areas should be minimised.

D. Control of External Noise Intrusion

Hostel planning should include buffer zones, setbacks, and landscaping strategies to reduce exposure to external noise sources such as traffic, commercial activities, religious events, and generator

noise. Building orientation should also be considered as part of noise mitigation strategies.

E. Improvement of Hostel Management Practices

University and hostel management authorities should implement behavioural and operational policies such as quiet hours, regulation of social activities, and maintenance of shared facilities to reduce unnecessary noise generation within hostel environments.

F. Public Awareness and Professional Capacity Building

Students, developers, and built environment professionals should be sensitised to the importance of acoustic comfort in residential design. This can be achieved through academic curriculum integration, professional training programmes, and institutional awareness campaigns focused on environmental quality in housing.

Contribution to Knowledge

This paper contributes to existing knowledge by synthesising published evidence on acoustic comfort in hostel environments within the Nigerian context. It highlights the interaction between architectural design decisions and acoustic performance in student housing and provides a structured understanding of the key design-related challenges affecting residential comfort. The study also extends current discourse on indoor environmental quality by focusing specifically on acoustic comfort, which remains under explored in Nigerian architectural and housing research.

Suggestions for Further Research

Future studies should:

- i. Conduct on site acoustic measurements in Nigerian university hostels to establish empirical noise exposure levels.
- ii. Investigate the relationship between acoustic comfort and academic performance among students in different institutional settings.
- iii. Explore the effectiveness of specific acoustic design interventions in improving hostel environments.
- iv. Compare acoustic performance between public and private student hostels in Nigeria.

- v. Examine occupant behavioural patterns and their contribution to noise generation in hostel spaces.

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