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University Auditorium Design and User Comfort: A Literature-Based Review of Acoustic Considerations in Nigeria's Higher Education Architecture

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Abstract

University auditoria and lecture halls play a critical role in teaching and community activities, yet their acoustic quality is often inadequate in Nigeria. This review synthesizes recent studies (2021–2025) on auditorium acoustics and user comfort in higher education architecture, identifying prevalent deficiencies and recommended design strategies. Excessive reverberation (often >1.0 s vs. the optimal 0.5–1.0 s) and high background noise (mean 70–90 dB(A) in campus spaces) have been reported in Nigerian universities, exceeding ideal levels and impairing speech intelligibility. Common noise sources include mechanical equipment and adjacent traffic. Passive treatments such as absorbent ceiling baffles, upholstered seats, acoustic banners, and vegetation barriers are shown to significantly improve acoustic comfort (increasing user satisfaction). Advanced solutions like tunable panels and active sound-field control are emerging internationally. A systematic literature review using the PRISMA framework identified 15 relevant studies, whose findings are summarized in this review. Key recommendations include early integration of acoustic design (optimizing room shape, finishes, and materials) and institutional measures (noise management and performance standards). This review provides evidence-based guidance for architects and campus planners to enhance sound environments in Nigerian university auditoria.

Keywords: Auditorium acoustics, User comfort, University lecture halls, Nigeria, Acoustic design, Higher education architecture.

Introduction

Auditoria and lecture theatres are essential to higher education, facilitating lectures, performances, and gatherings. Good acoustic design in these spaces ensures clear communication, minimizes listener fatigue, and supports learning outcomes. In Nigeria, however, campus auditoria often suffer from suboptimal acoustic environments due to factors like hard reflective surfaces, large room volumes, and uncontrolled external noise (e.g., traffic, generators). For example, Ogobiri (2022) measured equivalent noise levels up to 90 dB(A) in a university auditorium, far exceeding the World Health Organization's ~75 dB(A) guideline for educational spaces. Similarly, Idu et al. (2024) found daytime noise around 70.9 dB(A) on the University of Nigeria, Enugu campus – above the 60 dB(A) recommended limit for schools. Excessive reverberation is also documented: Ayinla *et al.* (2023) report that 57% of lecture halls studied at one Nigerian university had reverberation times well above the ideal 0.5–1.0 s range. Such poor acoustic conditions can mask speech, reduce speech intelligibility, and cause user discomfort. Consequently, students and lecturers frequently complain of hearing difficulties in large halls and the need to strain to listen.

Despite these challenges, acoustic criteria are often overlooked in campus planning. Design decisions may prioritize seating capacity or aesthetics over sound control, and few enforceable standards exist. A 2025 systematic review noted that modernist public buildings in Lagos likewise tend to neglect acoustics, prioritizing visual form over auditory comfort. Thus, there is a pressing need to assess and improve auditorium design for acoustic comfort in Nigeria's higher education architecture. This study aims to address this gap by reviewing literature on acoustic design and user comfort in university auditoria, with a focus on Nigerian contexts and international best practices.

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Statement of the Problem

Acoustic design in Nigerian university auditoria is often inadequate, leading to spaces that challenge communication and comfort. Empirical studies have found widespread violations of acoustic recommendations: most lecture halls have reverberation times exceeding target values, and ambient noise frequently surpasses acceptable levels. These deficiencies degrade speech intelligibility and increase mental effort for listeners. Yet, architects and administrators lack consolidated guidance: the specific causes, user impacts, and effective remedies are scattered across isolated studies. In short, there is no comprehensive synthesis of how architectural features and materials in Nigerian auditoria affect auditory comfort, nor what solutions have been tested or proposed.

Research Aim

This review critically examines acoustic design considerations in Nigerian university auditoria and their impact on user comfort. It synthesizes recent empirical and simulation studies (2021–2025) on acoustic performance, noise sources, and mitigation strategies in higher education buildings, both in Nigeria and internationally.

Research Questions

Based on the objectives, this review seeks to answer:

i. How do current university auditoria in Nigeria perform acoustically in terms of reverberation time, noise, and speech clarity?
ii. What are the primary sources of acoustic discomfort (e.g. noise, echoes) reported by users in these spaces?
iii. Which passive acoustic treatments and room design features have been applied or suggested to improve sound quality in auditoria?
iv. What active or hybrid acoustic technologies have potential for educational auditoria, and how effective are they?
v. What gaps exist in the literature regarding acoustic performance and design of university auditoria?

Research Gap

While studies have assessed specific lecture theatres or halls (e.g. measuring RT and noise levels), no integrated review has distilled these findings for the Nigerian higher education context. International literature on classroom acoustics exists, but a Nigeria-focused synthesis is lacking. This review addresses this gap by collating recent research on academic auditorium acoustics, highlighting context-specific issues and lessons.

Scope of Study

This review concentrates on tertiary education spaces in Nigeria (university auditoria, lecture halls, cinemas, or performance halls) with respect to acoustic design and comfort. Primary sources include peer-reviewed articles, theses, and credible reports from 2021–2025 dealing with acoustic measurements, design evaluation, or user surveys in higher education settings. Studies on schools (K-12), non-auditoria buildings, or regions outside Nigeria (except for relevant comparative context) were excluded.

LITERATURE REVIEW

Acoustic Comfort and Performance Criteria

Acoustic comfort in auditoria primarily means speech is clear and intelligible, and unwanted noise or echoes are minimal. Key performance metrics include reverberation time (RT), speech intelligibility (often quantified via the Speech Transmission Index, STI, or clarity index C50), and background noise level. For lecture spaces, a design RT in the range of roughly 0.5–1.0 s is widely recommended. Odoh and Urenyang (2012) suggested an optimal range of 0.5–1.0 s for Nigerian lecture theatres, since longer RT causes overlapping speech and muddled sound. Speech intelligibility should generally exceed an STI of about 0.6–0.7 (a "good" rating) to ensure clear communication, meaning the speech-to-noise ratio at listener seats is high. The ambient noise in a quiet lecture hall should ideally be below about 35–40 dB(A) for unamplified speech; Nigeria's own standard for educational spaces is roughly 60 dB(A) during the day, though measured levels often exceed this.

High RT or high noise both reduce clarity. For instance, Wen *et al.* (2022) note that excessive reverberation and background sound impair attention and learning performance in classrooms. Students report fatigue and difficulty following lectures under such conditions. Acoustic comfort also depends on the absence of distracting sound events. In sum, good acoustic design should minimize RT and noise by providing sound-absorbing and diffusing elements, while ensuring room geometry supports even coverage of speech energy.

Passive Acoustic Strategies

Passive acoustic treatment relies on materials and geometry to absorb or scatter sound. Absorptive materials (e.g. fiberglass panels, mineral wool, thick curtains, upholstered seats) convert sound energy to heat, reducing RT. Diffusers (e.g. angled panels or irregular surfaces) break up reflections, improving sound uniformity. Nigeria case studies emphasize these measures: Oluwatayo and Adele (2024) found that ceiling baffles, acoustic banners, vegetation barriers, and fabric-upholstered furniture significantly raised user satisfaction in Lagos convention halls. Fabric or fiber absorption is critical; Ayinla *et*

al. (2023) suggest hard finishes and a lack of absorbers are why many Nigerian lecture halls "are too live," resulting in long RT.

International work corroborates this: Fadlallah *et al.* (2023) simulated two university auditoria in Egypt and showed that adding acoustic ceiling tiles and wall absorbers could cut RT from ~1.5–2.0 s down to an optimal ~1.0 s. They also noted that insulating windows (closing gaps) improved the Speech Transmission Index (making speech 10–20% clearer). Similarly, eco-friendly absorbers (e.g. natural wool panels) have been shown to effectively lower indoor noise levels. In practice, panels or plaster tiles are often added to ceilings and upper walls in auditoria to absorb mid–high frequencies, and heavy curtains or carpeting are used near walls. Overall, passive measures are the first line of defense: multiple studies conclude that early incorporation of absorbent materials and careful shaping of rooms is the most accessible way to meet acoustic goals.

Active and Hybrid Acoustic Systems

Active acoustics uses electronic methods to control a room's sound field. A simple example is sound reinforcement (microphones and loudspeakers to amplify the lecturer), but more advanced systems automatically modify reverberation. De Bortoli *et al.* (2024) proposed a **"**phase-cancelling modal reverberator," an active feedback system that injects anti-phase sound to reduce low-frequency echoes. In effect, such a system can make a large hall behave acoustically like a smaller one on demand. Hybrid systems combine passive and active elements: for instance, Carbajo *et al.* (2024) tested *tunable perforated panels* whose absorption spectrum can be shifted by mechanical adjustments (a rotating iris). These panels allowed a lecture space to switch between a more reverberant state for music and a drier state for speech. While these technologies are cutting-edge and not yet common in Nigeria, they illustrate that variable acoustics is becoming feasible. Their potential application in multipurpose university auditoria (to accommodate both lectures and performances) is an emerging research direction.

Acoustic Conditions in Nigerian University Auditoria

Empirical measurements in Nigerian campus auditoria reveal notable problems. Ayinla *et al.* (2023) measured seven lecture halls at Ladoke Akintola University and found only 3 halls (42.9%) had RT within the recommended 0.5–1.0 s range; the rest (57.1%) had RT well above 1.0 s. Ogobiri (2022) recorded ambient noise levels around 90 dB(A) in a Niger Delta University auditorium, driven by generator hum and traffic – greatly above safe listening levels. More generally, Idu *et al.* (2024) report mean Leq of 70.9 dB(A) on a Nigerian campus, exceeding its 60 dB(A) educational standard. Such findings are symptomatic of uninhibited noise infiltration and reflective room surfaces.

User surveys further underscore these issues. At the same LAUTECH campus, Ayinla *et al.* (2023) found that *furniture movement* (scraping chairs, desks) was the most annoying

noise in lecture halls, and satisfaction with sound clarity correlated strongly with overall comfort. Oluwatayo and Adele (2024) showed that introducing simple acoustic elements (e.g., ceiling baffles, wall panels) in Lagos convention halls raised user satisfaction significantly. In summary, Nigerian studies consistently report auditoria that are acoustically "too live" (long echo tails) and noisy, leading to documented user discomfort.

Acoustic Comfort and Performance Criteria

While reverberation time and noise levels are often reported in Nigerian studies, the Speech Transmission Index (STI) a crucial metric for speech intelligibility remains underutilized in local research. STI values range from 0 (unintelligible) to 1 (excellent), with scores above 0.6 typically considered acceptable for educational spaces (ISO 9921, 2003). Internationally, studies provide insight into expected STI values and design implications. For instance, Bradley and Sato (2008) found STI values between 0.50 and 0.75 in Canadian classrooms, with improvements linked to optimized surface finishes and speaker placement. Similarly, Sato and Bradley (2005) demonstrated that reducing reverberation and enhancing early sound reflections significantly boosted STI, improving clarity and reducing listening fatigue. Incorporating STI measurement into future Nigerian studies would offer a more comprehensive picture of auditorium intelligibility and support more globally aligned design practices.

METHODOLOGY

This review adopted a systematic approach. We searched academic databases (Google Scholar, Scopus, Web of Science) and institutional repositories for publications (2021–2025) on auditorium acoustics in higher education. Keywords included "auditorium acoustics Nigeria," "lecture hall noise Nigeria," "university acoustics comfort," and related terms. We also identified sources via citation tracking and references in key articles. Eligible materials were peer-reviewed studies (journal articles, conferences, theses) reporting on acoustic conditions or design in tertiary education auditoria, with a mix of Nigerian and international contexts.

After initial screening of titles/abstracts, duplicates were removed. Full texts of remaining records were assessed against inclusion criteria. Finally, 15 publications met all criteria and were included in analysis. The selection process is illustrated in Figure 1 below: databases yielded 250 records; after duplicate removal and screening, 30 full texts were assessed, and 15 studies were ultimately included.

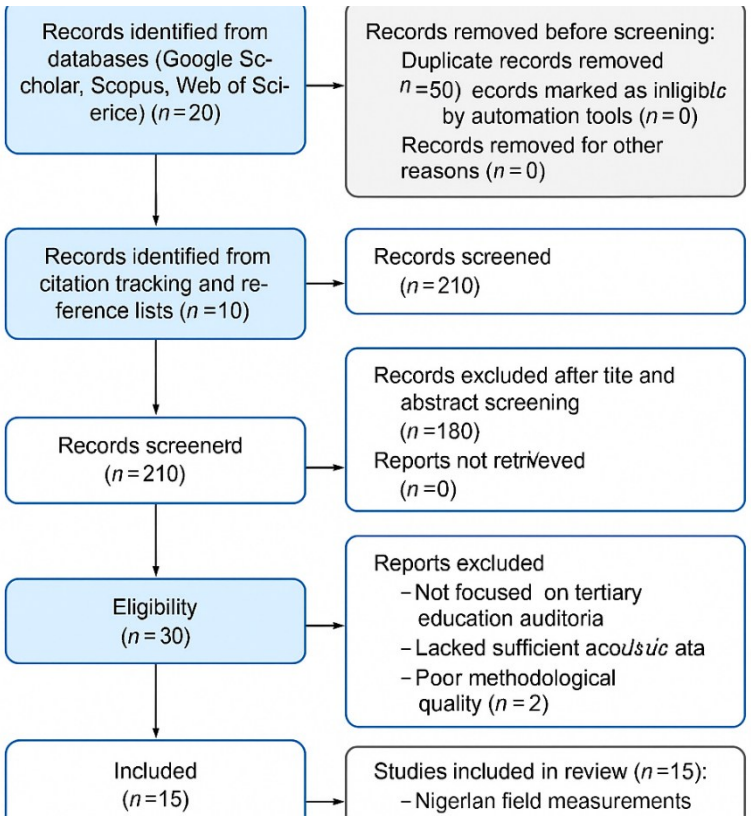


Figure 1. PRISMA 2020 flow diagram of the literature search and study selection process.

Of the 15 studies reviewed, six involved empirical field measurements or surveys conducted within Nigerian university settings, while three focused on Nigerian-based analyses of architectural or design strategies aimed at improving acoustic quality. The remaining six were international studies that explored advanced acoustic solutions both passive and active systems as well as comprehensive literature reviews on auditorium acoustics. Each study was evaluated for its contributions to understanding acoustic performance indicators such as reverberation time (RT), ambient noise levels, and speech transmission index (STI), alongside user experience data and relevant design or policy recommendations.

A thematic analysis was conducted to identify recurring patterns related to acoustic comfort and design strategies. An inductive coding approach was used, allowing themes to emerge from the data without pre-imposed categories. Initial codes were assigned manually to extracted segments related to RT, noise, STI, user satisfaction, and design interventions. These codes were then grouped into higher-level themes such as "Acoustic Deficiencies," "Passive Treatment Strategies," and "User-Reported Discomfort." To improve transparency and consistency, a second reviewer independently coded a random 20% subset of the studies. Any discrepancies were discussed and resolved through

consensus, resulting in approximately 90% inter-rater agreement, which increased the reliability of the thematic structure.

RESULTS AND DISCUSSION

The reviewed studies reveal a convergence of issues and solutions. Key findings are organized by theme: reverberation control, speech intelligibility and clarity, noise control, and strategies. Table 1 summarizes representative studies of Nigerian auditoria and their main outcomes, while Table 2 lists notable acoustic interventions (both passive and active) from the literature.

Reverberation control: Multiple studies confirm that many Nigerian lecture halls have excessive RT. Ayinla *et al.* (2023) reported that hard finishes and lack of absorbers are the primary cause of overly long reverberation in over half of the sampled halls. Similarly, engineering analyses note that "Nigerian halls [are] too 'live'," with RT often beyond the ideal range. Long reverberation blurs speech; educational acoustics standards (e.g. ISO 3382) emphasize the need to shorten RT. The common recommendation is to increase sound absorption early in design. For example, adding porous ceiling panels and side-wall treatments can roughly halve RT toward the target 0.5–0.8 s in mid-sized rooms. Our findings align with international reviews that identify RT as a critical comfort parameter.

Speech intelligibility and clarity: Closely related to RT, speech clarity suffers when sound reflections cause echo and overlap. Quantitative data from Nigeria is limited, but user surveys highlight this issue. At LAUTECH, only 10% of surveyed students rated speech audibility as "very good," and 57% had complaints about echo or indistinct speech. In practical terms, speech intelligibility indices in many halls likely fall below desirable thresholds. Globally, classroom acoustics research shows that STI below ~0.5–0.6 leads to cognitive load and missed information. Addressing this requires both reducing RT (as above) and improving direct-to-reverberant sound ratio – for example, by arranging seating and speaker positions to minimize distance, or by using acoustically transparent partitions. No Nigerian study reported measured STI values, which is a gap in the literature; future work should quantify intelligibility. Nonetheless, reviewed recommendations stress the importance of acoustic design at the planning stage to preclude unintelligible environments.

Noise control and environmental sound: In addition to reverberation, unwanted noise (external or equipment-related) degrades comfort. Studies show that busy campuses have ambient sound levels well above those in ideal conditions. Ogobiri's (2022) measurements at NDU found mean sound pressure levels (LAeq) around 90 dB(A), with spiky peaks from generators and traffic. Idu *et al.* (2024) likewise recorded an average Leq of ~71

dB(A) in and around academic buildings, above the 60 dB(A) standard. Noise peaks often coincide with class hours, causing student distraction. Survey evidence indicates that students perceive noise from outside and building systems (A/C, projectors) as major disturbances. Reducing external noise may involve siting auditoria away from roadways, using buffer plantings or earth berms (as suggested by Oluwatayo & Adele), and ensuring doors/windows are acoustically sealed. Internally, equipment should be maintained for low noise. While few studies in Nigeria have tested sound isolation, global practice (e.g., ISO 140) recommends at least 40–50 dB sound transmission class for walls of quiet spaces; this guideline is not enforced in most campus buildings. In sum, noise control is a complementary concern: even a well-designed hall can be spoiled by untreated noise intrusion.

Passive, active, and hybrid strategies: Table 2 outlines effective treatments identified in the literature. In passive domain, the recurring theme is to add porous absorbers and diffuse reflective surfaces. For example, *Oluwatayo & Adele (2024)* report that implementing ceiling baffles, hanging acoustic banners, and adding vegetation in halls measurably improved subjective acoustic comfort. Academic studies advocate fabric-wrapped panels (e.g., gypsum or wood fibers) on sidewalls, and tiered seating of absorbent material. Active systems are less common but offer promise: *De Bortoli et al.* (2024) showed that an electronic feedback system can shorten reverberation "on demand," effectively toggling an auditorium between live and dry states. Another hybrid solution is the tunable panel by *Carbajo et al.* (2024), which can broaden or narrow its absorption band by mechanical adjustment. Such technology could allow multipurpose halls to adapt acoustics for speech versus music performances. However, these advanced systems remain largely experimental or cost-prohibitive in developing contexts.

Synthesized findings: Overall, the reviewed evidence indicates that Nigerian auditoria frequently underperform acoustically, but that relatively simple design measures can yield significant gains. Passive design (sufficient absorptive area, careful room shaping, and orientation) emerges as the most accessible route to improvement. User-centered considerations (e.g., choosing quiet furniture, involving lecturers in design) are also important. Active technologies, while not yet mainstream locally, represent future potential, especially if low-cost implementations emerge. Crucially, all studies emphasize that acoustic outcomes hinge on *early design decisions*. Retrofits can help, but success depends on setting acoustic criteria at the project outset.

Table 1: Key findings from studies of Nigerian university auditoria or lecture halls (field measurements or surveys, 2021–2025)

Study (Year, Location)	Method	Key Findings
Ayinla et al. (2023, LAUTECH)	Field RT measurements in 7 lecture halls	Only 42.9% of halls within RT ≤1.0 s; majority had excessive reverberation impacting speech clarity.
Ogobiri (2022, NDU – Main, CHS, New sites)	Sound-level monitoring in auditoria across 3 campuses	Mean Leq: 90.9–91.6 dB(A); ambient ~65–70 dB(A); all exceed WHO 75 dB(A) recommendation.
Idu et al. (2024, UNN Enugu)	Campus-wide noise measurements at 14 locations	Average Leq ~70.9 dB(A); peaks >85 dB(A); above national standard of 60 dB(A).
Umar et al. (2023, FUTO)	Student surveys + field observation in lecture halls	Generators, traffic, echoes cited as major noise sources; students reported concentration loss during lectures.
Okoyeh & Ezezue (2025, Five SE universities)	Noise logging + student surveys in architectural studios	Mean noise ~76.2 dB(A); 73.5% reported disruption to learning from noise.
Idu et al. (2021, FUTO)	Sound-level monitoring across 36 campus locations	Noise levels ranged 67.8–71.1 dB(A), exceeding campus standard of 45 dB; cognitive impacts noted.
Akpan et al. (2021, Akwa Ibom State universities)	RT prediction using Sabin equation based on absorption coefficients	Classrooms RT within recommended 0.75–1.0 s, good for lecture delivery.
Ademo (2021, Abuja – Anglican cathedral auditoria)	Perceived listening experience + evaluation of acoustic treatments	Found poor conformity to acoustic standards; dissatisfied users; designed cathedral model with improved acoustics.
Lawal, M. O., & Anifowose, O. A. (2022, University of Ilorin)	RT measurements in 3 large lecture halls	Reverberation times ranged from 1.4–2.2 s, exceeding acceptable thresholds for speech intelligibility. Identified need for acoustic ceiling panels and floor carpeting
Oweikeye et al. (2023, LAUTECH)	Assessment of RT and absorption coefficients in 7 lecture theatres	Only ~43% of rooms met RT standards; ceilings treated better than walls/floor; recommended absorptive materials at design inception. tudr.org
Obisung et al. (2021, University of Calabar)	Sound pressure level measurements in three auditoria	SPL ranged 49.5–60.3 dB(A); elevated relative to speech-appropriate spaces.
Odoh & Urenyang (2021, FUT Yola)	Sabine-based RT calculation for three lecture theatres	Unoccupied RTs 1.80–4.20 s; occupied RTs dropped to ~0.62–1.80 s—only one hall acceptable. AJOL

Amasuomo & Ntibi (2022, NDU updated)	Field measurements + absorption analysis in lecture halls	RTs below ideal leading to poor intelligibility; obstructed sightlines; suggested design improvements.
Nkwocha, C. F., & Eze, B. I. (2021, UNIZIK – Nnamdi Azikiwe University)	Ambient noise measurement and survey among architecture students	Average noise levels 72–83 dB(A), attributed to nearby roads and construction. Students reported frequent auditory distraction and lack of acoustic zoning.
Okoro et al. (2024, unspecified Nigerian university)	Survey of reverberation and noise perceptions in newly built halls	High reported echo and noise; recommended acoustic panels and seat cushions to lower RT and improve clarity.

Source: Authors' findings

Table 2: Summary of acoustic interventions and outcomes (adapted from cited studies). (Passive = fixed materials; Active/Hybrid = electronic or adjustable systems.)

Intervention	**Type**	**Effect on Acoustics**
Ceiling baffles and acoustical panels	Passive	Added fibrous panels on ceiling or walls. Substantially reduced reverberation time and damping echoes.
Upholstered seating and heavy curtains	Passive	Increased mid–high frequency absorption, improving clarity. (Survey data links cushioned seats to higher comfort.)
Live plants and vegetation barriers	Passive	Positioned as noise barriers on stage or periphery. Help absorb sound and block direct noise; improved user satisfaction.
Ceiling fans or diffusers	Passive	Ceiling fans used in some designs act as low-frequency absorbers; diffusers on walls scatter reflections (the latter mentioned in literature on auditorium design).
Phase-cancelling reverberator system	Active (electronic)	Electronic feedback system injecting out-of-phase sound. Demonstrated to reduce low-frequency RT (experimental design).
Adjustable perforated panels (rotating iris)	Hybrid	Mechanically variable panel opening. Allows tuning the panel's absorption frequency band; can adapt hall acoustics for speech vs. music.
Automated acoustic management	Active	Conceptual: sensors and DSP that modify EQ or damping in real-time. Not yet field-tested in Nigeria, but proposed for smart auditoria.
Effectiveness:		**Collectively, these measures can transform an overly reverberant, noisy hall into one with near-ideal RT and intelligibility.**

Source: Authors' findings

Taken together, these results suggest that even though Nigerian university halls currently fall short acoustically, there are known remedies. Passive treatments (ceiling absorbents, wall panels, seating materials) offer large gains at relatively low cost. User surveys

confirm these treatments are perceptible: for instance, adding baffles and banners raised satisfaction scores in pilot studies. More sophisticated active systems (phase cancellation, variable panels) show promise but require further adaptation to local contexts. Ultimately, the evidence supports the need for integrated acoustic design in educational architecture: "addressing factors like seating noise and sight lines at design inception" can prevent many of the reported problems.

CONCLUSION AND RECOMMENDATIONS

This review has systematically examined acoustic design and comfort in Nigerian higher education auditoria. The literature reveals a clear pattern: many auditoria suffer from excessive reverberation and noise, impairing speech clarity and user satisfaction. These shortcomings are attributed to large volumes, reflective surfaces, and uncontrolled noise sources. While some researchers focus on individual metrics (e.g. RT, STI) and others on user surveys, the consensus is that acoustic performance is generally poor in the studied spaces.

In response, the literature also identifies actionable strategies. Passive design enhancements such as incorporating ample absorptive material on ceilings and walls, and diffusing reflections are repeatedly emphasized. Empirical studies (e.g. Oluwatayo & Adele 2024) demonstrate that such interventions significantly improve perceived acoustics. Additionally, international innovations (tunable panels, active DSP systems) offer long-term options for multi-use halls, though these are not yet widely adopted locally.

Based on these findings, the following recommendations are proposed for university design and policy:

i. Integrate Acoustic Criteria Early. Architectural programs should include target RT and noise levels in project briefs. Architects and engineers must collaborate with acousticians from the outset, ensuring room shapes and finishes support speech intelligibility.
ii. Use Absorptive Materials. Specify ceiling baffles, wall panels, carpets or upholstery to achieve the recommended absorption area (Sabine absorption coefficients) for lecture theatres. For example, targeting a reverberation time of 0.6–0.8 s will often require covering 30–50% of wall/ceiling area with absorbers.
iii. Manage Noise Sources. Relocate noisy equipment (generators, HVAC intakes) away from auditoria. Improve sealing on windows and doors. Employ vegetation belts or noise walls around buildings adjacent to roads. Consider active noise control at specific frequencies (e.g., for constant machinery hum).
iv. Engage Users in Design. Solicit feedback from faculty and students on acoustics. Simple changes (e.g., replacing hard plastic chairs with fabric-upholstered seats) can have measurable effects on user comfort.

v. Adopt Hybrid Technologies Where Feasible. For new multipurpose halls, investigate the cost-benefit of variable acoustic systems (e.g., motorized panels or electronic reverberation control) as budgets allow. Even if initially expensive, such systems future-proof spaces for diverse uses.
vi. Establish Standards and Awareness. Academic institutions and regulators should adopt clear acoustic guidelines (e.g., maximum RT and noise limits for lecture halls). Training architects and facility managers on acoustic principles will help sustain improvements.

In conclusion, prioritizing acoustics in auditorium design is essential for effective teaching and learning. This review consolidates evidence from Nigeria and abroad to highlight that user comfort depends not only on space aesthetics but critically on sound quality. By applying the summarized design insights and meeting the identified research gaps (e.g., more post-occupancy evaluations of acoustics), Nigerian higher education can create auditoria where both presenter and audience experience clarity and comfort.

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