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Exploring Noise Perception Study in Architectural Studios in the Universities in South-East Nigeria

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ABSTRACT: Noise is debilitating and ubiquitous and its presence in academic environment interferes with academic outcomes.This research investigates the perception of noise in architectural studios in the universities in South-East Nigeria. Recognizing the significance of environmental factors in architectural education, the study explores students' and staff subjective experiences and perceptions of noise within the studio setting. Through questionnaires, and qualitative analysis, this research aims to provide insights into the nuanced ways in which noise is perceived, shedding light on its impact on the learning environment and overall well-being. In the research, it was observed that the studio occupants are aware of the noise situation, albeit majority is comfortable with the level of noise. It was also observed that open-plan studio is perceived to be more noisy than isolated and divided studios ($F = 6.908$, $p = 0.001$); and full portioned studios are less noisy than studios partitioned to lintel ($t = 3.938$, $p < 0.001$). It was recommended that architecture studios be designed with divided spaces, and where open-plans are inevitable, studio spaces should be fully partitioned.

KEYWORDS: Noise, Noise Pollution,Noise Perception, Architectural Studios, Environmental Factors, South-East Nigeria, Subjective Experience

I. INTRODUCTION

In the realm of architectural education, the physical environment plays a pivotal role in shaping the learning experience of students and staff of every department. Noise, as a prominent environmental factor, holds a unique significance within the context of architectural studios.Architectural studios are dynamic spaces where students engage in a myriad of activities, including design discussions, critiques, model-making, and collaborative projects (Levy, 1980). The open and interactive nature of these studios fosters creativity but also introduces potential challenges related to noise. The nature of activities in architectural studios underscores the need for a nuanced examination of noise perception and its consequences.

Noise perception is inherently subjective, varying among individuals based on factors such as personal preferences, cultural backgrounds, and prior experiences (Stansfeld, 1992; Bronzaft, 1993; WHO, 1995; Chepesiuk, 2005; Oyedepo et al., 2012). Understanding how students and staff perceive noise within architectural studios is essential for creating an environment that accommodates diverse preferences. By acknowledging the subjective nature of noise perception, educators and administrators can tailor interventions to cater to the specific needs of the architectural community.

Critical thinking and intense concentration are necessary for the design process. Disturbances in cognition can be caused by excessive noise, making it more difficult for students to concentrate on complex design assignments (Pheng et al., 2006; Thakur, 2006; Zannin and Zwirtes, 2009; Goswami, 2011; Xie et al., 2011; Zannin et al., 2013; Tzivian et al., 2017). By investigating how noise perception impacts students' ability to focus, instructors can put strategies into place that preserve the best possible conditions for long-term learning.

Effective communication between students and staff is crucial, as collaboration is a fundamental component of architectural education (Engineer Supervising Design, 1991; Boyer & Mitgang, 1996). Communication channels can be

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obstructed by noise disturbances, which can impact the process of collaborative learning. By comprehending the ways in which noise perception affects teamwork, interventions that maximize communication while reducing disruptions can be developed.

Environments that strike a balance between stimulation and calmness are conducive to creativity. The creative process may be hampered by excessive noise (Passchier-Vermeer, 1993). Furthermore, extended exposure to loud noises can cause stress and exhaustion, which can have an adverse effect on the staff's and students' general wellbeing (Dygum & Gurun, 2008). The need for a comprehensive approach to studio design and management is highlighted by the awareness of the possible negative effects of noise on creativity and wellbeing.

In addition to being instructional spaces, architectural studios serve as design prototypes for aspiring professionals. Taking this into account is essential to creating an atmosphere that complies with industry norms and gets students ready for their future careers.

The insights gained from studying noise perception have direct implications for pedagogical approaches within architectural education. Educators can develop strategies to integrate awareness of noise dynamics into the curriculum, fostering a culture of respect for the learning environment and promoting responsible studio behaviour.Therefore, understanding noise perception in architectural studios is paramount for creating a learning environment that is conducive to concentration, collaboration, creativity, and overall well-being. By recognizing the subjective nature of noise perception and its multifaceted impact, educators and administrators can implement targeted interventions, fostering an optimal environment for the holistic development of future architects. This understanding is foundational for advancing architectural pedagogy and shaping the physical spaces where creativity and innovation thrive.Thus, this study aims to explore the subjective perception of noise in architectural studios of universities in South-East Nigeria.

II. LITERATURE REVIEW

The impact of noise on educational environments, particularly within architectural studios, has garnered attention in the literature. While some studies provide valuable insights, there is a notable gap in the understanding of noise perception in architectural studios specific to the South-East Nigeria context.

The response to noise may be influenced by acoustical characteristics of sound, such as intensity, duration, and frequency, in addition to non-acoustic factors like location, time of day, and individual factors like noise sensitivity (Guski, 1999; Boman and Enmarker, 2004), age, perceived quality of the living environment, and attitudes toward different modes of transportation (Lam et al., 2009; Guski, 1999).

Numerous international studies have investigated noise perception in educational settings. For instance, Evans and Johnson (2000) explored the impact of ambient noise on concentration in university classrooms, emphasizing the importance of acoustical design. Similarly, the work of Brown et al. (2020) delved into the subjective experiences of students in educational settings, revealing varying perceptions of noise levels.

Environmental quality affects life satisfaction assessments given that managing physiological conditions that are suboptimal due to environmental stress has psychological effects (Evans & Cohen, 2004). Research by Maxwell and Evans (2000) focused on the relationship between noise, creativity, and design thinking in schools. Their findings underscored the delicate balance required for an optimal creative environment, where certain levels of noise may foster creativity while excessive noise disrupts cognitive processes.

Numerous non-acoustical factors, such as one's attitude toward the source of the noise or an increased sensitivity to it, can affect how people react to that noise (Job, 1988; Mackennel, 1980; Borsky, 1980). Another factor influencing an individual's response to noise is their degree of control over the source of the noise (Glass and Singer, 1972). Dockrell and Shield (2006) conducted a comprehensive study on the role of acoustical design in educational spaces, recognizing its impact on student performance and well-being. However, the majority of these studies are situated in Western contexts, necessitating a closer examination in regions with different sociocultural and educational dynamics, such as South-East Nigeria.

The existing literature on noise perception in educational settings provides valuable insights, but a substantial gap remains regarding the context of South-East Nigeria. A nuanced examination is crucial to understand how cultural, pedagogical, and regional factors contribute to the perception of noise within architectural studios. Bridging this gap will not only enhance the global understanding of noise dynamics in educational spaces but will also

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contribute practical insights for the improvement of architectural education in this specific context.

Previous research has mostly been conducted in Western environments, which may obscure cultural differences that affect how noise is perceived. To comprehend how cultural factors influence how teachers and students in South-East Nigeria perceive noise in their classrooms, a more nuanced analysis is needed.Research on the the general wellbeing of faculty and students in South-East Nigerian architectural studios.

III. METHODOLOGY

3.1 STUDY DESIGN

The study adopted facility-based research in which surveys are conducted to collate the subjective qualitative descriptors of noise from the sample population. Data was collected from students and staff in architectural studiosin five different government-owned universities in the 5 states in south-east Nigeria; with each university representing a state in the region. The universities selected for the study were: Abia State University, Uturu (ABSU); Alex Ekwueme University Ndufu Alike, Ikwo (AE-FUNAI); Imo State University, Owerri (IMSU); Nnamdi Azikiwe University, Awka (UNIZIK); University of Nigeria, Enugu Campus (UNEC).The study population consists of 1473 students and 104 academic staff. The results of the data were compiled to determine the cumulative perception of noise from the region. Analysis of variance (ANOVA) was used indicate differentials and Duncan Multiple Range Test (DMRT) was used to identify precise differences between mean pairs.

3.2 PARTICIPANTS

The study participants were made up two groups: Architecture students undergoing training in the selected universities both undergraduate and postgraduate (100 level – 600 level); and Architecture teaching staff in the selected universities. Taro Yamane (1967) was used to determine the sample size of 315 students and 83 staff for the study. Stratified random sampling technique was used to administer questionnaires; 297 and 70 were returned respectively. The inclusion criteria of student population, in addition to willingness to participate, included being an architecture student, present and seated in the studio at the time of data collection; the staff population included being an academic staff who teach the students in their design studios and were present at the time of data collection.

3.3 DATA COLLECTION

dynamics of architectural studios in Nigerian universities has been scarce. This region's distinct studio structures, pedagogical approaches, and cultural influences call for a targeted study to close the current gap in the literature.Moreso, while some studies discuss the effects of noise on learning, more research is required to fully understand how noise perception affects academic performance as well as

The survey lasted for a period of 15 weeks from June to September 2023. Data was collected from each architectural studio in each of the selected university. Respondents were randomly selected. A total number of 398 questionnaires were issued, 315 and 83 to students and staff respectively. Questionnaires returned were 297 and 70 representing a non-response rate of 5.7% and 15.7% from students and staff respectively. The physical measurement captured on-field noise data with the aid of AS834+ Digital Sound Level Meter to obtain noise descriptors at various logging stations (nodes) in each architectural studio. Each studio was diagonally dissected and data collection equidistant reading points were strategically placed at the nodes, and samples collected. The average values calculated from the field measurement are to be used in statistical analysis. Each point was logged for a period of 10 minutes to ensure data stability.

3.4 ETHICAL CONSIDERATIONS

The research protocol was first approved by the relevant Heads of Department of each Schools of Architecture under study before any form of data collection began. Participants were first informed of the purpose of the study and were assured anonymity of their voluntary response. Participants reserved the right to withdraw from the study and were under no obligation to return the questionnaire.

IV. PERCEIVED NOISE LEVELS

4.1 SURVEY RESULTS

The demographic characteristics of the study participants are analysed in Table 1.

Table 1 shows that users of the architectural studio in the study were categorised into students and staff; 297 (80.9%) were students while 70 (19.1%) were staff spread across all five institutions. The institutions had more male architecture respondents 269 than female 98. More than half of the respondents (57.2%) are between the age bracket of 21 and 30 years while 28.9% are less than 21 years of age.

In figure 1, UNIZIK had the highest response rate (94.7%) with a student and staff

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population of 406 and 33 respectively, followed by ABSU (93.1%) with student and staff population of 204 and 18. UNEC had a response rate of (92.4%) with student and staff population of 453 and 27. IMSU had a response rate of (89.2%) with student population of 242 and 16 people; while AE-FUNAI had the least response rate (88.6%) with a student and staff population of 168 and 10 persons respectively.

In Figure 2, 200 level studios had the highest number of respondents, while the postgraduate Masters 100 level studio had the least number of respondents. The distribution of the respondents was affected as AE-FUNAI has a relatively new department of architecture without a postgraduate program (M.Sc. 1 & 2) and yet to have students in their 400-level studio.

Table 1: Demographic characteristics of the study participants

	Frequency	Percent
User		
Students	297	80.9
Staff	70	19.1
Gender		
Male	269	73.2
Female	98	26.8
Age group		
< 21 years	106	28.9
21-30 years	210	57.2
31-40 years	36	9.8
41-50 years	11	3.1
above 50 years	4	1.0

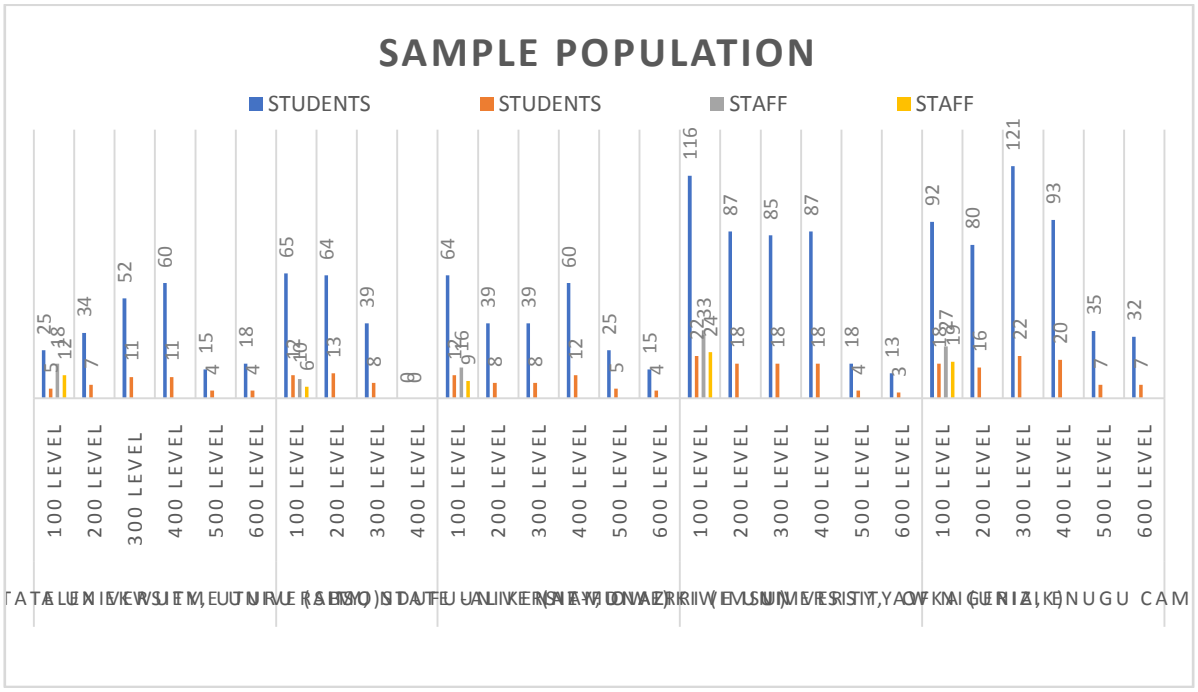

Figure 1: Names and sample population of selected universities

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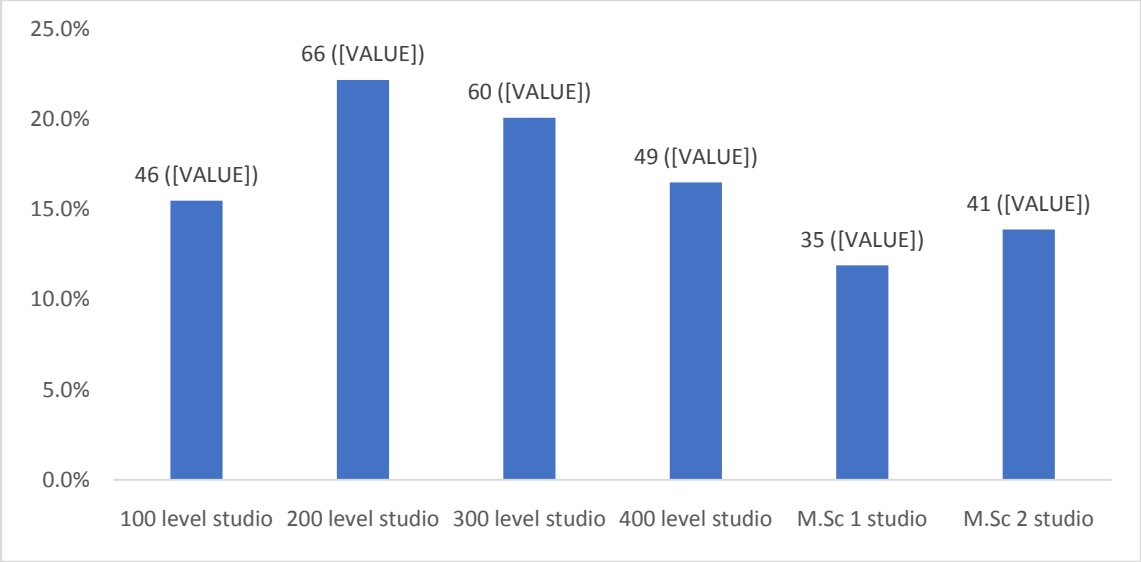

Figure 2: Respondents designated Architectural studio space

Table 2: Noise level assessment in architectural studios by the study participants (self-report)

	Frequency	Percent
Do you experience noise pollution in your studio space?		
yes	274	74.7
no	93	25.3
How often do you experience noise pollution in your architectural studio?		
Rarely	79	21.6
sometimes	148	40.2
not sure	34	9.3
frequently	102	27.8
almost always	4	1.0
Rate the overall level of noise pollution in your design studio		
very high	11	3.1
high	100	27.3
moderate	191	52.1
low	49	13.4
very low	15	4.1
To what extent is the level of noise in your architectural studio acceptable to you?		
very unacceptable	48	12.9
unacceptable	115	31.4
not sure	110	29.9
acceptable	83	22.7
very acceptable	11	3.1
How would you rate the level of noise pollution in your studio?		
very annoying	34	9.3
annoying	100	27.3
slightly annoying	144	39.2
rarely annoying	89	24.2

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Table 2 reveals that the majority of respondents (74.7%) report experiencing noise pollution in their architectural studio on occasion (40.2% sometimes, 21.6% rarely, and 27.8% frequently, respectively). The majority of respondents (52.1%) assessed the studio's overall level of noise pollution as moderate, followed by high (27.3%) and low (13.4%). The majority of respondents (31.4%) think the studio's noise level is unacceptable. 27.3% find the noise level annoying, compared to 39.2% who find it slightly annoying.

4.2 VARIATION IN PERCEPTION

Table 3 shows that the perceived noise levels of studios with divided spaces (74.44dB) is significantly lower than that of isolated spaces (79.03dB) and open-plan space (78.08dB), ($F = 6.908$, $p = 0.001$). However, the Duncan multiple comparison test indicates that noise levels of isolated space and open-plan space are not significantly different. Studio space with full partition (72.63dB) have significantly lower noise levels compared to studio space with partition to lintel (79.33dB), ($t = 3.938$, $p < 0.001$). No significant difference was found in the noise levels of architectural studios of different building types ($F = 1.632$, $p = 0.153$).

Table 3: Comparison of mean noise levels of architectural studios with different design/type

	Mean (dB)	SD	F	P value
Building type				
Standalone building	75.39	7.66	1.632	0.153
Interdisciplinary building	75.52	7.54		
Adaptive reuse building	73.77	11.89		
Multi-use buildings	78.22	7.38		
Temporary/ mobile space	81.76	7.37		
Others	78.73	2.56		
Layout category				
Isolated space	79.03*	4.95	6.908	0.001
Open-plan space	78.08*	8.26		
Divided space	74.44	8.47		
Nature of partition for divided spaces				
Full partition	72.63	8.99	t = 3.938	< 0.001
Partition to lintel	79.33	3.93		

*Duncan multiple range test indicating means not significantly different

V. DISCUSSION

Across the globe, noise generation significantly differ according to location, landuse structure, building type and daily activities. In the incidence of noise in architectural studios in universities in south-east Nigeria, majority of the respondents (approx. 75%) experience noise in their architecture studios, thus, confirming the ubiquitous nature of noise globally. However, more than half of the respondents (52.1%) assessed the studio's overall noise level as moderate. Meanwhile, majority of respondents (44.3%) think the studio's noise level is unacceptable and does not conform with the WHO's guideline on classroom noise. Further study should be conducted, to determine the current noise level of architectural studios in universities in south-east Nigeria, and how it fits into the globally accepted standards.

In the study, (36.6%) of the respondents are disturbed by the noise pollution in the studios and find it annoying, while as high as (63.4%) are not bothered by the levels of noise pollution. This conforms with Weber et al., (2014) which stated that, the impact of noise is often neglected yet they induce severe effects on humans and on living organisms.Similarly, Passchier-Vermeer (1993) is of the opinion that noise-based annoyance; characterized by feelings of resentment, displeasure, dissatisfaction and discomfort, occurs when noise interferes with one's thought process, feelings or daily activities and can be observed in the classrooms. This trend shows that respondents in the study area have adapted to the noise condition of their environment, and as such are symptomatic of assertions by Passchier-Vermeer (1993).

While the open-plan spaces foster better teacher-student relations and encourage student participation, the traditional square classroom set up with rows of desks idealizes the teacher's authority and the students' submission (Sureda & Colom, 1989; Romana Blay, 1991; Gilmartin,

1998). Certain studies on open-plan classrooms indicate that teachers were adopting more conservative teaching practices, when compared to teachers in traditional square classrooms; Traditional classrooms were less likely to promote active, noisy, independent learning because they were afraid of disturbing other classes (Ahrentzen & Evans, 1984; Rivlin & Rottenberg, 1976). This trend continues in this study as the perceived noise levels of studios with divided spaces (74.44dB) is significantly lower than that of isolated spaces (79.03dB) and open-plan space (78.08dB). The variance in noise levels was rightly identified when analysing noise perception in studios with different types of partitions; Studio space with full partition (72.63dB) have significantly lower noise levels compared to studio space with partition to lintel (79.33dB), ($t = 3.938$, $p < 0.001$).

VI. CONCLUSION

The study identified that noise is perceived to be present in architectural studios in universities in South-East Nigeria, and noise level is perceived to be moderate majority of the occupants. Open-plan studios are alsoperceived to be more noisy than isolated and divided studios. The study thus, concludes that noise is present in architectural studios, and the occupants are not bothered by noise, albeitaffected by it. Understanding noise and how it is perceived helps architects create acoustically-focused studios that strike a balance between the collaborative and individualized facets of architectural education.

VII. RECOMMENDATION

This study therefore recommends that this perception and how it fits in to the globally accepted standards and WHO guidelines should be studied. The study also identified that a greater number of occupants are not bothered by the noise in their environment, yet are affected by it. This study thus, recommends that the effects of noise pollutants on cognitive function and productivity in architectural studios of universities in south-east Nigeria be studied. Furthermore, open-plan studios were identified to be more noisy than isolated and divided studios; and studios with full partitions are less noisy than studios with partitions to lintel levels. The study recommends that: open-plans should not be employed in designing architectural studios, although it facilitates students' interaction; if open-plans must be used because of interaction and collaboration benefits, full partitions must be used to ameliorate the effects of noise in the studio; divided studios should be employed in designing studio spaces for the most effective noise level rating.There is an urgent need for universities to inform students, staff and general public on the dangers of noise in the environment especially in the academic settings. The health effects of noise might be long term but the effects of noise overall life satisfaction and well-being is immediate. Such awareness scheme will prove useful to reducing noise levels since noise is a man-made hazard.

Further studies should be conducted to determine the current noise levels in architectural studios in universities in south-east Nigeria and how they fit in to the globally accepted standards and WHO guidelines. Also, studies should be conducted on the effects of noise pollutants on cognitive function and productivity in architectural studios of universities in south-east Nigeria

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