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Research Article

EVALUATION OF INTERACTIVE SPACES FOR ENHANCED LEARNING IN ARCHITECTURE DEPARTMENT BUILDINGS IN NIGER STATE, NIGERIA

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Abstract

The design studio is still the focal point of curricular programmes in architectural faculties around the world, and it is regarded as the gold standard for architectural design education. However, the architecture studio's primary role in the existing academic framework of architectural education needs to be reconsidered. As a result, a shift to architecture studio design is required to create an environment that delivers an immersive and collaborative feeling of setting for studio users. The job of architecture is to build and develop places that fulfil the demands of architecture users and the usage of spaces by different individuals and groups of people, just as an architecture design studio is considered as a learning environment and usually a location where interactions occur. This study investigates the methodologies and goals of architectural design for open space facilities that relieve stress in learning environments such as those found on university campuses in a compact urban setting. The literature reviews, along with expert input, indicate strategies for integrating sustainability as the foundation for achieving a functional institutional environment structure for Nigerian schools of architecture; thus, this serves as the foundation for the development of a questionnaire to collect relevant data. Improving quality and service delivery through better interactive space organisation. The findings suggest that architects should incorporate sustainable building areas into their theoretical preparation. According to the study, it is critical to set standards for an alternative design approach that is user-centered while also strengthening the training of student architects by creating more interactive spaces.

Keywords: Collaborative learning, design studio, enhanced learning, interactive spaces.

Araştırma Makalesi

NİJERYA'NIN NİJER EYALETİNDEKİ MİMARLIK BÖLÜMÜ BİNALARINDA GELİŞMİŞ ÖĞRENME İÇİN İNTERAKTİF ALANLARIN DEĞERLENDİRİLMESİ

Özet

Tasarım stüdyosu halen dünyanın dört bir yanındaki mimarlık fakültelerinde müfredat programlarının odak noktasıdır ve mimari tasarım eğitimi için altın standart olarak kabul edilmektedir. Ancak, mimarlık stüdyosunun mimarlık eğitiminin mevcut akademik çerçevesindeki birincil rolünün yeniden gözden geçirilmesi gerekiyor. Sonuç olarak, stüdyo kullanıcıları için sürükleyici ve işbirliğine dayalı bir ortam hissi veren bir ortam yaratmak için mimarlık stüdyosu tasarımında bir değişim gereklidir. Bir mimari tasarım stüdyosunun bir öğrenme ortamı ve genellikle etkileşimlerin gerçekleştiği bir yer olarak görülmesi gibi, mimarlığın işi de mimarlık kullanıcılarının taleplerini ve farklı bireyler ve gruplar tarafından mekanların kullanımını karşılayan mekanlar inşa etmek ve geliştirmektir. Bu çalışma, kompakt bir kentsel ortamda üniversite kampüslerinde bulunanlar gibi öğrenme ortamlarında stresi azaltan açık alan tesisleri için mimari tasarım metodolojilerini ve hedeflerini araştırmaktadır. Literatür taramaları, uzman görüşleriyle birlikte, Nijerya mimarlık okulları için işlevsel bir kurumsal çevre yapısına ulaşmanın temeli olarak sürdürülebilirliği entegre etmeye yönelik stratejilere işaret etmektedir; dolayısıyla bu, ilgili verileri toplamak için bir anketin geliştirilmesine temel teşkil etmektedir. Daha iyi etkileşimli alan organizasyonu yoluyla kalite ve hizmet sunumunun iyileştirilmesi. Bulgular, mimarların sürdürülebilir bina alanlarını teorik hazırlıklarına dahil etmeleri gerektiğini göstermektedir. Çalışmaya göre, kullanıcı merkezli alternatif bir tasarım yaklaşımı için standartlar belirlemek ve aynı zamanda daha interaktif alanlar yaratarak öğrenci mimarların eğitimini güçlendirmek kritik önem taşıyor.

Anahtar kelimeler: İşbirliğine dayalı öğrenme, tasarım stüdyosu, geliştirilmiş öğrenme, etkileşimli alanlar.

1. INTRODUCTION

Globally, the perspective on interactive architectural environments views digital technologies as a backdrop to our life, much like the perspective on physical architecture (Aalhashem et al., 2023). This viewpoint enables an analysis of interactive digital technologies in terms of the opportunities they present for visibility, involvement, and action (Wiltse and Stolterman 2010). The study of interactive architecture explores into new architectural approaches that combine virtual and digital environments with real-world, tangible spatial experiences. By using the time-based characteristics of digital technology, interactive architecture research looks into the development of novel methods to move around and occupy space (Knox, 2017).

Since interactive architectural spaces provide new opportunities for space design and experience, they are crucial. They make it possible to create environments that are dynamic and adaptable to each person's requirements and choices (Lupacchini, 2023). This research delves into the notion of dynamic and interactive interior design in modern architecture, with a focus on utilising technology, creativity, and science to manipulate perceptual-emotional components. This eliminates the need for extra tools or assistance and enables the conversion of surfaces into virtual and interactive worlds. Users' interactions with their surroundings can

be rekindled and reconnected through interactive architecture, which can improve daily living in novel ways (Li, 2019).

Interactive architecture can enhance interior layouts and lighting performance in buildings via the application of technology and responsive design (Chen and Wen, 2022). Moreover, by incorporating architectural innovations and advancements in intelligent surfaces and interactive facades, interactive architecture has the capacity to convert conventional places into imaginative and sophisticated settings (Gherghescu, 2018). In general, immersive, customised, and captivating experiences that improve well-being and quality of life can be created in interactive architectural spaces. The design studio, which is at the centre of architectural education, is where students get core insight through a defined pedagogical approach of learning by doing.

Olotuah *et al.*, (2016), stated that architectural education is undoubtedly insufficient because what constitutes good architectural design instruction varies depending on the individual. Every teacher teaches differently from the others, according to their own established beliefs and principles. Meanwhile, different faculties, and even the same department, have a wide range of resources, instructional approaches, and areas of concentration. In spite the accomplishments of growing studios to act as a powerhouse, flowing out revolutionary ideas, imaginative thinking and measurable outcomes of social and cultural vitality, linking the most knowledgeable, motivated researchers with a broad variety of fresh knowledge.

But there's a deeper issue: a lot of students experience significant levels of stress during their time in college, and this stress puts students' academic performance at risk (Oduwaiye et al., 2017). Campus design in this context goes well beyond simply providing study space. Thus, in order to foster student interaction and collaboration through the dual roles of social engagement and environmental enhancement reinforcing each other jointly, featuring an open space in healthy campus life, the issues of sustainable development need to be incorporated into the institutional context for architectural teaching and practise.

This study focuses on the institutional framework of Nigeria's Architectural Schools and the sustainability objectives as an integral part of that framework. The emphasis is on how to build open spaces to alleviate stress among students and encourage healthy campus life interaction and collaboration. The objectives that guided the study are (i) to suggest strategies for integrating sustainability for achieving functional buildings for schools of architecture in Nigeria. (ii) To determine the association between users centered design and collaboration among the level. (iii) To determine the association between the functionality design and collaboration among the level. The goal of the objectives is to improve quality and better interactive spaces for architectural learning. To test the assumption of the study, the following hypotheses were put forward:

Hypothesis 1
H0: There is no association between the user centered design and collaboration among the level.
H1: There is an association between the user centered design and collaboration among the level.
Hypothesis 2
H_0: There is no association between the functionality design and collaboration among the level which is prompted by the nature of space.
H_1: There is an association between the functionality design and collaboration among the level which is prompted by the nature of space.

2. LITERATURE REVIEW

In general, the effects of interactive architectural environments on learning have been assessed in architecture school buildings. Significant improvements have been made to the architecture of learning spaces in higher education, with an emphasis on creative initiatives that improve novel learning opportunities (Molineiro *et al.,* 2022). The Learning Environment Model for Higher Education (LEMHE), a useful framework that the study offers, can be used by educational institutions to create classroom environments that improve higher education learning. According to Atyah (2020), research has been done on how the design of educational environments affects the performance, happiness, and well-being of both teachers and students. This highlights the significance of having welcoming, comfortable, and adaptable learning spaces.

The architectural studio has been extended beyond conventional rooms by future learning spaces including immersive virtual environments, which provide new opportunities for learning communities (Manca, 2020). A post-occupancy assessment of an Icelandic school building that blends limited and open areas has also been carried out, offering valuable information on the design's advantages and disadvantages (Sopher *et al.*, 2019). These studies highlight how improving learning at architecture schools requires architectural techniques that support flexibility, well-being, and the integration of indoor and outdoor learning environments. It is appropriate to provide users with physical and psychological comfort during school hours because architecture plays a significant role in educational spaces and classrooms.

From an environmental psychological perspective, physical concerns are typically considered as a container in which human behaviour and interaction occur and user needs—emotional, social, psychological, and physical—are met. But human needs, both physiological and psychological, can suffer greatly from a lack of space (Molloy, 2021). Previous studies have demonstrated that a number of factors, including student self-concept, teacher preparation, the teaching method, the school environment, the government, and the kids' primary environment, affect students' academic success. Reddy *et al*., (2018) define stress as the result of the interplay between the student's evaluation and its reactions, as well as the ambient stress.

While just the right amount of stress can boost productivity, too much stress can lead to illnesses both physical and psychological, undermine self-worth, and have an adverse effect on students' academic performance (Brobbey, 2021). The National Crime Records Bureau reported that one student commits suicide every hour (Singh *et al*., 2023). By offering a setting for both formal and casual activity, open spaces frequently aim to encourage interaction. Hanan (2013) stated that open areas between buildings that serve as connections between the surrounding landscapes provide a campus a feeling of direction by fusing and arranging various locations and features. By incorporating appealing settings and producing visual surprises, they can also offer an artistic significance. Many creative and inventive ideas are developed in outdoor settings, free from the confines of classrooms and conversations.

Hence, open spaces need to be coherent. Coherence refers to consistency, or ease of understanding. Ambiguity, confusion, and disorientation are huge barriers to coherence. Lau *et al.,* (2014) opined that important principles for a healthy learning environment are located in open space on campus. Open areas can encourage teamwork and encounters by chance, as well as a less formal and more casual approach to work. There are ways in which the design of a space will affect the occupants' mental health. A fundamental concept for designing open space on campus is to provide a meaningful place for basic student needs such as warmth,

relaxation and social interactions (Zhang and Li, 2023). This involves a well-designed breakout area with comfortable seating and even walking meeting routes may inspire students to be more involved and spice up their work atmosphere.

However, it is important to remember in designing solutions that campus has several buildings with different open space characteristics. All academic organizations have the same spatial layout, but public and private areas must be included in the outdoor design. The study of open spaces on American campuses leads to issues of the design of large common areas and special courtyard places and space among buildings in more than one location (U.S. Council on Education, 2006). Spatial experience quality must respond to user needs and support campus users' efficient, simple, secure, enjoyable, exhilarating experiences. Zhang et al., (2009) asserted that the principles of spatial quality in campus design are fluency between indoor and outdoor spaces, suitability for the realization of student events, flexibility of usage and comfort for any user.

Studies by Kathleen and Gowri (2015); Foellmer, *et al.,* (2021); Fägerstam (2012) shown that a well-designed and linked indoor and outdoor campus networks can be a powerful influence on the initial and long-standing experiences of students that foster a sense of belonging to the learning community. Numerous studies (Shekhar *et al.,* (2019; Arun and Harikumar 2021) on spatial features have shown, in addition, a relationship between these features and the desire of people, and the instinctive need for protection and survival even of human beings. Established relations were verified severally, having been investigated by different researchers.

Büyükşahin *et al.,* (2018) posited that spatial features in architectural spaces include space size, movement and circulation in space. Lau *et al.,* (2014) expressed that the courtyard could be ideal for a relaxed sense of space as well as number of open sides. Having reviewed influences of learning spaces that impact student achievement, evidence was gathered of landscape effect on people's wellbeing, from ancient times to the present day (Abraham *et al*., 2009). These factors include the belief that viewing vegetation, water, and other natural elements can reduce stress (Ulrich, 1979). Amount of window view of nature enhance self-discipline increased and stress reduction (Taylor *et al*., 2002). Building conditions such as light, colour, temperature, air quality, acoustics, school size and furniture have a direct effect on the actions and performance of the students.

2.1 User-Centered Theory of the Built Environment

Theoretical study in the field of interactive architecture began in the late 1960s (Wood, 2011). A few architects would apply early cybernetic theories to study the potential within the discipline of architecture. Examining the experiences of building users leads to the development of a theory of the built environment. The built environment, according to Vischer (2008), exists to support the actions of the users who inhabit it. This is the fundamental principle of user-centered philosophy. As a result, this theory indicates routes for further investigation into this complex interplay and provides instruments for assessing the effectiveness of the created environment in use. The study addresses how to analyse and approach user experience in order to better understand the relationship between the built environment and its users. It also covers the challenges of designating users and setting boundaries around the built environment. The obstacles in putting this theory into action include organising the notion of the built environment, defining users, and establishing a consensus on what constitutes an experience (Kalvelage and Dorneich, 2014). Another challenge is combining the need to ensure overall building performance with providing users

with control over building conditions and operations in order to improve user experience (Emo et al., 2016). The study demonstrated the need of including cognitive biases and human spatial behaviour when designing agent-based models for architectural and urban usability research. Through responsive environments and affective computing, it is possible to construct user-centered smart settings that accommodate a broader spectrum of users, including individuals with neurodiverse conditions.

The study approaches define how to approach and measure the user's experience of built space in order to better understanding of the user-environment interaction in order to create a user-centered theory of the built environment. The analysis is based on extensive research on office space utilisation. The study's findings are as follows: (i) it develops a user-centered philosophy of the built environment, emphasising the importance of the user's experience in interpreting and assessing the efficacy of the built environment. (ii) Provides ideas on how to quantify and approach user-built environment experiences in order to improve knowledge of the relationship between users and their surroundings. (iii). discusses the challenges of implementing a user-centered approach, such as defining users, determining what defines an experience, and establishing boundaries around the concept of the built environment. (iii) underlines that understanding the user-environment connection necessitates considering the temporal component of space use. (v) From a macro viewpoint, connects user-centered theory to the built environment's creation, delivery, occupancy, and disposition, with the purpose of unifying all phases into a single, comprehensive theoretical framework. (vi) contends that a user-centered theory can influence future research and have an impact on decision-making in the building delivery process in order to ensure that the user's experience is reflected.

3. METHODOLOGY

This study used a quantitative research strategy to collect data on architectural design studio interaction via questionnaire administration.

3.1 The survey Instrument

An image of the essential issues and conditions affecting their performance in their studies was obtained from early observations and interactions with architecture students, from which a questionnaire was designed in line with their requirement for interactive spaces. The questionnaire included closed questions with yes/no answer alternatives as well as questions with pre-defined answer categories, with certain questions allowing for multiple responses. The employment of a questionnaire is regarded as the most ideal tool for obtaining the most cost-effective, dependable, and widely used technique of gathering the necessary information by the respondents. The questionnaire was distributed to architectural students at the chosen school. This improved the accuracy and validity of the results.

3.2The Survey

In order to reach a wide number of respondents, a questionnaire survey was judged ideal for this study. It was also utilised objectively to gather perspectives on the subjects under investigation. In their study to explore respondents' perceptions of public building projects in Nigeria, Akande et al. (2018) used a similar approach. Before the survey was administered, the questionnaire was piloted using the expected, standardised questionnaire to ensure that the respondents could readily grasp it before it was deemed appropriate to obtain the essential data. The survey sample was collected primarily from Nigerian architecture departments, with

respondents picked using random sampling techniques. The questionnaires were created online using Google Forms and distributed to respondents by email, WhatsApp, and Facebook.

3.3 Reliability Test

The data was analysed and reliability tests were performed to verify the reliability of the measurement scales utilised for analysis in this study. The reliability of the instruments was determined using Cronbach's standardised alpha (Table 1) to verify unidimensionality between the test scales. 14 variables were identified from the data set since they have numerical values, and the reliability coefficient for all 14 parameters is 0.878. This means that the data is highly reliable.

Table 1: Reliability Test

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.878	14

3.4 Relative Importance Index

Each observation was graded and the most important ones were selected using the Relative Important Index. The dominant variables were necessary to define and aid policymakers in making decisions on the integration of the approach to interactive space design. Accurate prevalence data is thus essential to accomplish such a task. The usage of the Relative Importance Index (RII) was explored as one method of determining such prevalence.

3.5 Data analysis method

Descriptive statistics were utilised to evaluate questionnaire responses and summarise socio-demographic data, while statistical analysis was performed using the statistical package for social scientists (SPSS) to analyse the difficulties revealed in this study.

4. FINDINGS AND DISCUSSION

4.1 Socio-Demographic Characteristics of the Respondents

The survey received 177 responses. As a result, the sample size is deemed sufficient. The results suggest that 27% of responders are female, while 73% are male. Only 18.6% of those polled are between the ages of 15 and 19, while 44.6% are between the ages of 20 and 24. Meanwhile, 31.6% are between the ages of 25 and 29, and 5.1% are 30 and older. This finding implies that the majority of respondents were mature and capable of laying the groundwork for comprehending the design strategy for interactive spaces. According to the institutions surveyed, 65.5% are from the Federal University of Technology, Minna, and 26% are from the Federal Polytechnic Bida, both in Nigeria. According to the data, only 55.9% of respondents have open space meant to increase student interactions, while 44.1% do not have open space dedicated to enhance student interactions in their institution.

4.2 Contribution of design features in facilitating interactive spaces

The contribution of each design component was assessed, and the traits were ranked in terms of how they increase the student's learning as perceived by the respondent by calculating the Relative Importance Index (RII) using the formula below:

$$RII = \frac{\sum W}{A * N}$$

Where W = Weight given to each statement by the respondent
A = Highest response integer which is 5
N = Total number of respondent

According to Table 2, user-centered design came in first, followed by utility in second, and encouraging connection in third.

Table 2: Design features in facilitating interactive spaces

Design features	Relative Important Index (RII)	Rank
User Centered Design	0.6350	1
Flexibility	0.5887	4
Fostering Connection	0.6079	3
Blended Learning	0.5016	5
Functionality	0.6090	2

4.3 Integration of Interactive Spaces

According to the findings reported in Table 3, the respondent placed "Interaction ease design process in studio" first. The second highest ranking was "achieving a common goal through collaborative work using interaction." This suggests that the incorporation of interactive environments is regarded as a component in enhancing learning. In the meantime, "awareness of the collaborative work attributes and condition from interaction" came in third place.

Table 3: Integration of Interactive Spaces

Integration of Interactive Spaces	RII	Rank
Aware of the collaborative work attributes and condition from interaction	0.7401	3
Achieving a common goal from collaborative work using interaction	0.7468	2
Individual's use of other member's feedback and critics for improving their works	0.7209	4
Collaboration from interaction brings about free rider	0.6858	5
Interaction ease design process in studio	0.7638	1

4.4 Importance of interactive spaces

According to the data in Table 4, respondents chose "collaboration among the level which is prompted due to the nature of space" as the most important aspect of interactive spaces. Meanwhile, "students are less productive on campus due to stress" is ranked second. Studio connection to each other was placed lowest, which could be attributed to the fact that studio connection does not always have to do with settings that promote learning.

Table 4: Importance of interactive spaces

Importance of interactive spaces	RII	Rank
Stressful environment prevents interaction amongst students	0.7638	3
Collaboration amongst the level is prompted due to nature of spaces	0.8158	1
Studio connected to each other enhances easy interaction amongst students	0.7615	4
Students are less productive due to stress in the campus	0.8101	2

To see if there was any relationship between user-centered design and level collaboration. Table 5 showed the findings of the analysis, which suggest that there is a link between user-centered design and collaboration at the student level of study, allowing them to achieve to their fullest and best potential while minimising unnecessary distractions. For these findings, the Chi-square test of independence (Table 6) was performed to determine if the dependent variable affects or influences the independent variable.

Table 5: Association between users centered design and collaboration among the level.

			[User centred design (learning spaces to allow students to perform to their highest and best potential and to minimize superfluous distractions.)]			Total
			Low	Moderate	High	
[Collaboration amongst the level is prompted due to nature of spaces]	Disagree	Count	11	7	0	18
		Expected Count	4.5	6.6	6.9	18
	Neutral	Count	15	14	10	39
		Expected Count	9.7	14.3	15.0	39
	Agree	Count	18	44	58	120
		Expected Count	29.8	44.1	46.1	120
Total		Count	44	65	68	177
		Expected Count	44.0	65.0	68.0	177

Table 6: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.785[a]	4	.000
Likelihood Ratio	33.272	4	.000
Linear-by-Linear Association	28.225	1	.000
N of Valid Cases	177		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.5.

The asymptotic significant value is less than 0.05, according to the results in Table 6. As a result, we reject the null hypothesis and conclude that there is a link between user-centered design and level cooperation that is prompted by the nature of space. When there are learning environments that allow students to perform to their fullest and best potential while minimising unnecessary distractions, this influences student collaboration. The level of association was measured since there is an association between user-centered design and cooperation among the levels (Table 7). According to the Gamma (Goodness and Kruskal's gamma), the relationship is strong. With a score of 0.584, the relationship is statistically significant.

Table 7: Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.352	.059	5.536	.000
	Gamma	.584	.084	5.536	.000
N of Valid Cases		177			

a. Not assuming the null hypothesis. b. Using the asymptotic standard error assuming the null hypothesis

Table 8 presents the findings that show that there is an association between the functionality design and collaboration among the level prompted by the nature of space, which allows the spaces provided to accommodate all participants comfortably, and ensures that each proposed use of the space can be hosted without putting stress on the r Similarly, for the findings below, the Chi-square test of independence (Table 9) was employed to determine if the dependent variable impacts or influences the independent variable.

Table 8: Association between the functionality design and collaboration among the level

			[Functionality (Space to accommodate all participants comfortably, and to ensures that each proposed use of the space can be hosted without putting stress on the room or disquieting users.)]			Total
			Low	Moderate	High	
[Collaboration amongst the level is prompted due to nature of spaces]	Disagree	Count	13	5	0	18
		Expected Count	5.7	6.2	6.1	18.0
	Neutral	Count	14	13	12	39
		Expected Count	12.3	13.4	13.2	39.0
	Agree	Count	29	43	48	120
		Expected Count	38.0	41.4	40.7	120.0
Total		Count	56	61	60	177
		Expected Count	56.0	61.0	60.0	177.0

Because the Asymptotic significant value is less than 0.05, we reject the null hypothesis and infer that there is a link between functionality and level collaboration. When there is a space to comfortably accommodate all participants, and to ensure that each intended use of the space can be hosted without putting stress on the room or disturbing users, it affects or influences student collaboration.

Table 9: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.557[a]	4	.001
Likelihood Ratio	23.265	4	.000
Linear-by-Linear Association	16.901	1	.000
N of Valid Cases	177		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.69.

The level of association was examined since there is a link between functionality design and collaboration among the levels (Table 10). According to the Gamma (Goodness and Kruskal's gamma), the relationship is strong. With a value of 0.436, the link is statistically significant.

Table 10: Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.254	.064	3.821	.000
	Gamma	.436	.102	3.821	.000
N of Valid Cases		177			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

5. DISCUSSION OF FINDINGS

Findings from this study indicate that if architects consider the aforementioned elements when building learning environments, student involvement will rise. According to the data analysis, the major stress problems are those that architects fail to address while designing. This study found that strategically placed open space techniques and elements not only reduced stress but also improved collaboration, resulting in superior academic performance. The image above depicts the elements identified by respondents as improving student engagement on campus. According to the paper, the use of user-centered design in Spatial design, utility in Landscape design, and green design that fosters connection have been chosen. According to the study's findings, in order to improve interaction among students from the design's genesis stage, the architect should have adequate information stress reductions. They must stay current on all evolving trends in identifying interactive environments in order to make sound decisions that will improve engagement and collaboration while decreasing stress. This adds value to the learning environment and helps students improve their academic performance, confidence, and creativity. It is also suggested that more extensive research be conducted on student perceptions that influence learning settings. In order to develop relationships, a user-centered approach should be used at the early stages of design.

6. CONCLUSION

This study demonstrates a novel approach of learning and technological development that focuses on spatial complexity, green informal meeting spaces, and landscape in learning processes. This results in a new system of educational spaces and a new open environment in which interactions between students and teachers are encouraged. This would also boost

collaboration and improve communication rates, changing how individuals feel and behave while studying or working in the building environs. The need for interaction spaces has thus been advocated, and the efficacy of their design has become central in university buildings and an important factor in making university buildings a functional tool for the community. The learning environment should portray learning and teaching aims, promote the school mission, incorporate technology, and be sufficiently flexible for non-class activities. Informal collaboration places are undeniably important.

AUTHOR CONTRIBUTIONS

Oluwafemi K. Akande: Conceptualization, methodology, formal analysis, investigation, data curation, writing - original draft preparation, writing - review and editing, visualization and supervision. **Chioma Lilian Obi-George**: Methodology, writing - review and editing, project administration. **Charles Yakubu Makun**: Methodology, validation, and financial resources provision. **Emmanuel Moses Anikor**: Validation, and financial resources provision and project administration. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ETHICS COMMITTEE APPROVAL

This study does not require any ethics committee approval.

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