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B. J. Olawuyi
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BOOK OF PROCEEDINGS

MAIN THEME:
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3RD -5TH MAY, 2021

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School of Environmental Technology International Conference (SETIC 2020)

3RD – 5TH MAY, 2021

Federal University of Technology Minna, Niger State, Nigeria

CONFERENCE PROCEEDINGS

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PREFACE

The School of Environmental Technology International Conference (SETIC 2020) is organised by School of Environmental Technology, Federal University of Technology Minna, Nigeria. In collaboration with Massey University New Zealand, Department of Civil Engineering Faculty of Civil Engineering and Built Environment Universiti Tun Hussein Onn Malaysia, Malaysia Centre For Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE) UTM-KL Malaysia, Global Academia, Department of Architecture, Faculty of Engineering and Architecture, Istanbul Gelisim University Istanbul Turkey, Sustainable Environmental and Technology (SET) Research Group, Department of Architecture, Universiti Sains Islam. The main theme for this year conference is "SUSTAINABLE HOUSING AND LAND MANAGEMENT". This promotes and encourage innovative and novelty for policy issues for inclusive and sustainable housing, access to finance for housing and land development, sustainable building materials, building cost management, sustainable and resilient cities, geoinformatics for land management, rapid urbanization, sustainable land use and spatial planning, gender issues in access to land.

The responses from participants for this conference are overwhelming, well attended, and successful. The operation mode was Virtual for all participants who choose the oral presentation mode. While, Physical for all poster medium presenters. Our participants are from various Universities and other sector across the globe, from countries like United State for America (USA), Turkey, Malaysia, China, Saudi Arabia, Kenya, New Zealand just to mention a few. Hence, this conference provides a good platform for professionals, academicians and researchers to widen their knowledge and approach on latest advances in research and innovation. Papers presented in this conference cover a wide spectrum of science, engineering and social sciences.

Finally, a note of thanks must go to SETIC 2020 Local Organizing Committee (LOC) for their remarkable dedication in making this conference a success. We hope the event will prove to be an inspiring experience to all committee members and participants.

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Contents

User Centred Approach to Interactive Architectural Spaces For Sustainable School of Architecture Buildings in Nigeria

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Abstract:

Design studio, still the center of curricular program in architectural faculties worldwide, and considered the standard for education in architectural design. The architecture studio's main role in the current academic framework of architectural study however, needs to be rethought. Therefore, redirection to architecture studio design is required to achieve an atmosphere that provides an immersive and collaborative sense of setting for studio users. Just as architecture design studio is seen as a learning environment and usually an area where interactions occur, the function of architecture is to build and develop spaces that meet the needs of architecture users, and the use of spaces to different individual and group of people. This paper explores the techniques and goals of architectural design for open space facilities that provide stress relief for learning environments like those of university campuses in a compact urban setting. The literature reviews together with the input of experts indicate strategies for integrating sustainability as the basis for achieving a functional institutional environment structure for the Nigerian schools of architecture thereby, this is the basis for the creation of a questionnaire to gather relevant data. From improving quality and better service delivery in terms of improved interactive space organization. The findings indicate the integration of sustainable building spaces into architects' theoretical preparation. The study recommends that it is important to establish guidelines for an alternative design approach that is focused on the user and at the same time strengthen the training of student architects by creating more interactive spaces.

Keywords: Collaborative Learning, Design Studio, Interactive Spaces, User's Centred Approach.

INTRODUCTION

The design studio lives at the heart of architectural learning by a well-established pedagogical process of 'learning by doing' builds Core insight for learners. Learning in architecture are certainly inadequate. Architectural design teaching means different things for different people; each instructor teaches appropriate to their own developed ideas and values and in a manner different from others. Meanwhile, a large number of areas of focus, teaching methods, and facilities are present in various faculties and even within a single faculty (Salama, 2006). In spite the achievements of developing studios to serve as a powerhouse, gushing out revolutionary ideas, imaginative thinking and measurable results of social and cultural vitality, linking the most knowledgeable, committed researchers with a broad range of new knowledge. There's a bigger problem in that, many students in their university life are subject to high levels of stress.

Hamaideh (2011) noted that the stressful life of the university also threatens academic performance among students. In this context, campus design is far beyond giving study space. It should also be healing serving both physical and emotional needs. Thus, the issues of sustainable development need to be incorporated into the institutional context for architectural teaching and practice in order to promote interaction and collaboration between students through the dual role of social engagement and environmental enhancement reinforcing each other jointly, featuring an open space in healthy campus life. The research 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 goal of the study is to suggest strategies for integrating sustainability for achieving functional

buildings for schools of architecture in Nigeria. This is to improve quality and better interactive spaces for architectural learning.

LITERATURE REVIEW

In educational spaces and classrooms, architecture plays an important role; it is therefore appropriate to give users physical and psychological comfort in school times. Physical concerns have usually been taken into account from the environmental psychological viewpoint and are named as a container in which human actions and interaction take place and the emotional, social, psychological and physical needs of users are addressed. However, space can lead to serious harm to physiological and psychological needs of human beings (Lang, 2012). Throughout past research, student self-concept, teacher education, teaching process, the school environment and government have been established as factors that influence student academic success, and the primary environment of the students. This stress is described by Lee and Larson (2000) as an interaction between environmental stressor, the student evaluation and its reactions.

Though optimum stress may improve performance, too much stress may cause physical and psychological disease, decrease self-confidence and can affect students ' academic achievements. According to statistics released by the National Crime Records Bureau, one student commits suicide every hour (Saha, 2017). Open spaces are often intended to promote interaction by providing an environment for formal and informal activities. Open spaces situated between buildings and function as joints of surrounding environments provide a sense of direction in a campus by integrating and coordinating different places and elements; they can also provide an aesthetic meaning by involving attractive surroundings and generating visual surprises. Through outdoor spaces, many creative and innovative concepts take place, away from structured lessons and discussions. The natural scenery and the calming environment in the open spaces encourage impromptu meetings and conversations, and provide fresh air for stressed scholars (Payne, 2009).

Evans and Mccoy (1998) established that architecture through stimulation can affect human health. It has been generally acknowledged that creative expression can be encouraged by an open and informal environment but the relaxation that an open space provides must be mild. To accommodate individual desires and social interaction, the environment must be versatile. This also needs to provide protection or defense against discomfort and overstimulation. A well-designed open space would create an integrated combination of private space for focused research and public space for interactive interactions within campus life. Stress is also present when changes or disturbances in the physical environment trigger difficult prediction. Hence, open spaces need to be coherent. Coherence refers to consistency, or ease of understanding. Ambiguity, confusion, and disorientation are huge barriers to coherence. Strange (2001) and Kenney and Daniel (2005) 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 such as 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. 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. Dober, 2000 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. Also studies have shown that a well-designed and linked indoor and outdoor campus networks can be central, but usually ignored catalysts in student learning and is a powerful influence on the initial and long-standing experiences of students that foster a sense of belonging to the learning community (Greene, 2013). Numerous studies 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 again and again, having been investigated by different researchers.

According to Garling (1969) spatial features in architectural spaces include space size, movement and circulation in space. Meanwhile Tanner (2009) opined that daylight and optimum visibility affect students' performance. While Lau and Yang (2009) 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 (Velarde et al., 2007). These factors include the belief that viewing vegetation, water, and other natural elements can reduce stress (Ulrich, 1984). 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.

Another important learning factor is sufficient provision of green areas. It offers space for exercise; space to experience nature; space for regeneration of body, mind and soul; and space for peaceful social interaction. Musavi (2006) found that among the environmental factors affecting campus performance includes the class feature in terms of heat, silence, lighting, furniture, facilities and cleanliness. Hence, for improve efficiency in educational environments attention to the environmental conditions such as the appearance of plants in the classroom can boost the performance of students and can also be used as an educational tool (Daly, 2010), Natural environment features such as tree views, nature reserve alleviate stress and improve mood (Hartig et al. 2007). Additionally, garden with fruit trees and a variety of floral species could likewise increase powers of concentration (Ottosson and Grahn 2005) alongside window shadings. This paper focused on two main assumptions as stated below

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.

METHODOLOGY

This paper adopted quantitative research approach to source for data concerning architectural design studio interaction.

The survey Instrument

From initial observations and preliminary conversations with architecture students, an image of the key issues and conditions affecting their performance in their studies was obtained, from which a questionnaire was designed in line with their need for interactive spaces. The questionnaire comprised of closed questions with yes/no answer options as well as questions with pre-defined answer categories, with the possibility for multiple responses in some questions. The use of a questionnaire being considered as the most appropriate tool by which the most economical, reliable and prevalent method of collecting the necessary information could be easily reached by the respondents. The questionnaire was administered to architectural students within the selected school environment. This enhanced the correctness and validity of the results.

The Survey

The use of questionnaire survey was considered appropriate for this study in order to reach a large number of respondents concerned. It was also used as an objective method to obtain opinions on the issues to be investigated. Akande et al., (2018) adopted a similar approach in their study to investigate the respondent's perceptions of public building projects in Nigeria. Prior to administration of the survey, the questionnaire was piloted using the expected, standardized questionnaire to ensure that the respondents could easily understand before it was considered appropriate to collect the required data. The sample for the survey was drawn predominantly from department of architecture in Nigeria and the respondents chosen using random sampling techniques. The questionnaires were designed online on google form and sent to the respondent through the use of social media such as Email, WhatsApp and Facebook. The survey instrument was carried out from August to October 2020.

Reliability Test

In order to determine the reliability of the measurement scales used for analysis for this study, the data was analyzed and reliability tests were carried out. Using Cronbach's standardized alpha (Table 1), the reliability of the instruments was obtained to ensure unidimensionality between the test scales. From the data set, 14 variables were observed because these are the variables with numeric values and the reliability coefficient of all 14 parameters is 0.878. This implies high reliability of the data.

Table 1: Reliability Test

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

Relative Importance Index

Relative Important Index was calculated and each observation was ranked and the most important ones was identified. The dominant factors were required to define and assist decision making of policymakers for guidance in the integration of the approach to interactive space design. To accomplish such a feat, accurate prevalence data is therefore required. The use of the Relative Importance Index (RII) was considered as one of the means by which such prevalence can be determined.

Data analysis method

Descriptive statistics were used to evaluate the responses obtained from the questionnaire and to summarize the socio-demographic data while statistical analysis was performed using

statistical package for social scientists (SPSS) to analyze the problems identified in this research.

Findings and Discussion

Socio-Demographic Characteristics of the Respondents

A total of 177 responded to the survey. Therefore, the sample size is considered adequate. Result obtained shows that 27% of the respondents are female while 73% are male. Very few (18.6%) of the respondents are from age 15-19 while 44.6% are from age 20-24. Meanwhile, 31.6% are from age 25 - 29 while 5.1% are age 30 and above. This finding indicates that the majority of the respondents were matured and capable of providing the foundation needed for understanding design approach for interactive spaces. Based on the institutions surveyed, findings obtained shows that 65.5% are from Federal University of Technology, Minna while 26% are from Federal Polytechnic Bida both in Nigeria. It was observed from the findings that among the respondents, only 55.9% have open space designated to enhance student interactions while 44.1% do not have open spaces to enhance student interactions in their institution.

Contribution of design features in facilitating interactive spaces

The contribution of each of the design features was examined and the ranking of the attributes in terms of how it enhances the student's learning as perceived by the respondent was carried out by determining 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

Result from Table 2 shows that user centered design ranked first, followed by functionality as the second and fostering connection as the 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

Integration of Interactive Spaces

The findings obtained as presented in Table 3 reveals that the respondent ranked "Interaction ease design process in studio" as first. This was followed by "achieving a common goal from collaborative work using interaction" ranked as the second. This implies that integration of interactive spaces is considered a factor to enhance learning. Meanwhile "awareness of the collaborative work attributes and condition from interaction" ranked third.

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

Importance of interactive spaces

According to the findings obtained from Table 4, the respondent perceived that among the importance of interactive spaces, "collaboration among the level which is prompted due to the nature of space" is ranked first. Meanwhile "student are less productive due to stress in the campus" is ranked second. Studio connection to each other was ranked least, this may be due to the fact that studio connection may not necessarily has to do with spaces that may enhanced 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 test the assumption of the study, the following shows the findings from the test statistics carried out.

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.

Table 5 shows that there is an association between user centered design and collaboration among the student's level of study which allows them to perform to their highest and best potential as well as minimize superfluous distractions. Chi-square test of independence (Table 6) was used to test if the dependent variable affect or influences the independent variable for this findings.

Table 5: Association between user 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	18.0
	Neutral	Count	15	14	10	39
		Expected Count	9.7	14.3	15.0	39.0
	Agree	Count	18	44	58	120
		Expected Count	29.8	44.1	46.1	120.0
Total		Count	44	65	68	177
		Expected Count	44.0	65.0	68.0	177.0

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.

Result from Table 6 above shows that the asymptotic significant value is less than 0.05. Therefore, we reject the null hypothesis and conclude that there is an association between the user centered design and collaboration among the level which is prompted by the nature of space. When there is a learning spaces to allow students to perform to their highest and best potential and to minimize superfluous distractions this will influences collaboration among students. Since there is an association between user centred design and collaboration among the level, the level of association was measured (Table 7). Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. The association is statistically significant with a value of 0.584.

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.

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.

Table 8 shows that there is an association between the functionality design and collaboration among the student's level which allows the spaces provided 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. Similarly, Chi-square test of independence (Table 9) was used to test if the dependent variable affect or influences the independent variable for the findings below.

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	
10 [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

The Asymptotic significant value is less than 0.05 therefore we reject the null hypothesis and conclude that there is an association between the functionality and collaboration among the level. When there is a space to accommodate all participants comfortably, and to ensure that

each proposed use of the space can be hosted without putting stress on the room or disquieting users will affect or influences collaboration among students.

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.

Since there is an association between functionality design and collaboration among the level, the level of association was measured (Table 10). Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. The association is statistically significant with a value of 0.436.

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Table 11: 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.					

DISCUSSION OF FINDINGS

Student interaction will increase from our findings if Architects take into account the above-mentioned factors when designing learning environment. The main stress problems are those which architects do not take it into consideration when designing as observed from the analyzed data. This study showed that well-positioned open space strategies and elements would not only minimize stress but also improve collaboration, resulting in better academic performance. The figure above shows the factors that improve student interaction in the campus setting as defined by the respondents. The application of user centred design in Spatial design, functionality of Landscape design, and Green design fostering connection have been selected according to the report. Based on the findings in the study in order to increase interaction among students from the inception stage of the design, the architect should have proper knowledge stress reductions. They should be abreast with all the changing trends in identifying interactive spaces in order to make proper decisions that will increase interaction and collaboration and reduce stress. This will give value to the learning environment and help increase the student's academic performance, confidence and creativity. It is also recommended that more detailed research should be done on student's perception that influence the learning environments. User's centred approach should be applied at the initial stage of design in order to foster connections.

CONCLUSION

Reviewing has shown the new method of learning and the development of technology focusing more on the spatial complexity, green informal gathering spaces and landscape in learning processes that led to a new system of educational spaces and created a new open environment in which interactions are encouraged within students themselves and teachers, encourage collaboration and strengthen communication rates which would change the way people feel and behave while studying or working within the building environments. The need for

interaction spaces from formal classical classrooms to informal circulation areas and open spaces is therefore 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 space should depict learning and teaching purposes, support the school mission, integrate technology, and be adequately flexible for non-class ends. Informal collaborative spaces are certainly significant.

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