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Impact of Studio Spaces on the Academic Performance of Architecture Students: A Case of the Federal University of Technology, Akure (FUTA)

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Abstract: *Due to the peculiarity of the architecture profession, architecture students usually work within environments that require specific spaces to function within design studios. Adequate spaces within a studio environment consist of drawing boards, sitting stools, drawers/lockers where drawings and other instruments are kept, and ample circulation space. The aim of this study was to investigate if the spaces provided for in architecture studios are adequate, based on the number of students per studio, and if these spaces are adequate, whether they have positive or negative impacts on the academic performance of the architecture students. The methodology involved gathering data on final year students' academic performance for three different sessions involving three different studio spaces on ARC 501 (Advanced Architectural Design), which is a core course and the final design course of final year students before graduating with a bachelor's degree from the Federal University of Technology Akure (FUTA), Nigeria. Findings from the study revealed that with the increase in the floor area of the studio spaces per student, there was no significant increase in their academic performance; rather, there was a gradual decline in the students' academic performance. This study has proven that studio spaces may not have corresponding positive effects on the academic performance of architecture students, but rather have somewhat negative effects, and probably there are other factors not considered in this study that may be responsible for better academic performance of architecture students in universities besides spacious studio spaces. The study also found that while small studio spaces tend towards better academic performance, large studio spaces tend towards low academic performance in architecture design courses.*

Keywords: Architecture, design, students, studio spaces, academic performance.

1. INTRODUCTION

Studio spaces have a tremendous influence on the quality of training and instructions given to students of architecture, and this shapes their academic performance, creative abilities and general wellbeing [1]. Recent studies have shown that the subject matter of the impact of studio spaces on the academic performance of students has gained significant attention. Such studies have indicated that when studio spaces are well thought of, well designed and realistically achieved, they are capable of encouraging collaborations between students, foster active learning and support students' satisfaction through active performance.

Studio spaces, unlike traditional classrooms are flexible and equipped with necessary and specialized tools and materials which allow students to explore, experiment with ideas and enhance artistic practices using different media. Design studios in Nigeria's architecture schools are the major spaces where students carry out learning activities [2]. The fundamental understanding associated with architectural education, refers to the studio as the space where students produce drawings in order to experience design education [3]. It also involves students' participation focused on a particular, open-ended, project-based problem, where they intuitively resolve that problem with their own understanding. Much attention should be given to studio spaces to provide necessary spaces for effective learning among students.

[4] stated that three principles to be considered in the design of school buildings are; naturalness, individualization and level of stimulation. [5] observed that the decline in the academic performance of the students in Nigeria is on the increase due to many reasons such as deterioration in the school facilities without a quick intervention, lack of functional designed spaces etc. Furthermore, [5] corroborated the findings of [6]. Lots of studies have been carried out on how to maintain the provided facilities for schools of architecture, the facilities

needed for schools of architecture, providing qualified teachers among others, but little effort has been put on how these designed spaces of schools of architecture affect students' performance.

[6] stated the problems confronting architecture education in Nigeria, but failed to include the degradation and decay of architectural learning facilities and effective learning environments for architecture students. A school of Architecture in particular which requires a functional design space for great academic performance of the students should therefore be put into serious consideration. Teaching in Nigerian tertiary school is teacher-centered popularly called the lecture method. In this present day where there are agitations for inquiry methods of learning, students still do not participate enough in learning. According to [7], it appears like "teachers and all stakeholders in education have forgotten that the most important educational goals are to promote retention and transfer". Eventually, students memorize what they are taught and are not totally and actively involved in the learning process due to some other elements that are fundamental to learning which are often ignored by the school administrators and government [7].

[1] emphasized that modern flexible studio spaces that incorporate advanced technology bring about better experiences in learning as they foster students' engagement thereby improving learning outcomes for different learning settings. This type of setting helps students progressive both in group collaborations and individual work, which is very beneficial for students learning, especially for those in fine arts and architecture. [8] also affirmed this position by highlighting that such flexible spaces that are comfortable positively correlate with students' academic performance as well as their wellbeing. Such spaces that are adaptable are capable of improving students' motivation and focus, especially in educational environments of higher learning.

Generally, these design spaces affect the users in many ways, therefore, there is the need for students in schools of architecture, especially in Nigeria to be physically, psychologically and socially amenable for their academic success. One of the major ways to achieve this success is by looking critically into the design spaces of the learning environment. The aim of this study is to evaluate the impact of design spaces especially studios on students' academic performance in FUTA, with a view to suggesting the adequacy of design spaces and their effects on students' academic performance.

2. LITERATURE REVIEW

2.1 Learning Space

Design studio and studio culture have both enhanced the learning abilities and academic outcomes of design students [9]. The architectural studio works within some certain cultures and values that have influenced students' education just as it has influenced the projects that students engage in to completion [10]. To this end, design studios play a sizable role in reinforcing ways of life while making others invisible. Schools and classrooms can be more than a place to inhabit as they can also acquire an emotional significance. [11] stated that emotions also have a significant impact on many aspects of the learning experience such as motivation, values, goals, actions and student-tutor relationships.

[12] posited that what people learn from architecture is a simple reflection of larger cultural values, as cultural values are more reflected in architecture. According to [13], "we expect schools to prepare students for living in a democratic society, yet we provide a learning environment that resembles a police state-hard, overly durable architecture, giant chain-link fences, locked gates, guards, and even guard dogs. Such architecture fails to encourage the sense of ownership, participation, or responsibility required for a democracy".

[14] suggest that learning spaces like studios ought to be related in some ways to learning, and in order for learning to be effective, it has to be consistent in delivery. This further goes to mean that learning spaces ought to meet basic functional roles of teaching and learning which provides a conducive environment for users.

2.2 Space Requirements for Learning Environments

Spaces in a school building refer to the useful area necessary for academic and extra curricula activities to function properly. There are basically three important/required spaces in the school building which include instructional spaces, recreational spaces and facilities [15, 16]. The instructional space is the space where formal learning takes place. Studios fall within the description of instructional spaces because they are purposely built for learning and training of architecture and design students. Instructional spaces include the architectural design studios/classrooms, drawing halls, painting studios, library, offices/staff rooms etc.

Space has the ability to influence human and cultural behaviour, as it is a critical factor in architecture. It is capable of also influencing and impacting on building designs as well as structures and even users' emotions in a positive or negative way. When the basic elements of design such as color, shape, texture or even arrangement of furniture are properly harnessed within a space, they can have direct impact on users and their perception of a given space. Physical space can improve students' learning beyond student's abilities as measured by standardized tests, and design of these spaces is thereby crucial [17]. [18] affirmed that instructional spaces are capable of promoting student-centered learning which directly impacts on students' preferences and modern lifestyle. [19, 20] claimed that unless the teachers and instructors use the teaching and training methods that align with the space in use, the spaces may not be relevant to the purpose of the designs. Instructional Spaces must be related to learning in order to be effective spaces [14]. [19] concluded that such spaces need to enhance the teaching and learning experience. In other words, a learning environment is a physical reality and must be able to support and accommodate the processes involved in teaching and learning [20]. [21] iterated that instructional spaces can have positive impacts on how they motivate learning and improve students' concentration within a space.

The concept of space affording and influencing the learning process at various degrees brings in the picture the idea of adapting space to fit different learning formats. To put this simple, space cannot be treated as a rigid entity hosting the learning process, but it should respond to afford different learning formats. [22] affirmed that small group classroom arrangements are better for interaction among students than large group, row type classroom arrangements. The small group classroom arrangement allows better interaction and communication among students and instructors. By carefully manipulating these properties of space, a designer or architect can enhance the efficiency of users, and can very intelligently communicate his or her message to them. However, [23] described this aspect of spatial qualities as "Many design theoreticians and critics write about architectural space as if it were some entirely abstract substances. They discuss such ideas as form, proportion, rhythm and colour as if they were parts of a private language used by designers and design critics. Through such criticism, architecture and the spaces it divides and encloses become seen as a refined art to be appreciated by the educated connoisseur".

2.3 Effects of Design Spaces on Students' Academic Performance

A major factor that impacts the students' academic performance is the quality of the design space they use for studying. The quality of the design space means that all requirements needed for teaching and learning are to be met. [24] analysis indicated that interior architecture and internal features of learning spaces can help students focus their attention on studying or prevent them from giving full attention to learning [25]. Desirable designs consist of having unmatched entrance areas, quite private and public spaces that improve a sense of mutual support and unity with special attention to the colour diversity [26]. [27] demonstrated that design characteristics such as poor acoustics, poor ventilation, insufficient lighting, and chronic noise exposure undermine learning. According to [28] "those specific attributes within learning spaces, such as natural lighting, spatial configuration, and technological integration, can enhance cognitive function and creativity, particularly within studio-based disciplines. In creating well designed studio spaces for students in disciplines like fine arts and architecture, higher educational institutions can create supportive environments that are capable of enhancing students' creative abilities which has positive outcomes on students learning.

In a similar study on indoor environmental quality of studio spaces, [29] established that factors such as lighting, air quality, and noise levels have significant impact on students' concentration and wellbeing since high noise levels and insufficient lighting bring about negative health symptoms such as headaches and less focus which hamper students' academic performance. This finding points to the fact that improved indoor environmental quality tends to support better health in students, hence better learning outcomes. School designers should create learning environments that motivate and encourage students and create a learning environment that supports learning, teaching and affect students' well-being positively. In fact, physical environments should not be only functional, but should provide tranquilizing spaces such as sound architecture and unique design. This will in turn help the students to perform better in their academics.

[30] opined that environmental design is influenced due to people's perception and understanding of the criteria for a well-designed learning space. This criterion includes the needs of the users, the functional design and the floor plan requirements. A well-designed learning space requires the need to understand the user/learner perceptions of psychological, perceptual and social conditions. It is always important to get the users opinion of a proposed design at the outset or conception of every design. Physical problems affect psychological feelings, for instance, choked floor space creates poor circular, poor ventilation, stuffiness in the space and can even cause poor natural lighting thereby, making it difficult to have a proper spatial arrangement. Spatial performance which comprises the physical and psychological performance influences academic performance.

In a situation where a department meant to grow fully into a faculty fails to expand and the facilities necessary in the learning spaces are no longer adequate for the learners, these make the learning spaces of such school inefficient. Such designed space is bound to reflect negative academic performance. [31] posited that student's academic performance is also influenced by the school and most especially the school facilities that the students are allowed to use. [31] also noted that these school facilities are depended on the designed spaces. A sophisticated facility used in school cannot work in a school that the spaces are terribly designed, such facility will not suit the space. Therefore, the physical spatial qualities including the school technology and facilities support are highly demanding and need to be considered.

Philippine basic education ensures that there is sufficient space for classrooms which is the basis for student's exceptional academic performance. It was found that having sufficient space in a classroom promotes good academic performance among students [32]. This means that space sufficiency and comfort-ability are crucial. However, this does not mean unnecessary space should be designed, as it will only amount to waste of space. [33] had initially affirmed that learner's psychology and the intermediate environment influence learner's educational results. [33] also noted nine important variables that are capable of influencing students' academic performance. These nine variables are motivation, development level, students' ability, quantity of instruction, quality of instruction, classroom climate, peer group and exposure to mass media outside of school.

In a recent and related study carried out by [34], the study investigated the effects of head-rooms and ceiling heights on students' performance and found that the students' academic performance dropped and was poor due to high ceiling heights in large study halls. The researchers suggested that such environments hindered students'

concentration. From the above reviewed literature, it is obvious that positive students'/learners' academic performance is greatly influenced by great and well-planned designed spaces. Thus, there is a connection between the physical environment and the psychological performance. There are also some indicators used for the designed spaces that influence the psychological and physical performance. Such indicators include visual privacy of room, conversational privacy of the room, room's air circulation system, freshness/stuffiness of the room air, glare, air quality and heating conditions [30].

3. METHODOLOGY

3.1 The Present Study

The methodology for this study involves collating of data through the results of ARC 501 (Advanced Architectural Design) of final year students of the department of Architecture in FUTA. ARC 501 (Advanced Architectural Design) is a core course for final year undergraduate students of architecture, and it is a 12-unit course comprising 6 units each for both first and second semesters.

The final year architecture students in the department of architecture in FUTA have changed or moved their design studios on four occasions. The first was in 2011, the next was in 2012, thirdly in 2017 and finally in 2021. These were due to renovation and accreditation issues and finally when a new building was constructed for the faculty of Environmental Technology, and new studios were allocated to the department of architecture. For the purpose of this study, three years were considered; these are; 2012, 2017 and 2021. The year 2011 was not considered and this is because in 2011, the studio space the students moved into was not originally built as a studio, but as a classroom for lecture purposes and did not fit for the purpose of this study. These three design studio spaces were measured in length and breadth to know their floor areas, and comparisons were carried out with the number of students per studio space.

ARCON, the professional body in charge of the regulation of Architects' practice in Nigeria and the body in charge of monitoring the quality of instructions that are passed to architecture students in Nigeria advocates for a minimum of 2.5 square meters (sq m) of floor area per student as the minimum or benchmark space requirement for learning architecture in studio spaces. The research method used here compared the design studios floor areas with the number of students of each of the years under consideration, as well as the students' results or scores on ARC 501 for the respective years. Also, ten students were selected each year from the three sessions using systematic random sampling method. Two students were selected from each set of ten until ten students were randomly selected from each year. Table 1 shows the area of each design studio, the number of students per studio in each year and the corresponding result of ARC 501 - Advanced Architectural Design. It also shows the area of space allocated per student for all the corresponding years involved. Plate 1 shows architecture students in their studio drawing during a live studio design session.

3.2 Assumptions

The study assumed that with bigger and better spaces for drawing boards, seating stools, well-lit and well-ventilated studio halls among other things, the students should be able to perform better in the grades of ARC 501 than others without such conditions for studying. It is worthy of mention also that since the Department of Architecture FUTA, had its program accredited by the ARCON (Architects' Registration Council of Nigeria) on professional basis, and by the NUC (National Universities Commission) on regular educational program basis, these show that the Department of Architecture in FUTA's quantity and quality of instruction to its students both from the academic perspective as well as the professional perspective are presumed adequate. Table 2 also shows the raw data of the students' grades as obtained from the department of architecture, at the Federal University of Technology Akure. The grades were often randomly selected students during the periods under review.

Table 1: Data comprising area of studios, spatial analyses and ranks

Studios and year under study	Length (m)	Breadth (m)	Area of design studio in m^2 (Rank)	Total no. of Students' Population	Floor area per student in m^2 (Rank)	Students' mean score per year (Rank)
Studio 1 (2012)	28.8	19.2	276 (3rd)	80	3.45 (3rd)	64.3 (1st)
Studio 2 (2017)	42	11.4	478 (1st)	124	3.68 (2nd)	62.6 (2nd)
Studio 3 (2021)	20	19	380 (2nd)	55	6.91 (1st)	60.1 (3rd)

Table 2: Comparing studio size, with students' grades selected at random, and mean score

	Area m^2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Total Ave. score
Studio 1	276	60	65	60	60	70	75	60	65	68	60	**64.3**
Studio 2	478	56	61	54	61	64	62	68	68	66	66	**62.6**
Studio 3	380	64	60	68	72	57	51	64	57	58	50	**60.1**

Plate 1: Architecture students drawing in the studio during a live studio session

4. RESULTS AND DISCUSSION

Within this study, a comparative analysis was carried out between the spaces provided for students' design studio works and their corresponding grades which show their performance in their final major design course - Advanced Architectural design (ARC 501).

Comparisons between the three different studio spaces show from Table 1 that studio 2 was the largest in terms of space size with 456 sq m and therefore ranks first. Studio 2 ranks second with 380 sq m, while studio 1 ranks third with a floor area of 276 sq m. Also, in terms of space, which is floor area allotted to each student in sq m (m^2), of course the largest studio will definitely have the largest floor area as studio 3 ranks first with 6.91 sq m per student, studio 2 ranks second with a 3.68 sq m, while studio 1 ranks third with a 3.45 sq m per student. All the three studios happen to have a floor area of studio space per student higher than the recommended 2.5 sq m per student recommended by the ARCON body. As a matter of fact, even the least space studio with the lowest floor area per student has 3.45 sq m per student which is a very high value compared to the ARCON recommended value of 2.5 sq m. These ranks varied among the studios because of the number of students admitted into the classes/levels for the corresponding years under review.

However, in terms of the performance of the students for the various years concerned, the study reveals that studio 1 with the smallest studio space per student (3.45 sq m) ranks 1st with an average students' score of 64.3. The biggest studio space with 3.68 sq m per student has an average performance of 62.6, while studio 3 with the second largest floor area per student has the least students' performance, with an average students' score of 60.1.

This study has shown that the least studio space (studio 1) with the least floor area per student (3.45 sq m) has the best students' performance of 64.3 average. The biggest studio space with 456 sq m, which ranks second in floor area per student, ranks second in students' academic performance with an average score of 62.6. While the moderately large size studio space with 380 sq m with the second largest floor area per student (6.91) ranks third with the least students' academic performance of 60.1.

This study has clearly shown that having large studio spaces with even large floor areas per student does not really add up to higher or better students' academic performance. Findings from the study further reveal that the studio with small floor area (276 sq m) and moderate student's population (80) may result in fairly high students' academic performance. Large studio spaces (studio 2) with large student's population of 124, results in moderate students' academic performance (62.6), while moderate studio spaces (studio 3) with low students' population (55) results in low students' academic performance (60.1).

In line with this study's objectives, the findings appear to support the opinions of [6], and [5], who claimed that the academic performance of students in Nigeria is on the decline, and due to many reasons, among which is the deterioration of school facilities and lack of functional design spaces.

Obviously, there is a decline in the academic performance of Architecture students from the sample that was studied as the average grades of students declined from 64.3 in 2012 to 62.6 in 2017 and 60. 1 in 2021. Rational thinking and common sense would have reasoned that with the increase in studio space size, there would be corresponding increase in the academic performance of final year students in design studio course - ARC 501, but this has not been the case. Could it be that the Users of these studio spaces were not involved in the design processes of the buildings during the constructions as stipulated by [30] which urged that users/learners' perceptions of psychological and social conditions needed to be thoroughly investigated before design and construction. [24] however suggested that the internal features and interior architecture

can help students to focus attention on studying while lack of it could prevent better studies. [35] affirmed that "design studio spaces that offer adaptable layouts, comfortable seating, and spaces conducive to collaborative work tend to foster creativity and improve students design quality". This kind of adaptive setting allows for deeper engagement and experimentation even as students attend to complex designs with little efforts which is typical of architecture students experience.

However, [36] warns that "excessive workloads and extended studio hours are capable of setting in the law of diminishing returns as students experience burnout and mental fatigue. Architecture and other studio-based courses such as fine arts are academically demanding, and can have negative tolls on students with unhealthy consequences such as poor sleeping and poor eating habits which inhibit students' mental health. Therefore, the studio environment needs to support students by encouraging their wellbeing and academic performance as much as possible.

Does sufficient or adequate studio space really promote good academic performance among design students as [32] claim? However, these findings also suggest the possibility of taking a closer look at the postulations of [33] on the possible variables that could influence better students' performance as motivation, developmental level, students' ability, quality of instructions, quantity of instructions, classroom climate, peer group and exposure to mass media outside of schools as factors that could possibly hinder the progress of students' academic performance and need to be critically investigated.

5. CONCLUSION

This study was able to investigate students' academic performance in design studio core course and expected better students' performance with increased studio spaces. However, the assumption that with more ample design studio spaces students' academic performance would be enhanced was not found to be true. It should be noted at this point that this study only considered deliberate and intentional purpose built physical spatial spaces that were provided for students design courses, and did not consider the psychological performance indicators as highlighted by [30] and [33]. Also, this study assumed that the quality and quantity of instructions to the students were adequate because the department had both professional (ARCON) and (NUC) accreditation back-to-back throughout the period/years that were considered for this study. The study has shown that the studio spaces provided for design students to carry out their studio projects may not necessarily affect their academic performance positively, as small studio spaces have shown to affect academic performance more positively compared to large studio spaces. This study has confirmed the research outputs of [22] which affirmed that small group classroom arrangements are better for interaction among students than large group classrooms. This study also brings to the fore the issues of collaborations among design students, because with larger spaces and fewer students, there will be less collaborations on design projects between the students, hence reduction in cross fertilization of ideas which tends to lower academic performance. Findings from the study also disagree with the works of [32] which suggested that sufficient space promotes good academic performance. It should also be noted that the academic performance of students in the course Advanced Architectural design (ARC 501) is gradually on the decline in the seven years duration between 2012 and 2019 from the academic records of the students that was sampled, and there needs to be an intervention of some sort to rescue the situation from further decline. For further studies, it would be necessary to consider the psychological variables that were mentioned by [33] and [30] in order to cross check if there are possible correlations between design spaces or studios, enhanced students' performance and psychological variables in students.

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