INTERGRATION OF INTERACTIVE SPACES IN DESIGN OF SCHOOL OF ARCHITECTURE FOR FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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ABSTRACT

Architectural design spaces, still the center of curricular program in architectural faculties worldwide, and is considered the standard for education in architectural design process that involves participatory practice. However, the architecture space's main role in the current academic framework of architectural study needs to be rethought. Therefore, redirection to architecture space design is required to achieve an atmosphere that provides an immersive and collaborative sense of setting for space users. This paper integrates 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 for improving quality and better service delivery in terms of improved interactive space organization. The findings indicate the integration of sustainable building strategy in learning space should depict learning and teaching purposes and be adequately flexible for non-class ends. The study recommends that it is important to establish guidelines such as flexibility, functionality, blended learning, and a user’s centered design 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.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The term "Learning" is the process of acquiring new or revised knowledge, it exists in the settings of education, individual growth, schooling, and training. The method of learning, also known as knowledge development is referred to as education and education is divided into three categories: elementary, secondary, and tertiary education. Universities, polytechnics, and colleges of education provide tertiary education (higher education), and architectural education training is included in this category (DeGregori, 2007).

The College of Arts, Science, and Technology in Ibadan, which later was moved to Zaria in Northern Nigeria in 1955, began architectural education in Nigeria in 1952. Since its establishment in 1961, As a result of the oil boom in the 1970s, the number of architecture schools has increased from a sole college (Ahmadu Bello University) to fifteen (universities and polytechnics), with a student population of about 300 in each institution (Oruwari, 1995). Graduates were granted Diploma degrees at first, but in 1962, the college was raised to a university, The Bachelor of Architecture degree was awarded by Ahmadu Bello University (ABU) in Zaria to alumnae, which was equal to the previous Diploma from the Royal Institute of British Architects (RIBA).

More than just flexible space is needed in schools. Converting space from one use to another is beneficial, but designers must consider how each space affects students when they participate in various learning activities and methods. Students in classrooms are affected physiologically, mentally, and behaviourally by architectural design. The aim of this project is to create a plan for a functional space and user-friendly atmosphere for architectural education, which can be accomplished by applying ergonomics to design and planning methodologies. Similarly, this often stems from the belief that planning and constructing new schools based on perceptions such as improving performance or meeting the capacity demand for an expanding student population is not always an appropriate or sufficient approach to creating successful learning environments.

1.2 Statement of the Research Problem

Collaborative and immersive learning is becoming increasingly common in today's educational world (Emam *et al*., 2019). However, this is not unrelated to the difficulties that the disconnect between the design studio and the learning atmosphere that can help learning pedagogy presents to architectural students. The physical layout of the classroom has been linked to student success, according to research findings. With the aim of creating an enabling atmosphere for higher learning in universities, this study provides a detailed and critical overview of the existing literature on the essence of the university classroom for collaborative and interactive learning. The effect of both physical and environmental influences on classroom interaction is considered in this paper.

1.3 Aim and Objectives of the Study

1.3.1 Aim of the study

The goal of this research is to explore at users' perceptions of the adequacy of interactive spaces offered in architectural design studios in order to suggest a user-centred approach strategy to interactive architectural spaces for sustainable school of architecture buildings in Nigeria.

1.3.2 Objectives of the study

The following are the objectives:

i. To investigate how users perceive interactive spaces in architectural design studios.
ii. To identify spaces that are needed to improve the interaction of architectural students.
iii. To propose a user-centred strategy for interactive architectural spaces for Nigerian school of architecture buildings.

1.4 Justification of Study

This method, known as interactive architecture, implies a process in which all design factors and parameters will form a complex and reciprocal relationship, and the effects of each factor or parameter on the final design will be considered. In addition, since most design problems have several aspects, the suggested approach's main axis is through interaction with all different aspects of design. As a result, the final design will be based on these reciprocal relationships, and it will be an output that adapts to all conditions and parameters to the greatest extent possible. Furthermore, the obsolescence of current facilities, which is linked to population growth, necessitates innovative spaces for education and facility operations. Furthermore, expansion of university departments and institutes, as well as the growth of science and engineering, enable campuses to move to other areas with sufficient space (Perry and Wiewel, 2005). In addition, recent discoveries and researches have broadened architectural education, resulting in a variety of new perspectives.

Architectural design, architectural engineering, and landscape architecture were the most well-known branches of architecture. Other branches of architecture, such as green architecture, sustainable architecture, interior architecture, and so on, have emerged in recent years, and the western world has welcomed this transition and incorporated it into their education curriculum, something that Africa is still struggling to do. As a result, Africa and Nigeria have fallen behind in the sector. As a result, establishing a school of architecture in Nigeria and at the Federal University of Technology, Minna, would be an excellent step toward positioning Nigeria as a leader in both architecture as a discipline and architectural education.

1.5 Limitation of Study

The non-existence of school of architecture in Nigeria universities pose limitation with regards to local case studies for this project. In addition, incessant securities challenges in the country also contributed to the limit in which data could be sourced for this project.

1.6 Scope of Study

The emphasis of this research is on the creation/provision of spaces in the school of architecture building that, in addition to their long-term sustainability, influence a collaborative and interactive atmosphere.

1. Beneficial
2. Useful
3. Stunning
4. Locatable
5. Easily accessible
6. Trustworthy
7. Priceless

React to current social, economic, ecological, and technological changes through listening to users. The key feature, intra-mural functions, are included in the design. Work space, shared spaces, break room, work stations, and offices are among these features. The following are the spaces that will be provided:

1. Foyer
2. Theather
3. Library
4. Entrances
5. Cafe
6. Exhibition
7. Workshop
8. Model-making room
9. Design studio
10. Terrace
11. Cad studio

12. IT department
13. Lounge
14. Open work area
15. Study space
16. Enclosed work area

1.7 Contribution to Knowledge

This study contributed to the knowledge by finding that strategically placed open space techniques and elements can potentially reduce stress while also improving communication, resulting in improved academic performance. Likewise, this can add value to the learning environment while also assisting students in improving their academic success, self-confidence, and innovation. The study established that interactive spaces, ranging from formal classical classrooms to informal circulation areas and open spaces, should be emphasized. Similarly, the effectiveness of their architecture should become a central feature of university buildings and an important factor in transforming them into community-oriented tools. In addition, the study extends knowledge in the area of learning environment to reflect learning and teaching goals, support the architecture mission, incorporate technology, and be sufficiently versatile for non-class purposes.

1.8 Definition of Terms

1. Interactive space

The use of space characteristics in relation to people as a design resource for fostering interaction among occupants.

2. Collaboration

Collaborative work is a method of achieving a shared goal by bringing people together for a common goal.

3. Pedagogy

An empirical discipline that studies how knowledge and skills are transmitted in an educational sense or through a teaching process, as well as the goals of education and how they can be accomplished.

4. Open spaces

A broad term used in interior design for any floor plan that maximizes the usage of wide, open spaces while minimizing the usage of small, enclosed rooms, particularly in workspaces, with a linear chain of open space reserves or a recreational corridor through the same areas left open to the public, such as courtyards.

5. Design strategies

A general plan that explains how the ends (goals) can be accomplished by the means (resources) that can be intended or emerge as a pattern of operation as the company adapts to its environment in the face of uncertainty.

1.9 Area of Study

Minna, Niger state, is the study location. It's a project for the Minna Community in Niger's capital city. The design and construction of a school of architecture at the Minna Federal University of Technology is the subject of this research.

Minna, the capital of Niger state, has 25 local government districts. Niger is one of Nigeria's 36 states. It is bordered on the north by the states of Kebbi and Zamfara, on the south by the state of Kwara, on the east by the federal capital territory of Abuja, and on the west by the Republic of Benin. It has a total area of 76,363km2. (Ajewole, 2013).

Figure 1.8: Map of Niger State with various local government areas

Source: Google image (2020)

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Architectural Education

Education in architecture is a type of education that necessitates a high level of creativity. As a result, an architect's primary responsibility is to plan and supervise the construction of different types of building structures for social purposes. The requirement to link the sketch done in the studio with the final design is of greatest relevance for successful practice in an educational institution that offers a degree in Architecture.

2.2 The World's Architectural Educational History

The administration system gave birth to the Ecole des Beaux-Arts that funded the educational institution in France. The Ecole recommended that draftsmen who want to make a name for themselves as designers and renderers start by conceptualizing structures on paper. This was consistent with the learning principles of the time, and launching an instructional program with the constraints imposed by construction ability and administrative guidelines of the time worked satisfactorily.

According to Weatherhead (1941), the French school was dominated by a known system of learning architecture in the 17th century, and the studio problems that arose differed from one step to the next. Through the efforts of his chaplain, Colbert, King Louis XVI established the Imperial Academy of Architecture. Because the French academic agreement has been substantially incorporated in structures for the leader or the public, the institute's objective is to provide guidance and support in combining with imperial working. The Royal Academy Foundation was expanded in 1699, and the social order was transformed as a result. Following that, in the years that followed, the base was augmented a few times. With the impending insurrection in France, all imperial scholars became obvious suspects of a chosen and undemocratic establishment. From 1793 to 1795, the permitted intellectual custom was ruined by the French rebellion and the National society of Science and Art was set up. Despite the fact that the rebellion defeated the Imperial Academics, it is said that it did not result in a major break in the planning tradition. As a result of the growth of a growing number of specific design and other specialized schools, the educational resolution in building training has grown increasingly limited in scope (Kahvecioglu, 2007).

Professionals who graduated from these colleges turned away from designing a variety of endeavours that had previously been considered a characteristic of its notoriety, such as scaffolding design and what became known as mechanical outline. Auxiliary materials provided by the mechanical unrest were handed over to the new professionals. Designers and other authorities could build and use cast iron and wrought iron that they had learned about at the Ecole des Beaux-Arts. Technical knowledge generated several divisions of Architectural education, which are currently available in educational settings, as a result of industrialization, modern technological advancement, and population growth during this time period (Salama, 1995).

2.2.1 Nigerian architecture education history

The College of Arts, Science, and Technology in Ibadan started architectural education in Nigeria in 1952, and in 1955, it was relocated to Zaria, Nigeria's northernmost city. In 1962, Ahmadu Bello University in Zaria was upgraded, graduates were awarded Bachelor of Architecture degree, which was equivalent to the earlier Royal Institute of British Architects Diploma (RIBA). Royal Institute of British Architects is a UK-based professional society for architects, it was retained as a partner until 1968, when the programs offered were split into two groups, the first offering Bachelor of Science (B.Sc) degrees in Architecture and the second offering Master of Science (M.Sc) degrees in Architecture, according to Magaji and Ilyasu (2016).

In 1969, a new program was started, making it Nigeria's second school of architecture. According to Uji (2001), the University of Lagos established an Architecture school in 1970, and by 1999, architectural degrees were awarded by sixteen institutions. The National Diploma and the Higher National Diploma were also awarded by 19 colleges of technology and polytechnics (Arayela, 2000). According to Magaji and Ilyasu (2016), Kano and Ogun states each have a state university, and Covenant University, a private college, also offers architectural degrees.

2.2.2 Architectural design

In comparison to other academy courses, the Architectural Brochure is unique in that, it is built around a single, advantageous "main" subject. The preparation is targeted at collaborating and introducing managerial processes in learners in the act of creating strategies, which are then translated into goods or agreements, with the basic necessity of solving problems by satisfying man's need.

From the initial concept to the final solution, the design procedure can be defined as a series of actions carried out by a designer. According to Kurt (2009), the practice involves the use of repetitive behaviours that fall somewhere between the concept of a problem and the solution to the problem. It is the inquiry and policymaking procedure that lays out the problems that must be addressed in the design process.

Design practices, according to Rittel and Webber (1973), can be interpreted as problematic setting, identifying, recognizing, and resolving problems, their primary origins, organization, and organizational dynamics in approaching ways to address the difficulties that occur. It is commonly regarded as a method of providing information by establishing design guidelines to meet the needs of users, customers, designers, and developers (Sanoff, 1992). The Design Studios emphases on practical methods and criticism of an individual experience in class exercises as a method of architecture training that is needed for students studying the discipline at a higher education institution.

2.2.3 Architectural design studio

Architectural design studios, according to Lueth (2008), are design environments where students receive practical architectural education. In the presence or absence of an instructor, students may learn new skills in the Studios. During allocated lecture hours, the instructor communicates with students, and the learner remains to transform their idea into a product.

Corona (2003) affirmed that a learner gains the information to plan in the studio, and design is expressed as an important action for a Designer, making the studio a valuable resource. It is important, and it gives the aspiring designer the chance to become a good planner.

The National Universities Commission, NUC, has accepted the proposal of the Architects Registration Council of Nigeria, ARCON, to elevate architecture research in Nigerian universities from departmental to faculty level, giving it a boost. After determining that ARCON had met all of the required requirements, the NUC agreed in principle to upgrade architecture research in Nigerian universities from departmental to faculty level (NUC, 2018).

2.2.4 Faculty of architecture

A faculty is a component of a university that consists of one or more departments in a college or university that is responsible for a specific subject (Gyurkovich, 2018). As a result, "faculty of architecture" refers to a university department that focuses on the design, research, and Built-environment management. The Department of Architecture in Nigeria presently provides B.Sc. or B. Tech. Degrees in Architectural Science and Landscape Design. A few Nigerian universities offered some of these courses.

2.2.5 Faculty of architecture department components

Many universities around the world have a faculty of architecture that includes the following divisions:

1. Architectural Science Department (Building design).

2. Landscape Design Department

3. Urban Planning and Design Department.

4. Interior Design Department.

2.3 Staffing Ratio of the Faculty

The Nigerian University Commission in Nigeria (NUC), the Architects Registration Council of Nigeria (ARCON), and the Commonwealth Union of Architects (CUA) have all given their approval to the department. Nigerian Public Universities Needs Assessment Committee of the Federal Government, on the contrary found some flaws in the teaching staff-to-student ratio in its report: Harvard University has a ratio of 1:4, NUS has a ratio of 1:12, and MIT has a ratio of 1:9. According to Prof Mahmood Yakubu's committee, "only 43% have PhDs instead of close to 100%," and instead of senior lecturers and professors making up 75% of the university workforce, only 44% are in this bracket. The Nigerian Institute of Architects' current requirement is 1:12 scale (interview of the Head of Department of Architecture, FUTA, 2012).

2.4 Interactive Architecture Design

Architectural design has always been a participatory project involving collaboration. It necessitates the collaboration of accomplished individuals, such as architects, engineers, and customers, in order to accomplish a collective goal. As a result, there has been a surge of interest in establishing a collaborative design studio and honing the abilities of architecture students. In design studios, architecture students must collaborate, connect, and debate with their peers and instructors. Furthermore, they must work together to accomplish a common purpose in order to be ready for the highly collaborative essence of the architectural career they will join (Daniel, 2002).

Architectural design learning has constantly been a distinct method of instruction. From the master-apprentice model in its early years to new project-based learning in the context of the design studio. “Many studios deal almost totally with the individual,” according to Crosbie (1995), “while the challenges of contemporary practice necessitate collective teamwork.” It has always emphasized individuality and practice that is biased toward the individual, as well as the value of communication and criticism. However, the architectural profession has become more fluid in recent years, necessitating a paradigm change toward a more collaborative approach.

“Students are ostensibly being prepared for practice, but they are also led to believe that they are independent designers, which is an uncommon circumstance in real life,” McPeek (2010) observes. Despite the fact that it is now the most common and important framework in the profession, the wider, team-oriented form of practice is often ignored and ridiculed.”

2.4.1 Interactive /collaborative learning strategy

Collaborative learning is a collection of teaching and learning strategies that allow students to collaborate in small groups (two to five students) to enhance their own and others' learning potential (Johnson *et al.*, 2007).

The design studio consists of a group of students who work together to solve a single, open-ended project-based problem, with each student solving the problem in their own unique way. A design jury then judges and reviews all of the students' work. Collaborative learning, on the other hand, is a teaching technique that is used for small groups with students of varying abilities, and in which all team members share in completing the assigned task. To develop their knowledge and comprehension abilities, they use a range of learning strategies and activities.

“Collaborative learning obviously demonstrates its dominance over individualistic and competitive learning modes,” say Rau and Heyl (1990). Students who are alone do not learn as well or as well as students who are part of a network of informal social connections.” When implementing effective collaborative learning, it's critical to change the student's position from that of a passive recipient to that of an active participant. As a result, respective group member should be accountable for assisting their teammates not only in understanding what is being taught, but also in developing a positive environment.

According to Springer *et al*. (1999), “how students learn has a significant impact on what they learn, and often students learn best through active, collaborative study, small-group work within and outside the classroom.” Participants' personalities are formed by their contact and teamwork. Furthermore, the type of tasks needed and how participants chose to handle them have an impact on the collaborative design process. To prevent problems and achieve an efficient collaborative experience, learning resources and techniques should be used. One of the most common issues in group work, according to

Blumenfeld *et al.* (1996), is “free-rider,” which happens when one or more members of the group refuse to contribute to the other members. They refuse involvement, making other team members feel exploited because they are responsible for the majority of the work. As a result, they either cut back on their own efforts or work alone. As a result, the value of this study, which aims to eradicate the "free-rider" syndrome and improve collaborative design performance.

Mattessich and Monsey (1992) define collaboration as "taking previously divided organizations into a new system with complete commitment to a shared purpose." Such partnerships necessitate in-depth planning and well-defined communication networks that operate at multiple levels. The collaborative arrangement determines who has power. Since each partnership partner contributes their own resources and prestige, the risk is significantly increased. The products are shared and resources are combined or collectively secured.”

In the design studio, collaborative learning is primarily a learner-centred approach. It empowers students to collaborate and encourages them to learn more about the studio's assignments. Teachers, on the other hand, are the only source of authority and expertise in the teacher-centred method, which is more traditional. Collaborative design helps students to develop their ideas by sharing them with their peers in the same group; this may lead to better solutions in certain situations, but not always. As McPeek (2010) points out, dialogue is more critical than the final outcome. This emphasizes the fact of architectural practice, which is based primarily on collaborative efforts.

2.4.2 Benefits of collaborative learning

Collaborative learning, when performed right, helps students in ways that regular independent learning does not (Laal and Ghodsi, 2012).

1. Improves problem-solving abilities

Students learn how to solve problems, which is an essential life skill. Individual students figure out the solution to a teacher-provided dilemma in traditional educational problem solving. This method of problem solving is useful, but it has limitations. In a collaborative environment, problem-solving necessitates diligent listening, revaluating viewpoints, and separating noise from viable solutions. Taking classwork to the next level by incorporating collaborative problem-solving as a learning extension from individual problem-solving.

2. Enhances social interactions

In a traditional classroom, social contact often detracts from the learning experience. The quality of teaching and learning is improved by social interaction in a classroom where collective learning is emphasized and performed correctly. Jig-sawing, for example, is an elective interactive learning strategy that forces students to rely on one another for crucial knowledge. Furthermore, collaborative learning enables students from several ethnicities and origins to participate in meaningful learning activities, allowing students from several ethnicities and origins to collaborate against a common goal.

3. Enhances communication abilities

Traditional teaching favours the "bookworm," the student who is happy to be left alone to complete his work without ever having to leave his home. Unfortunately, there aren't many real-life success stories that involve memorizing facts and taking notes while huddled in a corner at a desk. Real-world success necessitates the development of communication skills. Students are expected and encouraged to engage and collaborate with their peers in collaborative learning.

4. Encourages critical thinking

Employers and companies today want employees who can solve challenges creatively and critically. Critical thinking is needed for business success. When collaborating and solving problems, students can choose to learn critical thinking skills. Collaboration necessitates the clarification of concepts, points of view, and viewpoints through study and debate. Collaboration opens students to opposing points of view, forcing them to consider alternative solutions to a dilemma.

5. Decrease learning anxiety

Lecturers can forget or never knew how much anxiety some learners feel when taking part in whole-class discussions. Collaborative learning fosters a more relaxed and risk-free learning environment. In a small group environment, you'll find that learners who rarely speak up in class are able to share great ideas.

2.5 Pedagogy in Architectural Studios

Pedagogy refers to the "interactions amongst students, teachers, the learning environment, and the learning tasks" (Murphy, 2012). The way teachers and students interact in the classroom, as well as the educational methods used, are all covered under this umbrella phrase. Teacher-centred pedagogy and learner-centred pedagogy are often put on a spectrum; while these two methods can seem to be at odds, they will frequently complement one another in terms of achieving educational objectives. A teacher-centred strategy, for example, might be useful for introducing a new theme, but a learner-centred strategy might be required to allow students to explore these ideas and get a deeper understanding.

According to Uluoğlu (2000), designing is more than just putting things together. If it was simply a skill-based practice, it could be taught by training. However, we know that it also necessitates justification, which elevates it from being simply an event to praxis. The behaviours are not spontaneous, habitual, or unplanned in this case, but rather deliberate, selective, and intelligent. As a result, it is expected to encapsulate general awareness of architecture and design while also providing the individual with the resources to apply the general knowledge to precise cases and with an individual style. Since design is such a dynamic practice, its teaching necessitates specialized pedagogy, as the quote indicates.

Education in the design studio, according to Koolhaas (1991), entails encouraging students to interpret; it entails providing them with resources to investigate and various perspectives from which to turn "provided situations," rather than simply "creating within them more or less masterful buildings." Self-critique is an effective tool for doing this. According to Philippou (2001), critical knowledge of the design process is not usually regarded as a core pursuit of the design studio in traditional design studios. The only place where the task of designing an architectural project is experimented is in an architectural design workshop. As a result, the preceding statements emphasize the significance of questioning the architectural design studio. In the architectural design studio, we must move to new pedagogies because we no longer see the teacher-student relationship as a clear knowing-not knowing relationship in new pedagogies. The architectural studio should be a welcoming space where students can experiment with the design of a project while receiving guidance from the instructor.

2.6 Architectural Open Spaces

The connection between students and nature is deteriorating these days, and this issue ought to be addressed by safeguarding open spaces in school environments and other public spaces that could be used by students. "Educational," "social and physical," and "emotional" needs can all be met by open spaces in schools. Despite the fact that many studies have been conducted on the value of open spaces in the school setting.

2.6.1 Design of educational spaces

The factory model of education has largely influenced the design of public schools, which involves instilling knowledge in a small group of students in an enclosed environment called a classroom, for nearly two centuries. A huge number of individuals, including designers and instructors, have opposed this approach (Boss, 2001).

Students in institution that are properly cared for, obey laws of safety, as well as being kept tidy perform better academically than students who attend institutions with leaky roofs, damaged windows, and dark classrooms, according to research. For example, light and colour may help to create environments that are conducive to learning and prosocial conduct. (Dudek, 2014). According to some researchers and planners, integrating daylight into a greater energy-efficient architecture increases student achievement while also saving money (Reicher, 2000).

The negative impacts of excessive noise in the learning environment (Tanner and Langford, 2003), the necessity of proper furnishings (Bullock and Foster-Harrison, 1997), as well as requirement for enticing outside places such as green areas and leisure areas, have all been studied (Tanner, 2000). The role of nature in school design to student growth will be addressed in the current report. Since nature has various capabilities in terms of student growth, architects should be aware of each of these capabilities.

Active learning in outdoor settings, according to Moore and Wong (1997), promotes all facets of a learner's growth more readily than indoor environments. For successful environmental education, outdoor environments are also important. Evidence is increasingly indicating that the creation of environmentally friendly behaviours is linked to a blend of formal learning and informal, meaningful interactions in nature.

2.6.2 Benefits of connecting students with nature:

1. Better skill to concentrate (Ottosson and Grahn, 2005)

2. Improved powers of observation and creativity (Kellert, 2005).

3. Better individual skills including confidence (Taylor *et al.*, 2002)

4. Reduced stress/better skill to deal with hardship (Wells and Evans, 2003).

5. Increased language and collaborative skills (Burdette and Whitaker, 2005).

To meet the needs of students, schools should have three different types of open spaces. What are the needs:

1. Educational needs

2. Social and physical needs

3. Emotional needs

2.6.3 Impact of open environments on student's education

The role of nature in school buildings has an influence on the standard of learning that takes place there. A number of studies back up the connection between a green school environment and better learning (Malone and Tranter, 2003). Green environments can also help to improve focus (Grahn *et al*., 1997) and ability to pay attention (Taylor *et al*., 2001), self-control, according to a growing body of evidence (Taylor *et al*., 2002). Plants in the classroom have been shown to increase student success in studies.

Plants in classrooms can help students perform better. Green environments, according to Daly *et al*., (2010), may be particularly beneficial for students who struggle to learn in a formal school setting, are unwilling learners, have trouble focusing, or suffer from attention deficit disorder (ADD) (Pentz and Straus,1998). Students with attention deficit disorder, for example, have been found to have less attention deficit symptoms after spending relaxation time in open spaces (Kuo and Faber, 2004).

2.7 Designing Strategies for Open Spaces

In order to make efficient use of nature in the design of educational spaces, we must consider three types of student needs. There are some ideas about how to design open spaces in schools based on different types of needs.

2.7.1 Design strategies to improve educational needs: (Wells, 2000)

1. Establishing a connection between the classroom and the outdoors in order to integrate indoor and outdoor learning.

2. Providing open areas outside of the classroom for students to have direct contact with nature.

3. Creating educational terraces, where students can experience the growth of different plants. These spaces should be accessible through classrooms.

2.7.2 Design strategies to improve social and physical needs: (Kuo *et al*., 1998)

1. Building spaces for group games in a school's open atmosphere.

2. encouraging student social interaction by building small gardens around the sitting spaces and designing seating spaces that are appropriate for all students.

3. Create some educational board games to play in the schoolyard.

4. Create spaces in school open spaces for a group of students to rest.

2.7.3 Design strategies to improve emotional needs: (Van den Berg *et al.*, 2007)

1. allowing students to have expansive views of natural spaces from their classrooms.

2. Create a link between the inside and outside of the school.

3. Adding some lovely flowers and plants to the school's interior spaces.

4. Adding fountains, ponds, and green areas to schools to increase aesthetics and a sense of belonging in the space for students.

2.8 Summary of Chapter Two

In this chapter, the author has addressed research that illuminates learning as well as various learning theories that can help clarify how learning happens in the design studio. Using open spaces at schools can include three categories of student needs: "educational," "social and physical," and "emotional." By meeting these needs, the physical space of the school can be transformed into a productive setting for student growth. Open spaces can be beneficial to students' cognitive growth, as well as improved awareness of nature, a positive attitude toward nature, and the development of skills in open spaces.

In addition to the research, the author tried to figure out how open spaces can be used to support the physical and social growth of architecture students. Students should be able to engage in social spaces that are designed in open environments. Additionally, these spaces should be built to meet students' emotional needs. It's worth noting that each of the above considerations necessitates unique spaces and designs. Furthermore, because of the interaction between these two spaces, the design of outdoor and open spaces has an effect on the design of artificial school spaces. As a result, designers should pay close attention to each of these things, which can be accomplished in a variety of ways.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Method

Research used both qualitative and quantitative analysis methods to gather information about architectural design studio interactions. Using descriptive analysis to examine internationally renowned architecture schools that are designed to meet the current and changing standards of school requirements. This study is also looking at several local schools and architecture departments to see what services are lacking in the school system that can be included in the current proposed design.

3.1.1 Method of research data collection

The descriptive analysis approach was used to conduct this study, the primary sources of information used in this analysis were primary and secondary data. The facts obtained are qualitative, and the variable used to obtain the principal data was obtained through secondary data analysis. The researcher gathered the primary data for this analysis in the region. User perception surveys, observations, and case studies are examples of sources that collect relevant features that help to clarify the variable being evaluated.

3.1.2 Secondary data collection

The data was gathered from printed and unpublished articles, symposium papers, textbooks, and other publications. The data gathered was used to advance the study's interconnected expertise. Relevant evidence from previous studies and documents about the planning structure and organization layout of architectural design studios. The following items were considered in the literature review: archives, articles, journals, and magazines on topics related to the research. Brochures on architectural education and design studio practices were collected to learn about the design effects and different elements of the inquiry.

3.1.3 Primary data collection

1. **The survey instrument**

An image of the main issues and situations influencing student success in their studies was obtained from first observations and preliminary conversations with architecture students, from which a questionnaire was built in line with their need for interactive spaces. Closed questions with yes/no answer choices, as well as questions with pre-defined answer categories and the potential for multiple answers in some questions, were included in the questionnaire. The most appropriate method was stated as using a questionnaire for obtaining the most cost-effective, accurate, and widely used method of gathering the required information by the respondents.

Within the chosen school setting, the questionnaire was given to architectural students. The accuracy and validity of the findings were improved as an outcome of this. A pilot study was conducted in advance, 15 respondents were questioned by means of the developed, structured questionnaire to guarantee that the questionnaire was effortlessly comprehended by the respondents.

2. The survey of data collection

In order to attract a sufficient number of respondents, a questionnaire survey was deemed fitting for this research. It was also used to gain critical views on the topics under investigation. In their analysis of the respondent's views of public building projects in Nigeria, Akande *et al*. (2018) took a similar approach. Before it was deemed necessary to gather the required data to verify that the respondents could easily grasp the questionnaire, it was piloted using the intended, structured questionnaire. The survey sample was primarily drawn from Nigerian architecture departments, with respondents selected using random sampling techniques. The questionnaires were created using Google Forms and sent to respondents via social media platforms such as email, WhatsApp, and Facebook. From August to October 2020, the survey instrument was used.

3. Survey of sample selection

The survey's sample was primarily drawn from the departments of architecture in Nigeria. In the study area, the department account for a certain number of architectural students. Random sampling techniques were used to select respondents from among the students interested in the study field. To eradicate bias, the data used was primary data collected by the use of a questionnaire. Social media platforms such as Email were used to distribute the questionnaires. The questionnaires were sent to the respondents via Google Forms. Later, it was converted to Excel format. Furthermore, the 15 respondents who had already been interviewed were purposefully excluded from the study to avoid any possible prejudices that may have arisen from the questionnaire survey's pre-selected sample for the qualitative interview.

a. Method of research data analysis

In order to accomplish the study's objective, the relative importance index for ranking was used to calculate the responses obtained from the questionnaire using descriptive statistics. The socio-demographic data was summarized using descriptive analysis, and the problems identified in this study were analyzed using statistical analysis. Because the reading needs investigation, examination for the case study, and attempts to disclose people's opinions on how to alter or create a practical flexible learning space, the qualitative data analysis approach was used in the research. Related points of view were analyzed and itemized as a result, and this served as the foundation for making decisions. The criteria for case study selection were purposely selected based on;

1. User centred design
2. Flexibility
3. Fostering connection
4. Blended learning
5. Technology
6. Functionality

Study of the Spaces; The analysis of the case studies will take a critical look at the spaces provided for in an institutional building and are used by the students. The spaces include;

1. General Spaces; Entrance, Circulation Spaces, Toilets
2. Student Learning spaces; Studios, Laboratories, Modelling Room, Exhibition area, Lectures Room, Seminar Room,
3. Administrative Spaces; Faculty Offices
4. Relaxation Spaces; Entrepreneurial Hubs and Common Room.
5. Outdoor learning spaces.

b. Reliability test

The data was analysed and reliability tests were performed to assess the reliability of the measurement scales used in this study. The instruments' reliability was determined using Cronbach's uniform alpha to ensure un-dimensionality between the test scales. The questionnaire was given to 15 students who were later omitted from the study respondents in order to ensure the instrument's reliability. Cronbach's alpha was calculated for each test, and it was discovered that the reliability scales had acceptable values of 0.87. This means that the data is reliable and has a high level of reliability.

c. Relative importance index

In this analysis, the Relative Important Index was measured and each observation was ranged, classified and interpreted as the most important. The dominant factors needed to be defined to assist decision and policymakers in their potential decisions needed for guidance in the integration of the approach to interactive space design. To accomplish such a feat, accurate prevalence data is therefore required. One method for calculating such prevalence is to use the Relative Importance Index (RII). The significance level was determined using arithmetic mean value scores from the questionnaire created for this study, which mainly used on a scale of 1 to 5, likert scales are used. The lower the mean value, the less significant the element is in the analysis.

The case studies have been analysed on the following characteristics;

1.Architectural description

2.Design of The Spaces

3.Design Appraisal.

d. The assumption of the study

1. H0: There is no association between the User Centred Design and collaboration among the level which is prompted by the nature of space.

H1: There is an association between the functionality design and collaboration among the level which is prompted by the nature of space.

2. H0: There is no association between the functionality design and collaboration among the level which is prompted by the nature of space.

H1: There is an association between the functionality design and collaboration among the level which is prompted by the nature of space.

3. H0: There is no association between the functionality design and stressful environment that prevent interaction among students

H1: There is an association between the functionality design and stressful environment that prevent interaction among students

4. H0: There is no association between the User centered design and achieving a common goal from collaborative work using interaction

H1: There is an association between the functionality design and achieving a common goal from collaborative work using interaction

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Empirical (Quantitative) Findings

The data used was a primary data collected through the use of questionnaire. The questionnaires were sent through the help of social media such as email. The questionnaires were sent to the respondent through the mean of google form. Thereafter it was transformed into excel format. The data was examined and test for reliability was conducted and it was discovered that the reliability was 0.87. This imply that the reliability was high therefore other analysis can be conducted.

Relative Important Index (RII) was calculated and each observation was ranged and the most important ones was identified and interpreted. Also carried out was Chi-square test of independence and it was observed that more of the cells that have expected values were less than 0.05 were more, therefore the cell were merged in such a way that Lowest and low represent low and highest and high represent high. This invariably indicates that instead of 5 ranks 3 were used finally. This also was done for strongly disagree and disagree to represent Disagree while strongly agree and agree to represent Agree. This is use for question 7, 9 and 10. It was observed that the number of expected counts reduces to one or zero at the end.

4.1.1 Reliability test

In order to verify the reliability of the measurement scales employed in this study's analysis, the data was analyzed and reliability tests were carried out. Using Cronbach's standardized alpha (Table 4.1), 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.

4.1.2 Reliability statistics

Table 4.1: Reliability statistics

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

Source: Author’s work (2020)

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.

4.1.3 Scale statistics

The overall mean of the data is found to be 48.87, with a variance of 75.273 and standard variation of 8.676. This implies that there is a wide variation in the data.

Respondents' socio-demographic characteristics

The study's respondents' background characteristics are depicted in Table 4.2. As can be perceived from the respondents, 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. 31.6% are from age 25-29 and lastly 5.1% are age 30 and above. This result indicates that the vast majority of those who responded are male and are age 30 and above. This, it is hoped, will offer the necessary foundation for comprehension design approach for interactive spaces.

Table 4.2: Respondents' background characteristics

	Frequency	Percent	Valid Percent	Cumulative Percent
GENDER	47	26.6		
Male	130	73.4	26.6	26.6
Female	177	100.0	73.4	100
			100.0	
Total				
AGE				
15-19	33	18.6	18.6	18.6
20-24	79	44.6	44.6	63.3
25-29	56	31.6	31.6	94.9
30 and above	9	5.1	5.1	100.0
Total	177	100.0	100.0	
LEVEL OF STUDY				
100 Level	16	9.0	9.0	9.0
200 Level	18	10.2	10.2	19.2
300 Level	17	9.6	9.6	28.8
400 Level	15	8.5	8.5	37.3
500 Level	14	7.9	7.9	45.2
HND 1	10	5.6	5.6	50.8
HND 2	15	8.5	8.5	59.3
Masters Level	50	28.2	28.2	87.6
ND 1	8	4.5	4.5	92.1
ND 2	11	6.2	6.2	98.3
Pre- ND	3	1.7	1.7	100.0
Total	177	100.0	100.0	

Source: Author’s work (2020)

4.1.4 Respondents' response rate

The total amount of questionnaires was distributed randomly using social media and the respondent rate of 177 questionnaires set out, completed and received back. From the table below, 65.5% are from Federal University of Technology, Minna while 26% are from Federal Polytechnic Bida.

4.1.5 Presences of open space(s) designated to enhance student interactions

Table 4.3 shows among the respondents, only 55.9% have open space designated to enhance student interactions while 44.1 do not have open space designated to enhance student interactions in the institution.

Table 4.3: presence of open spaces.

	Frequency	Percent	Valid Percent	Cumulative Percent
No	78	44.1	44.1	44.1
Yes	99	55.9	55.9	100.0
Total	177	100.0	100.0	

Source: Author's work (2020)

4.1.6 Respondents' awareness of interactive spaces

Table 4.4 shows among the respondents, only 55.9% have open space designated to enhance student interactions while 44.1 do not have open space designated to enhance student interactions in the institution.

Table 4.4: Awareness of interactive spaces

	Frequency	Percent	Valid Percent	Cumulative Percent
Average	87	49.2	49.2	49.2
High	25	14.1	14.1	63.3
Low	49	27.7	27.7	91.0
Very High	7	4.0	4.0	94.9
Very Low	9	5.1	5.1	100.0
Total	177	100.0	100.0	

Source: Author's work (2020)

4.1.7 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. The formula for calculating the Relative Importance Index (RII) was used. below to determine the respondent:

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

Where W = Weight given to each statement by the respondent

A = Highest response integer which is 5

N = Total number of respondents

Result from Table 4.5 shows that user centred design ranked first, followed by functionality as the second and fostering connection as the third.

Table 4.5: Application of interactive spaces

Design features to Enhance Learning	Relative Important Index (RII)	Rank
User Centered Design	0.6350	1
Flexibility	0.5887	4
Fostering Connection	0.6079	3
Blended Learning	0.50169	5
Functionality	0.60904	2

Source: Author's work (2020)

4.1.8 Knowledge of integration of interactive spaces

The findings obtained as presented in Table 4.6 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 4.6: Knowledge of integration of interactive spaces

Integration of Interactive Spaces	Relative Important Index (RII)	Rank
Aware of the collaborative work attributes and condition from interaction	0.7401	3
Achieving a common goal from collaborative work using interaction	0.74689	2
The 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	0.76384	1

Source: Author's work (2020)

4.1.9 Importance of interactive spaces

According to the findings obtained from Table 4.7, 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 "students 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 4.7: Importance of interactive spaces

Importance of interactive spaces	Relative Important Index (RII)	Rank
Stressful environment prevents interaction amongst students	0.76384	3
Collaboration amongst the level is prompted due to nature of spaces	0.81582	1
Studio connected to each other enhances easy interaction amongst students	0.76158	4
Students are less productive due to stress in the campus	0.810169	2

Source: Author's work (2020)

4.2 Hypothesis Testing

The study established four hypotheses to test the assumption of the study, the following shows the findings from the test statistics carried out which are stated below:

4.3 The Assumption of the Study.

Hypothesis 1

1. H0: There is no association between the User Centered Design and collaboration among the level which is prompted by the nature of space.

H1: There is an association between the functionality design and collaboration among the level which is prompted by the nature of space.

Table 4.8 shows that there is an association between user centred 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. For this study, to examine if the dependent variable influences or affects the independent variable, the Chi-square test of independence (Table 4.9) was used.

Table.4.8: Crosstab of collaboration amongst the level is prompted due to nature of spaces

Crosstab						
			[User centered 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

Source: Author's work (2020)

Table 4.9: Chi-Square tests of collaboration amongst the level is prompted due to nature of spaces

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.

Source: Author's work (2020)

The asymptotic significant value is less than 0.05, as shown in Table 4.9 above. As a result, we reject the null hypothesis and come to the conclusion that there is an association between the user centred 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 4.10). Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. With a value of 0.584, the association is statistically significant.

Table 4.10: Symmetric measure of collaboration amongst the level is prompted due to nature of spaces

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.

Source: Author's work (2020)

Hypothesis 2

2. H0: There is no association between the functionality design and collaboration among the level which is prompted by the nature of space.

H1: There is an association between the functionality design and collaboration among the level which is prompted by the nature of space.

Table 4.11 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, as well as ensuring that each intended use of the space may be met without placing the room under stress or making users uncomfortable. Similarly, for the data below, to examine if the dependent variable affects or impacts the independent variable, the Chi-square test of independence (Table 4.12) was used.

Table 4.11: Crosstab of collaboration amongst the level is prompted due to nature of spaces

Crosstab						
			[Functionality (Space to accommodate all participants comfortably, as well as ensuring that each intended use of the space may be met without placing the room under stress or making users uncomfortable.)]			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

Source: Author's work (2020)

The null hypothesis is rejected because the Asymptotic significant value is less than 0.05, and we conclude that there is an association between functionality and collaboration at the level. When there is a space that comfortably accommodates all participants and ensures that each planned use of the space can be accommodated without placing the room under stress or making users uncomfortable, it affects or influences student collaboration.

Table 4.12: Chi-Square test of collaboration amongst the level is prompted due to nature of spaces

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.

Source: Author's work (2020)

Table 4.13: Symmetric measure of collaboration amongst the level is prompted due to nature of spaces

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.

Source: Author's work (2020)

Since there is an association between functionality design and collaboration among the level, the level of association was measured (Table 4.13). Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. With a value of 0.436, the association is statistically significant.

. Hypothesis 3

3. H0: There is no association between the functionality design and stressful environment that prevent interaction among students

H1: There is an association between the functionality design and stressful environment that prevent interaction among students.

From table 4.14 below it shows that there is an association between functionality design and Stressful environment which is to accommodate all participants comfortably, and to guarantees that each intended use of the area can be accommodated without putting the room under strain or making users uncomfortable. Table 4.15 further demonstrates that for the findings below, to examine if the dependent variable affects or impacts the independent variable, the Chi-square test of independence was used.

Table 4.14: Crosstab of stressful environment prevents interaction amongst students

Crosstab						
			[Functionality (to accommodate all participants comfortably, and to guarantees that each intended use of the area can be accommodated without putting the room under strain or making users uncomfortable)]			Total
			Low	Moderate	High	
Stressful environment prevents interaction amongst students	Disagree	Count	7	6	2	15
		Expected Count	4.7	5.2	5.1	15.0
	Neutral	Count	11	11	1	23
		Expected Count	7.3	7.9	7.8	23.0
	Agree	Count	38	44	57	139
		Expected Count	44.0	47.9	47.1	139.0
Total		Count	56	61	60	177
		Expected Count	56.0	61.0	60.0	177.0

Source: Author's work (2020)

Table 4.15: Chi-Square test of stressful environment prevents interaction amongst students

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.300[a]	4	.004
Likelihood Ratio	18.809	4	.001
Linear-by-Linear Association	10.164	1	.001
N of Valid Cases	177		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.75.

Source: Author's work (2020)

Because the asymptotic significant value is smaller than 0.05, we reject the null hypothesis and conclude that there is an association between functionality and a stressful environment that prevents students from interacting.When the functionality (spaces to accommodate all participants comfortably, and to guarantees that each intended use of the area can be accommodated without putting the room under strain or making users uncomfortable to influences the stressful environment that prevent interaction among students. Since there is an association between functionality Design and stressful environment that prevent interaction among student, we measure the level of the association in table 4.16. Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. With a value of 0.483, the association is statistically significant.

Table 4.16: Symmetric measure of stressful environment prevents interaction amongst students

Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.245	.059	3.883	.000
	Gamma	.483	.108	3.883	.000
N of Valid Cases		177			

a. Not assuming the null hypothesis.

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

Source: Author's work (2020)

Hypothesis 4

4. H0: There is no association between the User centered design and achieving a common goal from collaborative work using interaction

H1: There is an association between the functionality design and achieving a common goal from collaborative work using interaction

Table 4.17 indicates that there is an association between functionality design and achieving a common goal from collaborative work using interaction which learning spaces provided will allow students to perform to their highest and best potential and to minimize superfluous distractions. The Chi-square independence test (Table 4.18) was employed to test if the dependent variable affects or influences the independent variable for this finding.

Table 4.17: Crosstab of achieving a common goal from collaborative work using interaction

Crosstab						
			User Centered Design (learning spaces to allow students to perform to their highest and best potential and to minimize superfluous distractions.)]			Total
			Low	Moderate	High	
Achieving a common goal from collaborative work using interaction	Disagree	Count	9	5	0	14
		Expected Count	3.5	5.1	5.4	14.0
	Neutral	Count	15	25	12	52
		Expected Count	12.9	19.1	20.0	52.0
	Agree	Count	20	35	56	111
		Expected Count	27.6	40.8	42.6	111.0
Total		Count	44	65	68	177
		Expected Count	44.0	65.0	68.0	177.0

Source: Author's work (2020)

We reject the null hypothesis since the asymptotic significant value is less than 0.05, implying that there is an association between functionality design and reaching a common goal through collaborative work via interaction. When there is learning spaces to allow students to perform to their highest and best potential and to minimize superfluous distractions then this will influence stressful environment that prevent interaction among students.

Table 4.18: Chi-Square test of achieving a common goal from collaborative work using interaction

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.568[a]	4	.000
Likelihood Ratio	29.497	4	.000
Linear-by-Linear Association	22.849	1	.000
N of Valid Cases	177		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 3.48.

Source: Author's work (2020)

Table 4.2: Symmetric measure of achieving a common goal from collaborative work using interaction

Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.321	.062	4.973	.000
	Gamma	.523	.089	4.973	.000
N of Valid Cases		177			

a. Not assuming the null hypothesis.

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

Source: Author's work (2020)

Since there is an association between the functionality design and achieving a common goal from collaborative work using interaction, we measure the level of the association (Table 4.19). Judging by the Gamma (Goodness and Kruskal's gamma) the association is strong. With a value of 0.483, the association is statistically significant.

From the analysis above, since there is a relationship between User centered design, Functionality with Collaboration among the student and stressful environment that prevent interaction among student, and each of these relationships is strong then recommendation can be made those open spaces should be built in order to alleviate stress among the student and encourage healthy campus life interaction and collaboration.

4.4 Data Presentation and Discussion of Results

4.4.1 Case studies (qualitative) findings

4.4.1.1 *Case study one*:

General Overview

Name: University of Lagos, Department of Architecture. Lagos State, Nigeria.

Location: Lagos State, Nigeria.

Project Architect; Not Available.

The School of Environmental Design, which was established in 1970, gave birth to the Faculty of Environmental Sciences.

Plate XXXIII:University of Lagos, Department of Architecture, Nigeria

Source: Author's work (2020)

The faculty was divided into three departments in 1980: architecture, building technology, and city and regional planning.

Plate XXXIV: University of Lagos, Department of Architecture. Nigeria
Source: Author's work (2020)

The University of Lagos, also known as 'Unilag,' has a vast campus with various schools and departments spread around. The University of Lagos does not have its own school of architecture building; instead, it has a Department of Architecture that is housed in the Environmental Sciences Building, which it shares with other departments.

Plate XXXV: MSc 1 design studio: University of Lagos, Department of Architecture, Nigeria

Source: Author's work (2020)

Despite the fact that the University of Lagos Department of Architecture is one of the best in Nigeria, it lacks an appropriate learning atmosphere for its architecture students.

Plate XXXVI: University of Lagos, Department of Architecture, Nigeria.

Source: Author's work (2020)

4.4.1.2 *Case study two*:

General overview

Name Federal University of Technology Minna, Nigeria, Department of Architecture.

Location: Minna, Niger State, Nigeria.

Project Architect; Not Available.

Project Year: 1983

Plate XXXVII: Department of Architecture, Federal University Of Technology Minna, Nigeria

Source: Author’s work (2020)

Minna Federal University of Technology was established on February 1, 1983, with the intention of influencing and influencing the countries' technicality in science and engineering works. The Environmental Building School is located in the academic centre of the Federal University of Technology Minna, approximately 90 meters from the main auditorium and 10 meters from the school's convocation area.

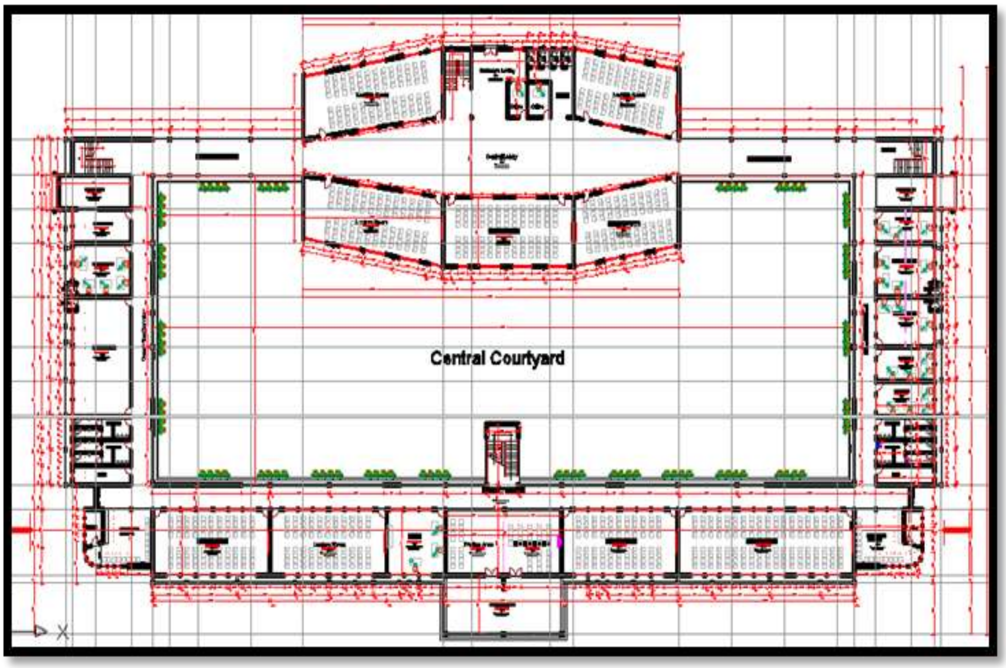

Plate XXXVIII: Sketch floor plan of Department Architecture, Federal University Of Technology Minna, Nigeria

Source: Author’s work (2020)

Architectural description

The Environmental Technology Faculty consists of four (4) floors in a multi-story structure. The departmental studios for Architecture occupy different floor levels in the building, which is built in a box format with a central courtyard. With the exception of a few high-ranking workers who are housed on subsequent floors, the majority of the offices for the Architecture department's daily administrative tasks are located on the ground floor. Except for the ground level, both floors have classrooms/studios, although they are not in any particular order.

Plate XXXIX: General waiting room, Department of Architecture, Federal University Of Technology Minna, Nigeria

Source: Author’s work (2020)

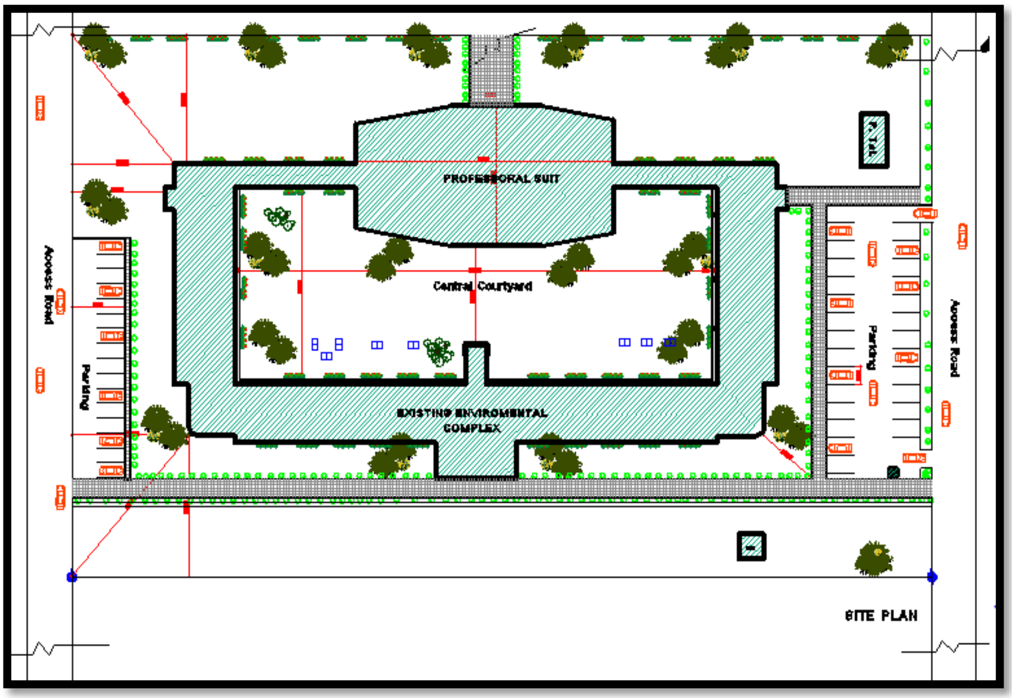

Plate XL: Site plan, department of Architecture, Federal University of Technology Minna, Nigeria

Source: Author’s work (2020)

There are no purpose-built or user-centred spaces for students, such as relaxing areas or a light and wind laboratory. And, since it is the latest standard of architectural education, the department does not have any other branches of architecture.

Design of the spaces

Studio; studios are built as wide-open spaces with walls, preventing students from seeing each other's work and allowing for easy movement within the building. But, since the studios are dispersed throughout the school, this type of design does not allow for interaction and sharing of ideas between students at different levels.

Plate XLI: Undergraduate design studio, Department of Architecture, Federal University Of Technology Minna, Nigeria

Source: Author's work (2020)

Plate XLII: Courtyard Department of Architecture, Federal University Of Technology Minna, Nigeria

Source: Author’s work (2020)

Appraisal

a) The spaces given, such as the studios, are not well zoned.

b) The layout of the building indicate that it is not a user-centred design.

c) The spaces aren't very adaptable or simple to transform for various academic purposes.

d) Students do not have access to rest areas or purpose-built support facilities.

4.4.1.3 ***Case study three*:**

General Overview

Name: University of Miami School of Architecture

Location: Coral Gables, United States

Architect: Not Available

Project Year: Not Available

Plate XLIII: Approach and Landscape view of University of Miami School of Architecture.

Source: Archdaily (2020)

Architectural description

The structure resembles a large shed, features a vaulted roof 18 feet above the ground supported by slender steel columns and a few fixed walls.

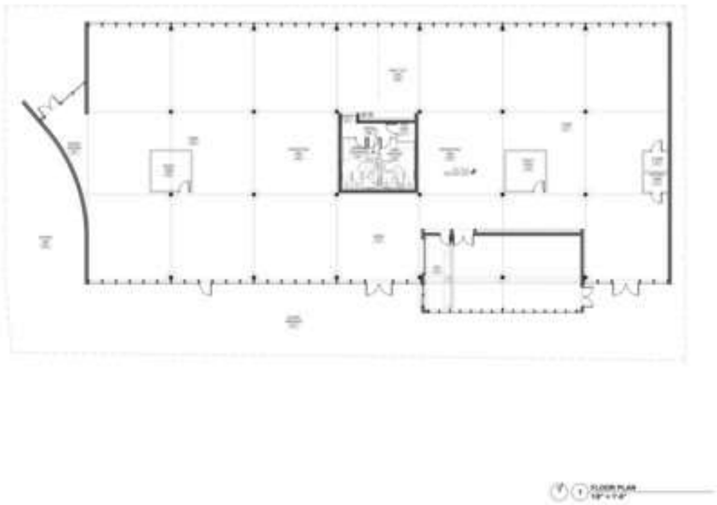

Plate XLIV: Lower ground floor and ground floor plan of UMEA School of Architecture.

Source: Archdaily (2020)

The roof design enables natural light to enter the structure, giving it a sense of openness.

The main public transit entrance is surrounded by a single curved concrete wall.

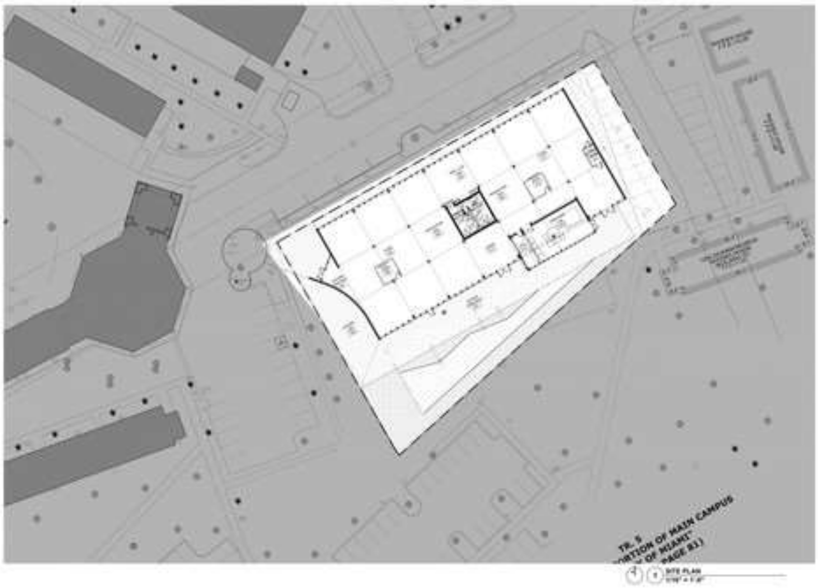

Plate XLV: Site plan of University of Miami School of Architecture.

Source: Archdaily (2020)

The studio's open space is centred on a 25-foot square workstation module that can hold 90 to 130 workstations in various combinations. The architecture of the studio rooms embraces every aspect of twenty-first-century education. A high-visual-drama moment is the roof, which is built of thin-shell concrete. In the Miami heat, the slab warps and appears to melt, creating an elegant arc that adds depth to the structure's design.

Plate XLVI: Exterior of University of Miami School of Architecture.

Source: Archdaily (2020)

Design of the spaces

Studio; studios are built with wide open spaces without walls, allowing students to see each other's work and allowing for easy movement around the building. This type of design often allows for interaction and sharing of ideas between students at various levels. For the next generation of designers, the building of a one-of-a-kind architectural laboratory and collaborative environment. The new 20,000-square-foot LEED-certified studio building supports and advances the school's instructional strategy.

Plate XLVII: Work station of University of Miami School of Architecture.

Source: Archdaily (2020)

Appraisal

Merits

1. The spaces given are well zoned, such as the studios situated along the sides of the walls, where daylighting is provided by the windows.

2. The building's features indicate that it was designed with the user in mind.

3. The spaces are flexible and easy to convert for different academic uses.

Demerits

1. There are no relaxation and circulation spaces provided within the building.

2. There are no allocated outdoor interactive spaces for the departments.

4.4.1.4 ***Case study four*:**

General overview

Name: School of Architecture, Universidad de los Andes

Location: Bogotá, Colombia

Architect: Not Available

Project Year: Not Available.

Plate XLVIII: Approach view of School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

Architectural description

The project is based on three beliefs identified by the client on the building's program: the pedagogical belief, which purpose is to reveal the needed elements of teaching architecture and design; the belief of integration, which stimulates interaction between the students of this certain faculty with the rest of the university and provides detailed spaces that inspire community; and the pedagogical belief, which targets to reveal the needed elements of teaching architecture and design

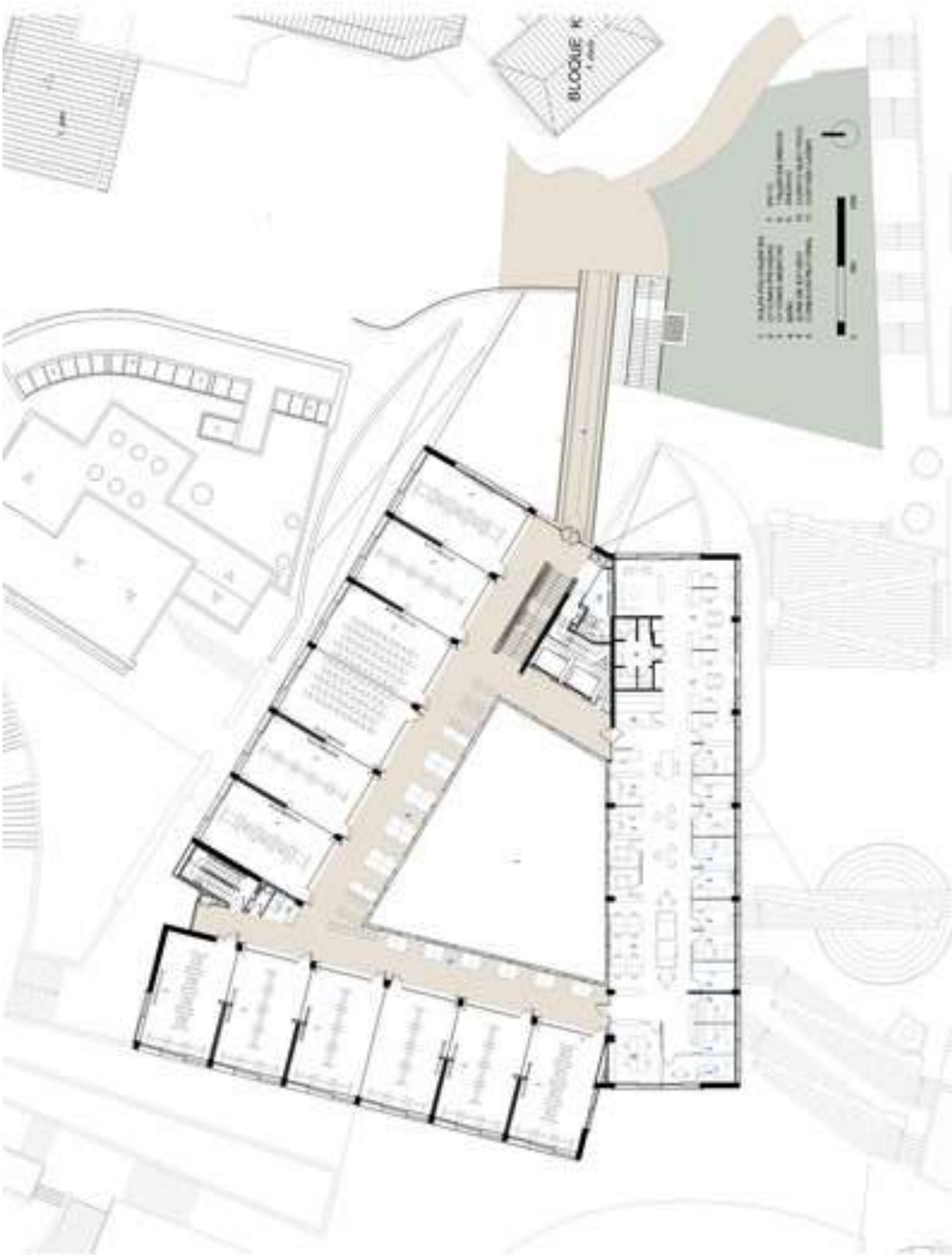

Plate XLIX: Ground Floor Plan of School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

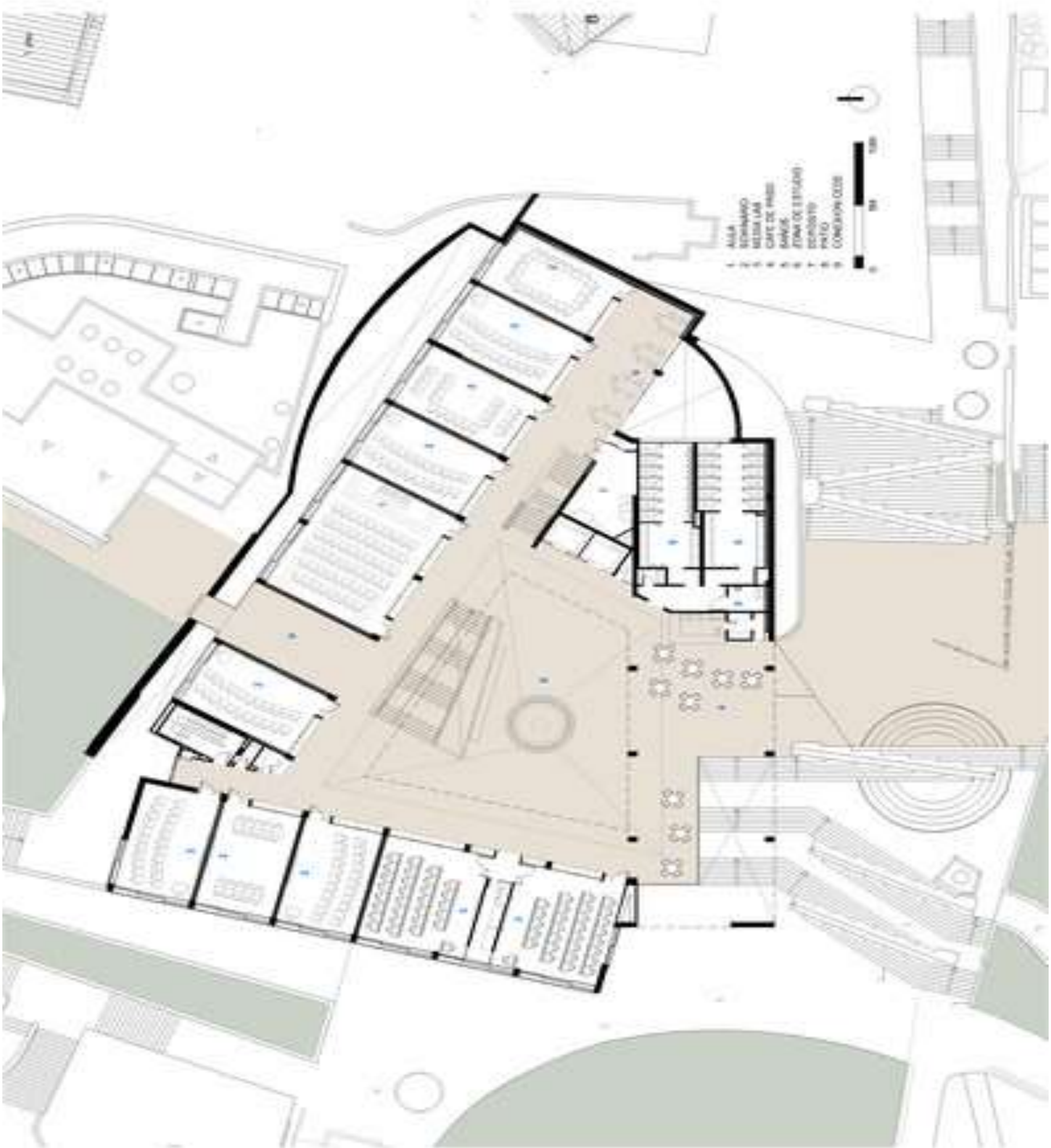

Plate L: First floor plan School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

Plate LI: First floor plan School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

Design of the spaces

The central courtyard, which serves as the faculty's representative meeting place, was previously undeveloped on campus. The multi-purpose classrooms, which are located on the second and third floors, are pedagogical spaces dedicated to the teaching of architecture and feature deterrent type.

Plate LII: Undergraduate studio at School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

Appraisal

a. The spaces offered are well zoned, such as the studios situated along the sides of the walls where daylighting is provided by the windows.

b. The building's features indicate that it was designed with the consumer in mind.

c. The spaces are adaptable and simple to transform for various academic purposes.

d. The building's users have no access to outdoor relaxation areas.

e. There are big voids above atriums in the building for student interaction.

Plate LIII: Studio at School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

Plate LIV: Pin up presentation of School of Architecture, Universidad de los Andes.

Source: Archdaily (2020)

4.4.1.5 *Case study five*:

General overview

Name: Austin E. Knowlton School of Architecture

Location: Columbus, United States

Architect: Not Available

Project Year: Not Available

Plate LV: Approach and landscape view Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Architectural description

The new school is both strategic and interactive. The vertical circulation route starts at the main entrance. Up and down the building, an inclined plane system passes through studios and examination areas. Offices are accessible from the studios and are positioned along circulation paths and in close proximity to students' daily jo

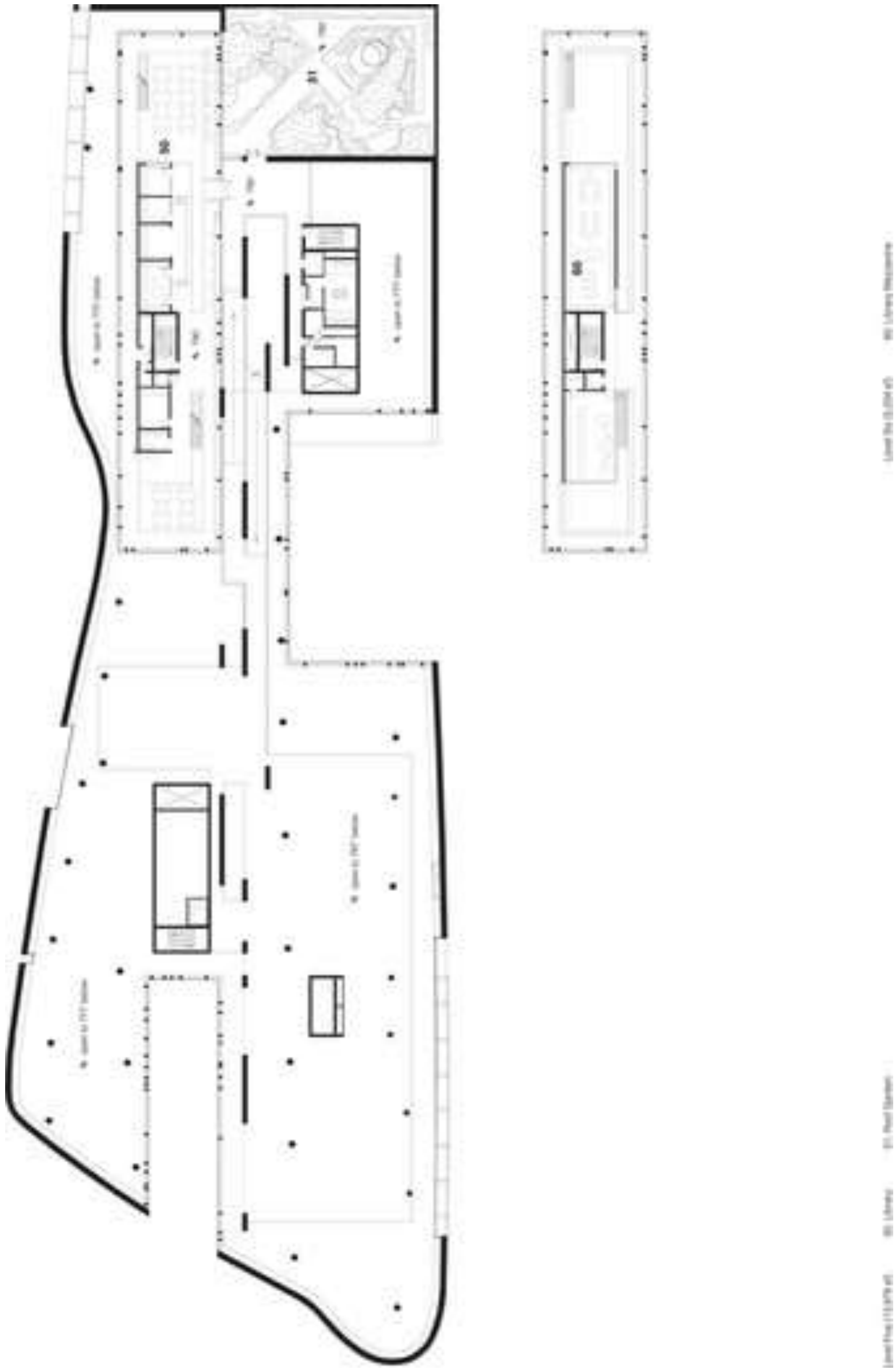

Plate LVI: Lower floor plan of Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Plate LVII: First floor plan of Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Plate LVIII: Second floor plan Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Design of the spaces

Enclosing, identifying, and the building shape is created by facing this larger site's areas and existing structures. Faculty offices are in close proximity to students' everyday work and are positioned along circulation paths, visible from the studios. A wood shop, a café, digital imaging facilities, computer labs, schools, an archive, and an art gallery are among the amenities available for the school's program areas, also include 45 studios, 65 offices, an auditorium, and a library.

Plate LIX: Interior corridor of Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Plate LX: Studio at Austin E. Knowlton School of Architecture

Source: Archdaily (2020)

Appraisal

a. The construction site location provides the building's users with a great link to nature.

b. Internal scoops serve as informal criteria and breakout rooms.

c. The lush green lawn with a gentle slope.

d. The adaptable spaces encourage student experimentation, social events, seminars, critiques, and strange occurrences. The porosity between studio spaces allows for this.

e. Spaces such as small conference rooms, bigger reading rooms, coffee stations, kitchens, and other facilities are available.

f. The curved walls would make attaching sketches to the walls difficult for the students.

4.5 Design Proposal for A User Centred Approach to Interactive Architectural Spaces

The design proposed in this section is derived from the study's gathering and analysis of data. The following is a summary of the plan.

4.5.1 Project background and justification

4.5.1.1 *Brief formulation*

The aim of this study is to create natural spaces that are more than just a room for a specific purpose, while also improving comfort, engagement, and space quality to meet the needs of today's students. A perfect artistic centre in terms of facilities, circulation, design, and finishes. It should be versatile in terms of preparation and circulation while also being designed to mould to the thinking of the students.

4.5.1.2 *The client's requirement*

The declaration of need for the proposed building was derived after thorough inquiry from the Departments of Architecture's lecturers and students, as well as recommendations for the building's appropriate location within the school. It was determined that the new school building would provide supporting services and purpose-built areas for various sports, as well as student relaxation spaces and quarters. It appears that a thorough design brief was developed. These are the additional design requirements that were discovered:

1. Administrative Unit: This will house the activities of the Academic Staff (Deans, HODs, Professors), non-Academic Staff (Secretaries, Technologists), management Staff, and all other School officers who are responsible for ensuring that Architectural Education is effectively provided to students.

2. Educational Facilities: Studios, lecture halls, research rooms, laboratories, libraries, visualisation facilities, lecture halls, rest rooms, and so on are examples of these.

3. Support Facilities; Indoor and outdoor relaxation facilities, Common room, gardens, outdoor sitting areas for interaction, security and storage, commercial spaces, parking areas will be provided for.

4. Training Facilities; Exhibition Hall, modelling rooms, presentation halls/rooms.

4.5.1.3 *Geographical information*

Minna, the capital of Niger state, has 25 local government districts. Niger is one of Nigeria's 36 states. It covers an area of around 76,363km2.

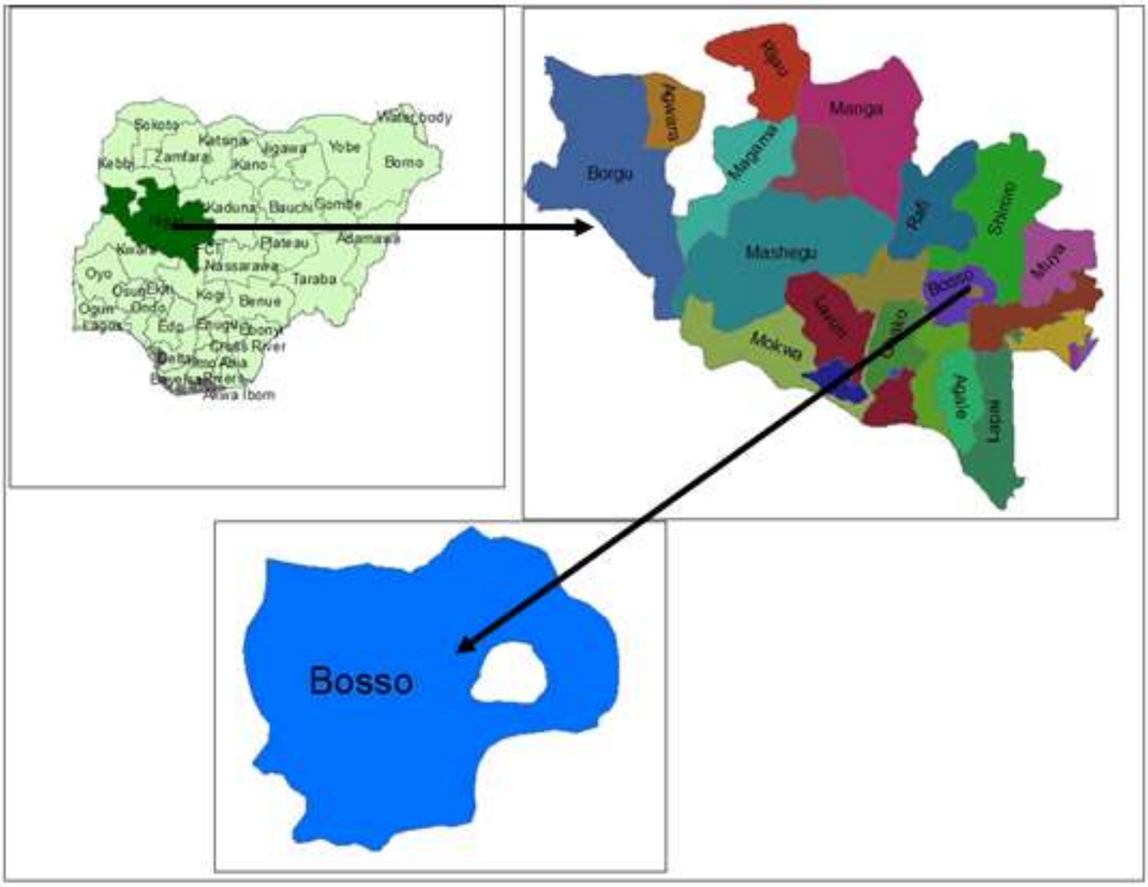

Figure 4.9: Map of Niger State's local Government

Source: Google image (2020)

4.5.1.4 *Climate*

Rainy (April to October) and dry (November to March) are the two seasons in Minna. Between April and October, it has been observed to rain. The propensity to concentrate, which occurs mostly in the months of July, August, and September. January receives the least amount of rainfall. This month's average rainfall is 1mm. The month of September has the most precipitation.

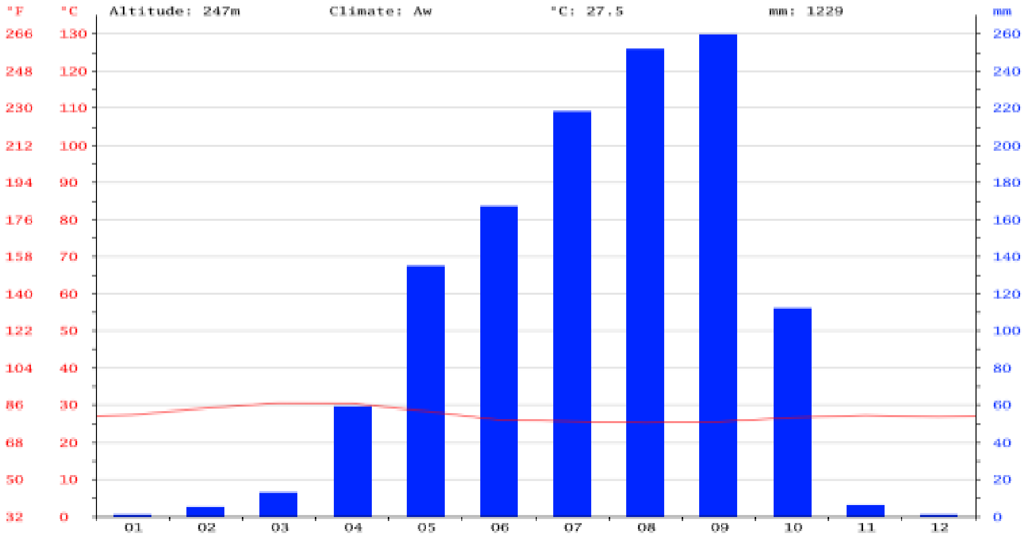

Figure 4.10: Map of Nigeria indicating climate classification

Source: Google images (2020)

4.5.1.5 *Sun*

Minna's day duration does not vary greatly across the year, staying within 32 minutes of completing a 12-hour period. The shortest day is December 21, with 11 hours and 43 minutes of daylight, and the longest day is June 21, with 12 hours and 32 minutes of daylight.

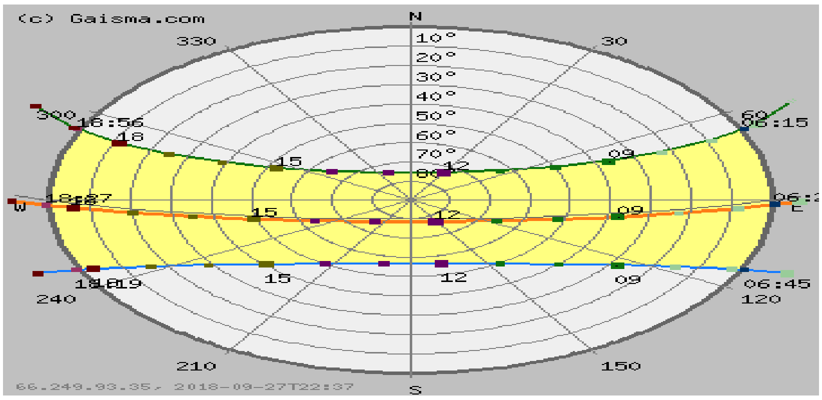

Figure 4.11: Map of Nigeria indicating climate classification

Source: Google images (2020)

4.5.1.6 *Temperature and precipitation/rainfall*

The rainy season lasts from March to November, with temperatures ranging from 28 °C (82.4 °F) to 30 °C (86.0 °F) during the day and 19 °C (66.2 °F) to 21 °C (69.8 °F) at night. Even the coldest nights can be accompanied by days that are well above 30 degrees Celsius (86.0 degrees Fahrenheit). As compared to high-altitude cities like Abuja, the temperature difference in a city near the coast is smaller. In addition, the hot season lasts 2.0 months, (2019 weather spark)

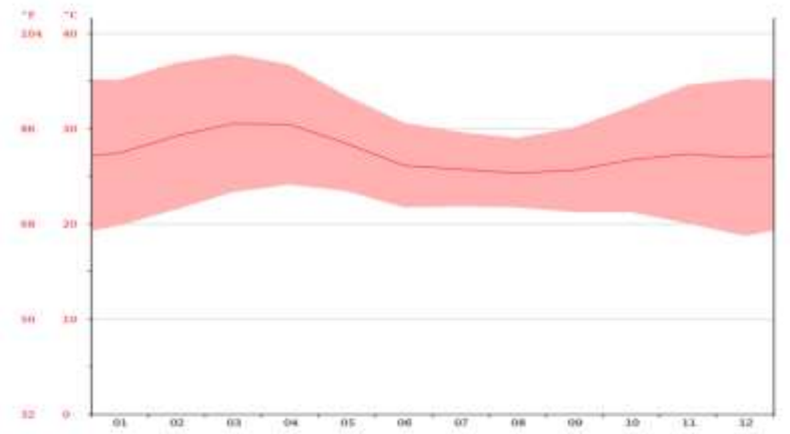

Figure 4.12: Climate data for Minna

Source: Google images (2020)

The climate in this city is tropical. Summers in this area see a lot of rain, while winters see very little. This climate is categorized as Aw by Köppen and Geiger. Minna has a regular annual temperature of 27.5 °C | 81.4 °F. The annual rainfall is approximately 1229 mm | 48.4 inch. In January, there is the least amount of rain. This month's average is 1 mm | 0.0 inch. The month of September sees the most precipitation, with an average of 260 mm | 10.2 inch.

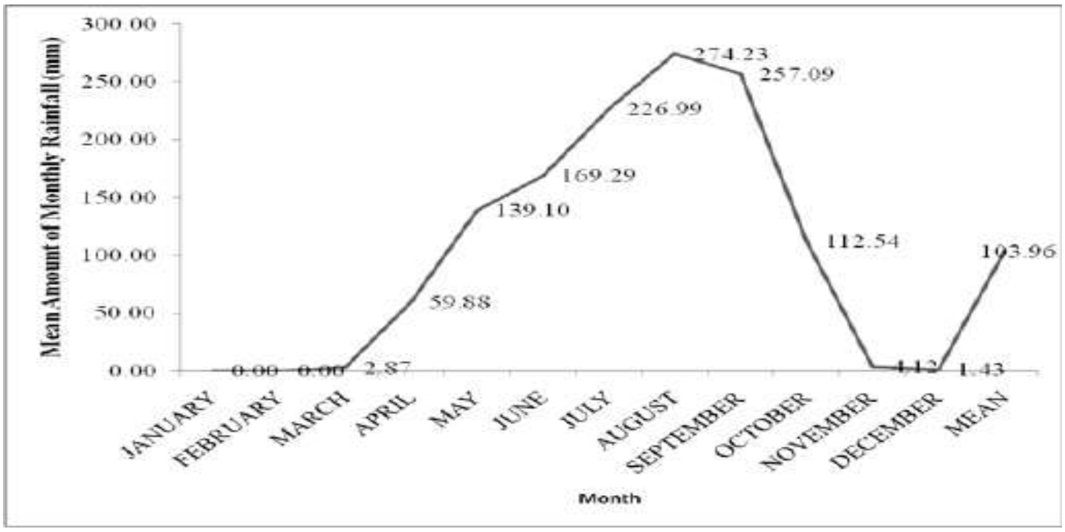

Figure 4.13: Rainfall and temperature data for Minna.

Source: Google images (2020)

4.5.1.7 *Relative humidity*

The observed humidity in Minna differs dramatically throughout the year. From January 25 to December 14, the wettest month of the year, at least 55%of the time, the comfort level is humid, oppressive, or unpleasant. The difference in precipitation between the wettest and driest months is 259 mm | 10 inch. Temperatures differ by 5.2 °C | 41.4 °F during the year.

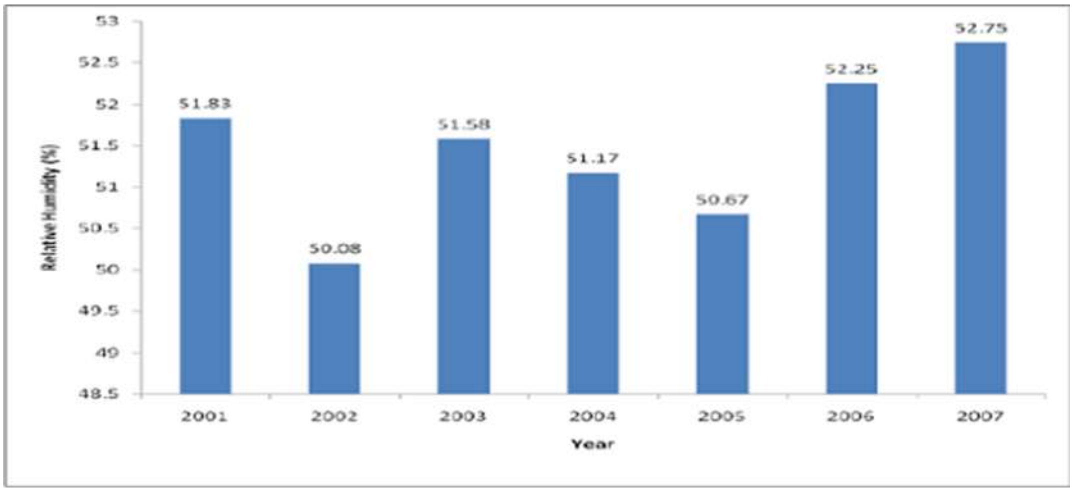

Figure 4.14: The percentage of time spent at various humidity comfort levels, categorized by dew point.

Source: Google images (2020)

4.5.1.8 *Vegetation*

The Minna is located in the West African Sub-Wet Region’s Lowland Rainforest zone. Though there are patches of dry rain forest that appear every now and then. Minna has a beautiful attribute that stems from its proximity to the coast: it shares the same coastal vegetation as cities like Lagos. And as a result, Minna has a lot of fertile soil for agriculture.

4.5.1.9 *Topography*

The topography is relatively flat within 2 miles of Minna, having a greatest height variation of 60 meters and 350 meters above sea level, with an average height of 1200 meters. There are only small elevation variations within 16 kilometres (400m). There are significant elevation variations within 50 miles (900m).

4.5.2 Site location and description

The lecturers in the department of Architecture were consulted about the best strategy for this project during the course of this research. They all agree that the Federal University of Technology Minna is an ideal location for a school of architecture to be developed in Nigeria.

4.5.2.1 *Site selection criteria*

The proposed site was chosen based on a number of parameters drawn from previous precedent studies' site planning approaches. It was taken with caution to remove the flaws found in the case studies while still incorporating the positive aspects found. The following are the key conditions that the site must meet:

1. The beautiful scenery provided by nature in this region adds a sense of comfort and relaxation.

2. Site Topography: The site has a relatively flat slope, which is beneficial to building because it reduces cutting and filling.

3. Enough Space and Future Expansion Potential: The chosen site has enough space for the building and can also accommodate the various academic and social activities of the students. It allows for future expansion, maintains attractive grounds, and avoids obnoxious overcrowding appearances.

4. Site Accessibility: The site is connected to the campus's inner core by a main road. This would make admission to other schools, such as the School of Environmental Technology, much easier.

5. Land Use: According to the Federal University of Technology Minna master plan, the site's official land use is for the construction of a new school building.

6. Landscaping: It is impossible to overestimate the psychological impact of a pleasing site and environment on students and staff. The site has attractive landscaping that will provide the ideal learning environment.

7. The site is surrounded by other academic and student events, creating a peaceful and conducive atmosphere for its users.

4.5.2.2 *Site location*

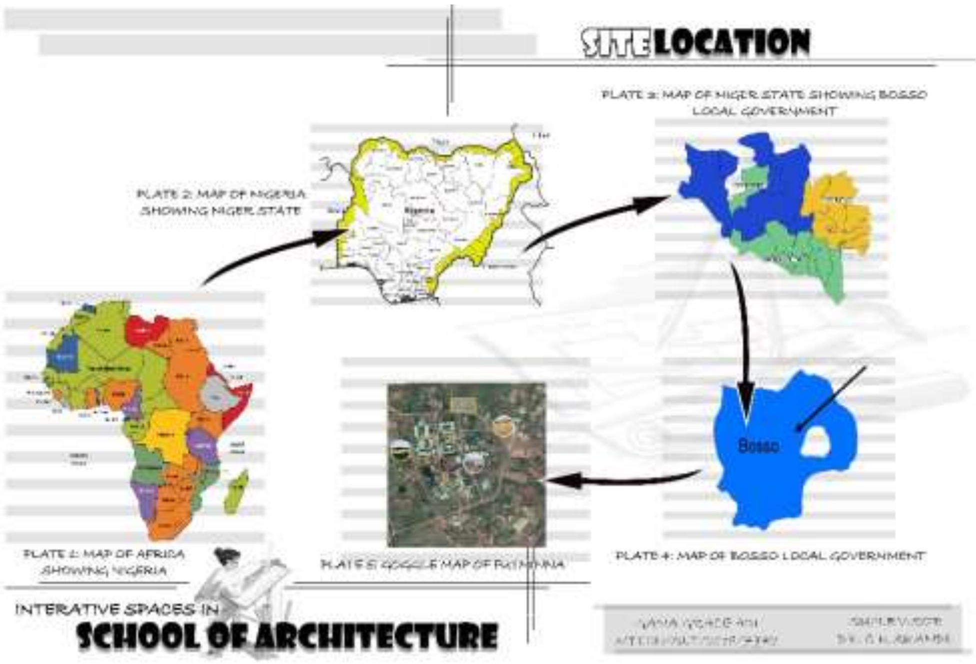

Plate LXI: Site Location

Source: Author's work (2020)

4.5.2.3 *Site analysis*

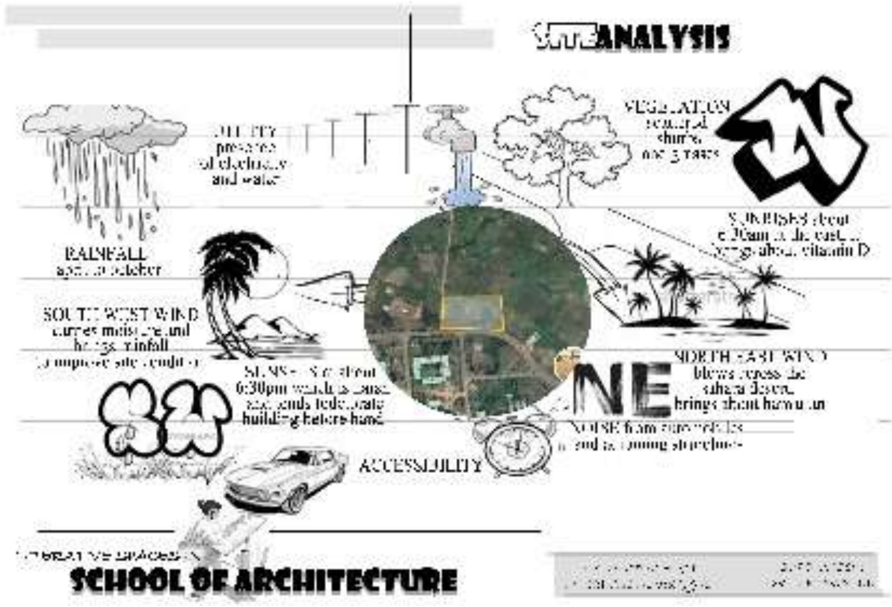

Plate LXII: Site analysis diagram

Source: Author's work (2020)

4.5.3 Existing physical conditions

The proposed school of architecture would be situated on the school's main campus. There are no water bodies or existing structures on the property that would necessitate removal or redevelopment.

Topography: The landscape is relatively smooth. There are no rock outcroppings or other obstacles in the way of the school's construction. The site is slightly below the level of the existing access road.

Vegetation and Soil Type: The site has moderately dense vegetation of about 2 meters in height, with trees of about 6 meters in height that are closely spaced. The soil has a moderate bearing potential and is loamy in nature. There are a few other spots with clayey soil patches.

Access Road: To the north of the property, there is an existing access road. Which is the road that linked the site to the campus's inner core and led from West. This is a suitable place for the planned establishment's entry and exit points.

Plate LXIII: Site inventory.
Source: Author’s work (2020)

4.5.4 Design criteria/ design philosophy

The method of 'balance & functionality,' which is influenced by the intention of an architect when designing and constructing a building or any structure, is the most appropriate for this proposed design. The project design is an important effort to strike a balance between studying, work, social interactions, and an efficient learning environment. It is attempting to avoid being an excessively institutional structure by designing it as a modular design that eliminates the traditional school design. This can be achieved by proposing a concept that is both modern in terms of aesthetics and functionality, as well as homey and unintimidating in appearance.

4.5.5 Design consideration

4.5.5.1 *Circulation*

Within the school facility, interconnected networks will be enlisted for easy access and interconnectivity among the various facilities on site. Different routes will be given to promote the partnership and interaction between the school's students and staff. Lobbies, stairways/stair halls, stairs, lifts, and walkways are examples of circulation spaces.

4.5.5.2 *Accessibility*

For easy access to the site, the school's entrance and exit will be located along the existing access lane. Properly coordinated architecture would allow easy access to on-site facilities such as lecture theatres, gardens, and demonstration sites.

4.5.5.3 *Sustainability*

Physical and climatic influences such as vegetation and topography can be minimized as a result of the building design and site layout. The school's architecture will strive to be in accordance with the natural environment and local climate, ensuring thermal comfort both inside and outside the building.

4.5.5.4 *Landscape*

The site's natural topography, vegetation, and soft and hard landscape elements will be built to provide the required successful learning and relaxing atmosphere for both students and staff.

4.5.5.5 *Ambient environment (noise/lighting/ventilation)*

Provision for natural lighting, glare reduction, proper space orientation, use of high-level windows, noise absorbing materials, practical zoning, and various room styles are all design considerations for noise, ventilation, and light features.

4.5.5.6 *Space allocation/schedule of accommodation*

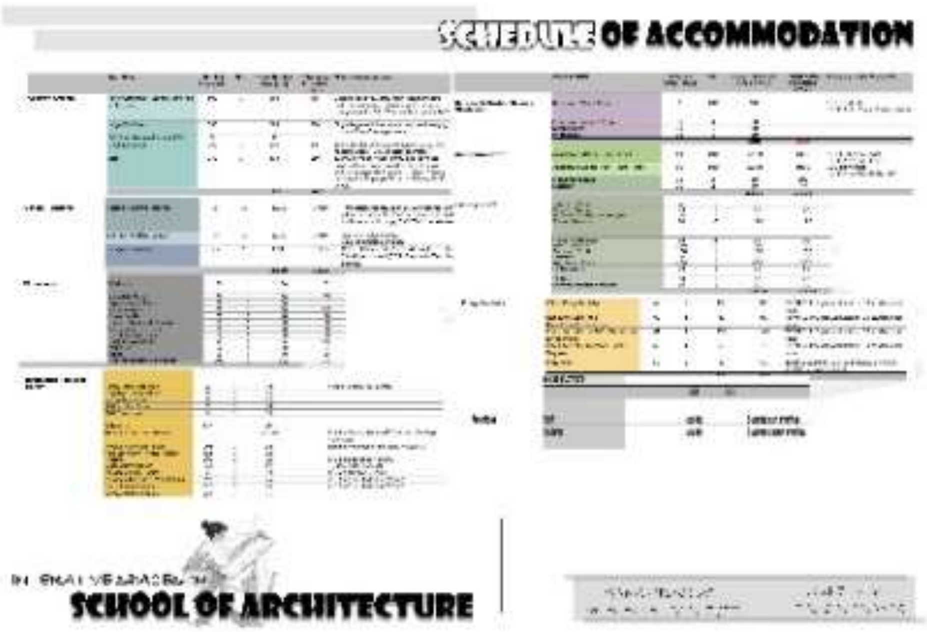

Plate LXIV: Schedule of Accommodation

Source: Author's work (2020)

4.5.5.7 *Bubble diagram*

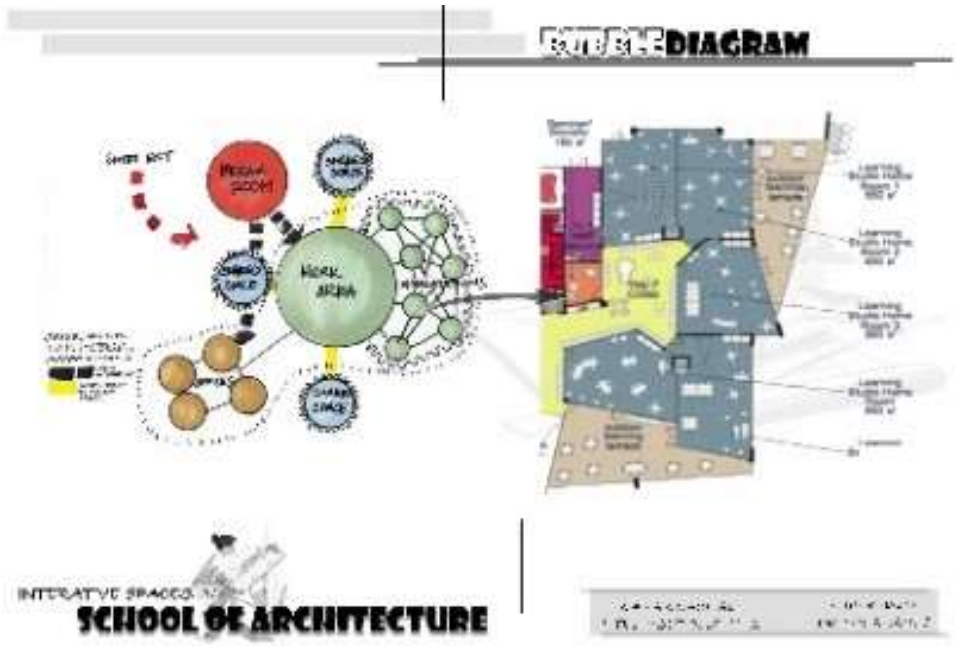

Plate LXV: Bubble diagram.

Source: Author's work (2020)

4.6 Appraisal of Proposed School

All of the criteria are intended to be met by the proposed School of Architecture at Minna's Federal University of Technology, Nigeria for a comprehensive architectural education, both vocational and research-oriented. As previously stated, it will house four architectural departments: Urban Architecture, Landscape Architecture, Building Design, and Interior Design. It will be a school with cutting-edge facilities, rather than the traditional institutional buildings found in Nigeria and its environs. The design aims to provide a facility for students in Nigeria to participate in architectural educational activities.

As a way of ensuring more successful learning within the school setting, the design gives a high degree of attention to the ergonomics of the building and learning environments. The most important aspects of the design were functionality, natural ventilation, daylighting, circulation, protection, types of spaces for other activities, and material selection for both the interior and exterior in terms of sustainability, durability, and maintenance.

Throughout the design, a basic design approach was used. Aesthetics and environment tolerance were also taken into account. The following facilities are included in the proposed school:

i. Architectural design studios

ii. Buttery

iii. Labs & Workshops

iv. Lecture Rooms

v. Galleries

vi. Presentation rooms

vii. Offices

viii. Conveniences

ix. Atrium

x. Courtyard

xi. Lecture theatres

xii. Gardens, outdoor seating areas and parking spaces

4.6.1 Construction procedures and material

The key structural elements in the design would be reinforced concrete and steel. Structural frame construction of columns and beams laid out in grids with walls serving as infillings is used to realize (build) the conceived (design) proposal. All structural work and specifications, such as the designs of columns, beams, slabs, reinforcements, and other structural elements, should be performed by a professional structural engineer registered with COREN, according to the Architect's instructions.

4.6.2 Sub-Structure

The foundation is the most important part of the sub-structure. The type, texture, and composition of the soil on the site will be investigated in order to determine its load bearing potential and properties. The structural engineer would be able to specify good structural detail and specifications as a result of this. For the building, a Pad-Strip foundation (a hybrid of Pad and Strip foundation) will be used. The wall will be built on a strip foundation, while the columns will be built on pad foundations. The foundation materials' consistency will include chemical resistance and sufficient compressive strength, assisting in the transfer of the entire building's weight and removing differential settlements. The soil's strength improves the buildings' stability and durability. Site clearing, site hoarding, topsoil removal, setting-out, trench excavation, casting of blinding, foundation footing and column bases, laying of foundation block wall, hard-core filling, damp proofing, and casting of in-situ ground floor slab are the main operations involved in the substructure stage.

4.6.3 Super-Structure

4.6.3.1 *Floors*

Gravel, sand, clay, and minerals are among the materials used in rammed earth construction. Rammed earth was chosen because it has a high thermal mass index (that is, it absorbs heat well and therefore provides good thermal insulation), soil from the building site can be used, minimizing shipping costs and electricity, and it has a low carbon footprint as compared to steel and concrete.

4.6.3.2 *Walls*

The most significant characteristics are strength and stability, as well as damp resistance, thermal and sound insulation, and fire resistance are all features. 225mm hollow sand Crete blocks will be used for both internal and exterior walls. Any of the convenience store and store walls will be made of 150mm sand Crete hollow blocks. The walls of lifts and stairwells should be made of thick concrete to serve as fire barriers, making it easier and safer to evacuate people from the building in the event of a fire. Metal composite wall panels will be used to cover the exterior wall board. Internally and externally, glazed curtain wall systems are used. Since all loads are transmitted via reinforced concrete columns, no internal wall is a load bearing wall.

Acoustically treated walls are used to isolate areas for different purposes. Commercial spaces and circulation areas are often separated by glazed partitions.

4.6.3.3 *Doors and windows*

Internal doors will be 2100mm in height, with widths of 750mm, 900mm, 1200mm, and 1500mm. The external doors will be 2400mm in height, 1800mm in width, and 2100mm in length. Depending on the room in which they will be used, doors are made of wood, glass, or metal, while window components are made of an aluminium frame with glass in-fill panels.

4.6.3.4 *Roof*

A functional roof must meet the following criteria: strength and durability, fire resistance, stability, sound insulation, energy conservation, and heat transfer. The type of roof pattern that will be used is determined by the building's span.

4.6.3.5 *Ceiling*

In the interior spaces, particularly on the last floor, a suspended panelled ceiling system will be used. This is because the suspended ceiling system is the most popular and least expensive ceiling system. The ceiling structure is made up of a grid frame that the ceiling covering (in this case, acoustic ceiling tile) is connected to. Acoustic Ceiling Tiles were selected for their long history of helping to improve and assist room acoustics. It's made of expanded perforated metal with melamine foam backing and comes in a variety of colours. white metal and chromed metal with coloured backing inserts are examples (light grey, charcoal grey and white). When fixed provide effective noise reduction. These soundproofing tiles control noise while retaining acoustics for occupant comfort in large and small spaces. They're also fibre-free, inexpensive, and simple to mount (with a T-bar/Tee-bar grid system).

4.6.4 Construction/building material

The school's position had an effect on the materials and building methods used. For both internal and external walls, the building will use the University's standard theme material, which is primarily load bearing materials such as red brick cladding, Sand-Crete blocks, reinforced concrete columns and beams. Curtain walls will be used in places where they are required by the design.

4.6.5 Building services/circulation/ventilation/lighting

4.6.5.1 *Building services*

Only the provision of utility facilities allows for the efficient usage of a building. Water supply, power supply, sewage disposal, waste disposal, and fire safety are all important.

i. Water supply:

Water will be delivered directly to the school reservoir by connecting the water supply system to the water mains from the university's general water supply system. Storage cisterns must be placed in strategic locations for various distributions and at various heights.

ii. Electrical systems:

The school's current power distribution network will be used to provide electricity. Electricity must be available on site to provide the necessary power to each floor and room. The wiring device must be conduit, well-designed, and wired in accordance with the accredited electrical engineers and services engineer's requirements. Wire cables should have a high conductivity and resistance. There will also be an alternate power source at the plant house to meet power requirements in the event of a power outage.

i. Drainage:

Surface runoff is directed into gutters around the building and on the property, and then into the main drainage system. Surface drainage system, sealed underground drainage system with on-site storage, and a hybrid system with enclosed drainage for paved areas and surface drainage for unpaved areas were used after careful consideration. On-site central drainage is also available.

ii. Fire protection:

Provision of fire detection and extinguishing equipment in strategic positions on each floor, where the appliances can be seen easily in the event of an accidental fire. Smoke detectors, sprinkler systems, fire alarms, hose reels, and fire extinguishers are among the items that will be given.

v. Acoustics:

The importance of good acoustics in a school's design cannot be overstated. To achieve a specific room sound, room acoustics begins with determining the basic size, shape, and finish materials of a given area, as well as the position and shape of sound reflecting and absorbing surfaces. These requirements are based on the expected purpose and target audience. Acoustics will be managed at the proposed school by using absorptive materials on the walls and ceilings, such as fibrous materials, volume resonators, insulation, carpet, and acoustic tile, as well as hard building materials such as gypsum board, wood, glass, masonry, and concrete.

vi. Waste disposal:

There are facilities for handling, storing, and collecting trash, as well as access for regular collection. The facilities are in a good location, are well ventilated, and meet all fire protection and public health regulations. The waste must be properly disposed of, and consumers must be educated about how to properly dispose of waste. On-site incinerators are available. To achieve clean building facades, sewage disposal would be encouraged by well-laid-out pipes. Toilet waste would be routed into soil pipes that run down the slope and through a septic tank. Where there is a critical joint of more than two pipes, inspection chambers are used. Grey water, or used water from washbasins, pools, and toilets, would be channelled into a waste pipe that runs parallel to the soil pipes but ends in the soak away pit. There is also a central sewage system in place for the entire university population.

4.6.5.2 *Ventilation*

Appropriate window placement and the use of wide courtyards is of utmost importance in order to provide adequate ventilation that is comfortable for all building users. Natural ventilation is available in all critical spaces. This was accomplished by using wide, sufficient openings that provided direct access to the building's exterior.

4.6.5.3 *Lighting*

In an educational building, both artificial and natural environments exist for students and staff. To ensure the comfort of students and staff, daylight is effectively harnessed. Daylight is an excellent source of natural, energy-saving light for a school (learning) environment because of its high light levels and strong colour rendering properties. When compared to artificial lighting, daylighting is usually preferred and efficient, artificial light, on the other hand, is thought to induce headaches and visual exhaustion. Throughout the house, large windows with a height of 2700mm and curtain walls (where necessary) are used. All studios, labs, lecture rooms, and offices have windows to allow natural light in, as well as exterior shading devices to regulate glare and temperature.

4.6.5.4 *Landscaping design*

Landscape refers to the process of enhancing the reshaping the contours of land, particularly around houses, and planting trees, shrubs, and ornamental plants may improve its appearance. Landscaping adds value to the facility in a number of respects, like economic value., environmental, health, and social benefits. It plays a crucial role in the design of any public building, such as this one (school Building). The importance of landscape in the design of school buildings, particularly when considering the successful learning environment, cannot be overstated. Landscape features such as trees and shrubs provide a cover for work areas and can be used to shade car parks, walkways, and the building, as well as enhance the school's aesthetic value. They are important in air movement control and can also be used as noise buffers and to break direct sunlight and heat radiation from the sun. They also aid in the improvement of air quality and the reduction of air temperature in the school environment.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

People come from various social and cultural backgrounds, and the advancement of technology has resulted in a lack of social contact. Architects should consider the above-mentioned factors when designing learning environments because they promote a sense of togetherness, binding people to build minds with more trust and imagination. As a result, student engagement would increase as a result of our findings if architects take into consideration the above-mentioned factors when designing learning environments. According to the data analysed, the most common stress issues are those for which architects fail to account while designing.

This study found that strategically placed open space techniques and elements reduce stress while also improving communication, resulting in improved academic results. According to the study, user-centred design in spatial design, landscape design functionality, and green design that fosters interaction has been chosen. According to the findings of the report, the architect should have proper knowledge of stress reductions such as provision of break out spaces in and around the building, provision of plants within spaces and use of large windows to let in natural light to make the environment conductive enough in order to increase engagement among students from the inception stage of the design. They should be up to date with all emerging trends in defining interactive spaces so that they can make informed decisions that will improve interaction and collaboration and reduce stress. This will add value to the learning environment while also assisting students in improving their academic success, self-confidence, and innovation.

It is also suggested that more in-depth research be conducted on how students' perceptions affect learning environments. In order to facilitate interactions, a user-centred approach should be used from the beginning of the design process.

5.1 Conclusion

In general, open spaces in schools can meet three types of student needs: "educational," "socio-physical," and "emotional." By meeting these needs, the physical space of the school can be transformed into a productive environment for student growth. Open spaces can be beneficial to students' mental growth, resulting in improved awareness of nature, a positive attitude toward nature, and the development of skills in open spaces. Furthermore, open spaces should be suitable for student's growth. Students should be able to engage in social spaces that are designed in open environments. Additionally, these spaces should be built to meet students' needs.

Similarly, the study has revealed a new method of learning and the development of technology that focuses more on spatial complexity, green informal gathering spaces, and landscape in learning processes, which has led to a new system of educational spaces and created a new open environment in which interactions between students and teachers are encouraged, promote collaboration and improve interaction rates, which will alter how people feel and act when learning or working in the studio. The importance of interaction spaces, ranging from formal classical classrooms to informal circulation areas and open spaces, is thus emphasized, and the effectiveness of their architecture has become a central feature of university buildings and an important factor in transforming them into community-oriented tools. The learning environment should reflect learning and teaching goals, support the school's mission, incorporate technology, and be sufficiently versatile for non-class purposes. The importance of informal collaborative spaces cannot be overstated.

The following results were reached based on case studies, literature reviews, and questionnaires completed by various architectural students:

1. Movements are separated.
2. Incorporating elements of suspense into the setting by placing interactive spaces such as common room, user distributed seating and outdoor learning spaces
3. A healthy proportion 40 percent to 60 percent of open space to built-up area

5.2 Recommendations

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 by the architects has become central in university buildings and also an important factor in making university buildings a functional tool for the community. Since an interactive space is created for both staff and students, it is critical to comprehend their desires while creating interactive spaces such as the ones below.

1. Convenient access
2. . User convenience
3. The environment of virtual spaces
4. Noise
5. Aesthetic
6. Security

7. Privacy

8. Climate

9. Space segregation

The learning space should depict learning and teaching purposes and be adequately flexible for non-class ends. Informal collaborative spaces are certainly significant.

5.3 Suggestion for Further Research

It was suggested that putting in place spatial design techniques helped students to feel less stressed. It's a warning that spatial design practices are the key drivers of stress reduction. As a result, there's a case to be made for solving interaction issues at the design stage. The use of landscape and green design in learning environments demonstrates that they are important factors affecting engagement and collaboration. It also shows that during the conceptual stage of building design, these three variables should be taken into account by architects in order to reduce tension and improve experiences in learning environments.

Based on the debate and results so far, there is a lack of suitable design policies, rules, and regulations to entice architects into learning environments. There are no open space techniques or elements in the majority of the information gathered from the respondents, who are architects. Many practitioners only use their flexibility and experiences over time, so open space strategies are approached as individual building strategies. Research is another obstacle to open-space learning environment techniques. Insufficient research on new techniques and elements of open spaces, according to architects, has also contributed significantly to the existing state of learning environments.

For more research on design guidelines to improve the efficient use of interactive space in schools of architecture, this study recommends the following.

1. Size: a selection of small open spaces between buildings to provide a more suitable atmosphere for encouraging interaction rather than large spaces that create undue distance between buildings, disconnecting them.

2. Circulation: making space available to minimize traffic.

3. Spaces: a continuous network of spaces where people can meet, exchange ideas, and share experiences.

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APPENDICES

Appendix A: Questionnaire

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

DEPARTMENT OF ARCHITECTURE

INTERGRATION OF INTERACTIVE SPACES IN DESIGN OF SCHOOL OF ARCHITECTURE FOR FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

The provision of student's interactive spaces in institutions are very important for students to interact and reduce stress. Students develop meaningful connection with their peers through interactions in shared spaces, academic facilities and relaxation areas. The open spaces encourage interaction and help to facilitates campus involvement. The purpose of this survey is to investigate the current experiences of architecture students within the spaces provided for their learning and to develop sustainable strategies for future improvement. This survey is only for academic purposes; hence your responses will be anonymous and confidential.

BACKGROUND INFORMATION

1. Gender

    Male

    Female

2. Age

    Less than 15

    15-19

    20 - 24

    25 -29

    30 and above

3. Name of Institution

- FEDERAL POLYTECHNIC BIDA
- FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

4. Level of study (Please tick the most applicable to you)

- Pre – ND
- ND 1
- ND 2
- HND 1
- HND 2
- 100 Level
- 200 Level
- 300 Level
- 400 level
- 500 Level
- Masters level

5. AVAILABILITY AND IMPORTANCE OF INTERACTIVE SPACES

5. Please rate the level of interactive spaces provided to enhance your learning in your department

- very high
- high
- average
- low
- very low

6. In your department is there any open space(s) designated to enhance student interactions?

- o Yes
- o No

7. Please rank your observation of how the following design features of your department enhance your learning: with 1=lowest and 5=highest

Design Features to Enhance Learning	1	2	3	4	5
User centered design *(learning spaces to allow students to perform to their highest and best potential and to minimize superfluous distractions.)*					
Flexibility *(spaces that accommodate interactive learning, layouts and surfaces that are easily viewed and shared.)*					
Fostering connection *(learning spaces designed to facilitate collaboration and support the engagement of all kinds of users – both quiet and outspoken)*					
Blended learning (spaces to *assemble and actively work through problem sets collaboratively, bringing what had once been individual assignments back within the learning space, to be solved amongst groups.)*					
Functionality (*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*.)					

8. Please tick to identify the provision/availability of any of the following in your department to support and enhance student's interaction. (please tick more than one if necessary).

- Group study room (*a small, technology-rich study space that can be used for a wide variety of pursuits).*
- Distributed user seating (*informal groupings of tables, chairs, and comfortable seating options - dispersed throughout a building, that promote individual and group study).*
- Outdoor learning *(carefully designed landscapes that surround and intermingle with architecture and provide a much-needed respite from the confines of traditional interior learning spaces.)*
- Break out spaces (*small, private spaces that can double as locations for tutoring and mentoring.)*
- Event spaces (*grand public spaces that host a variety of gatherings, from academic to social offerings.)*

9. Please indicate your level agreement with the following statements on Integration of Interactive Spaces in your departmental building 1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Integration of Interactive Spaces	1	2	3	4	5
Aware of the collaborative work attributes and condition from interaction					
Achieving a common goal from collaborative work using interaction					
The individual's use of other member's feedback and critics for improving their works					

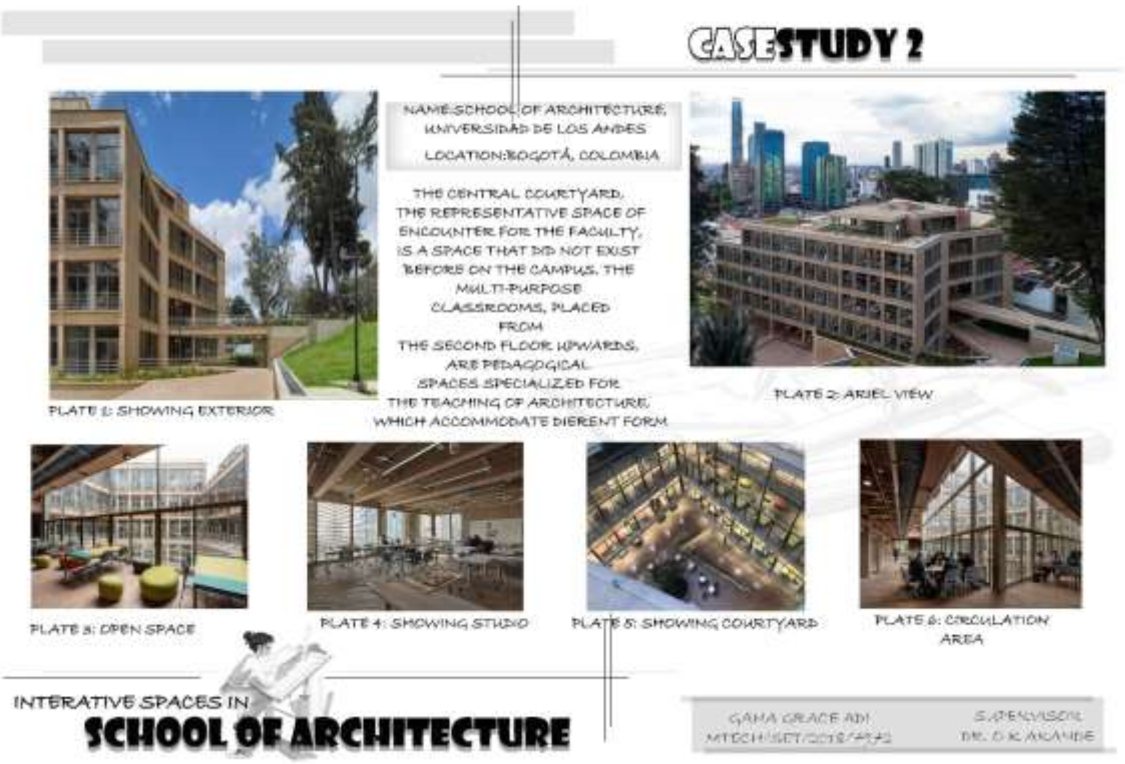
Collaboration from interaction brings about free rider					
Interaction ease design process in studio					

10. Please indicate your level agreement with the following statements on Importance of interactive spaces to your learning in architecture using the following: 1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Importance of interactive spaces	1	2	3	4	5
Stressful environment prevents interaction amongst students					
Collaboration amongst the level is prompted due to nature of spaces					
Studios connected to each other enhances easy interaction amongst students					
Students are less productive due to stress in the campus environment					

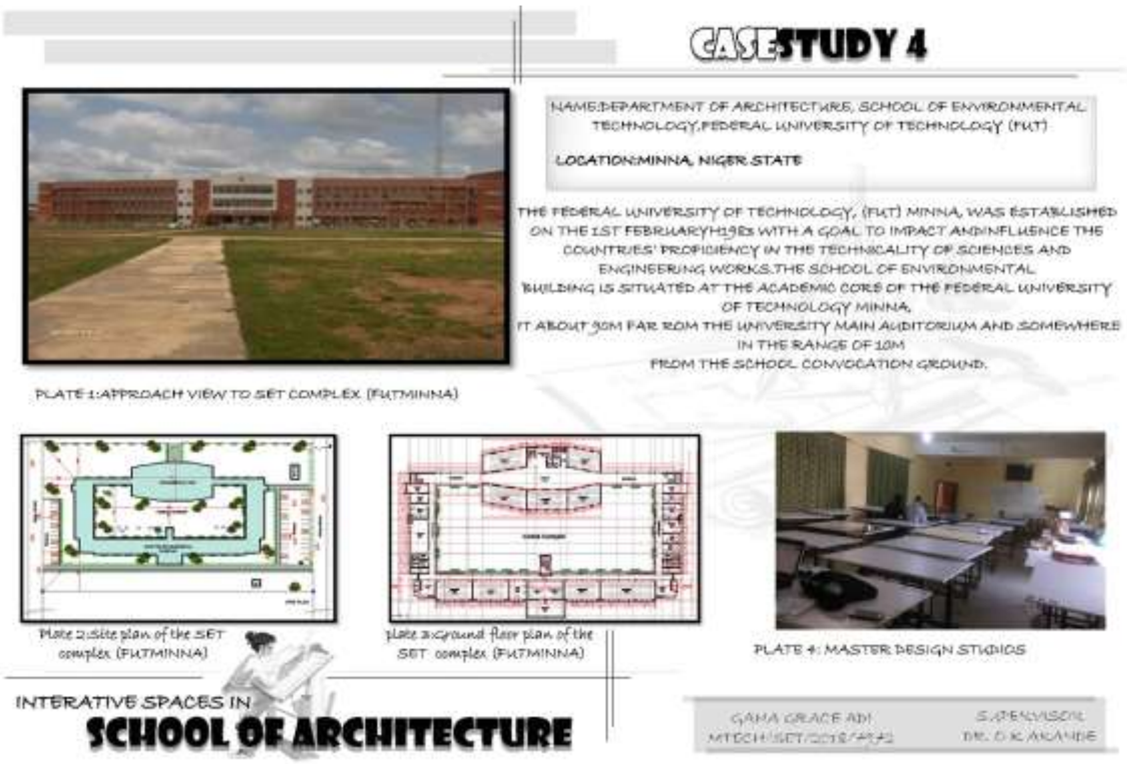
Appendix B: Case study 1

Appendix C: Case study 2

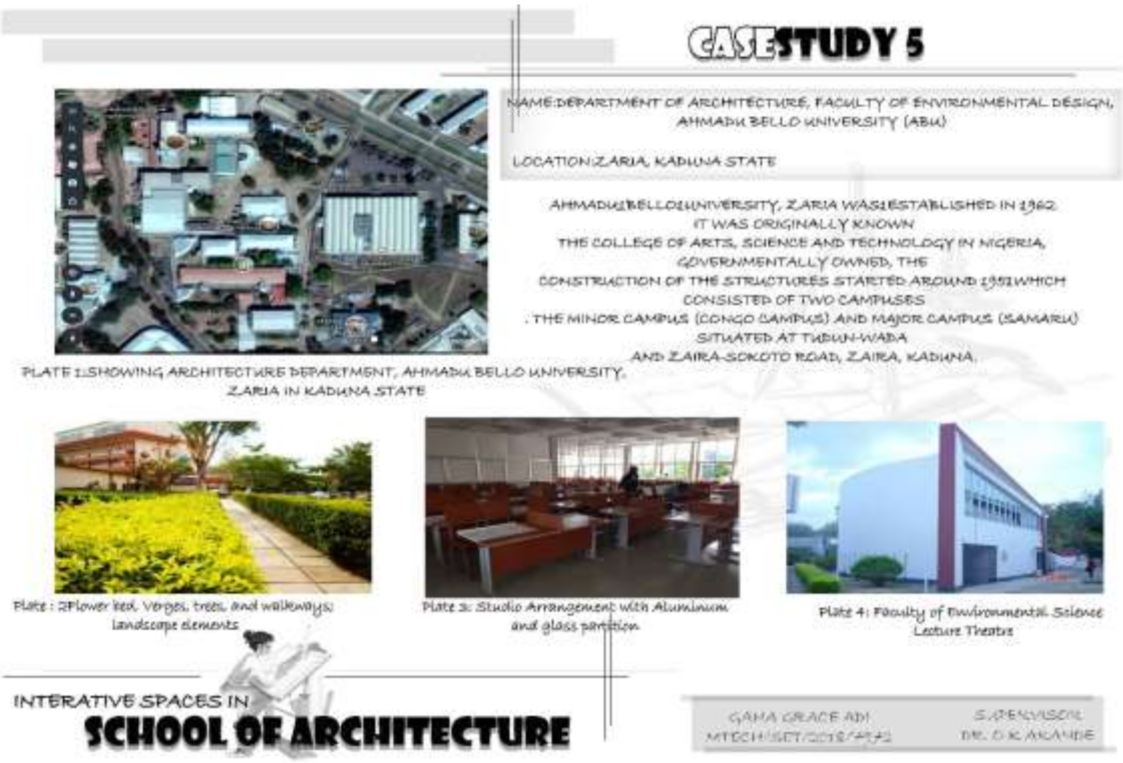


Appendix D: Case study 3

Appendix E: Case study 4

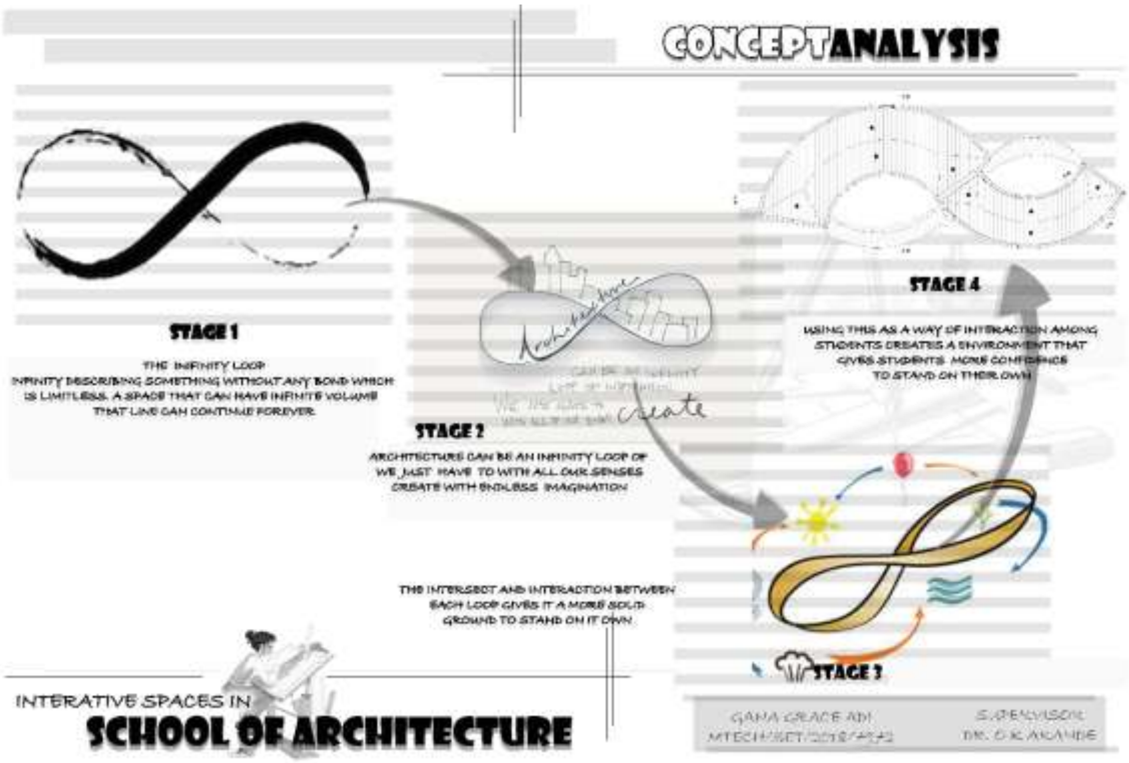


Appendix F: Case study 5



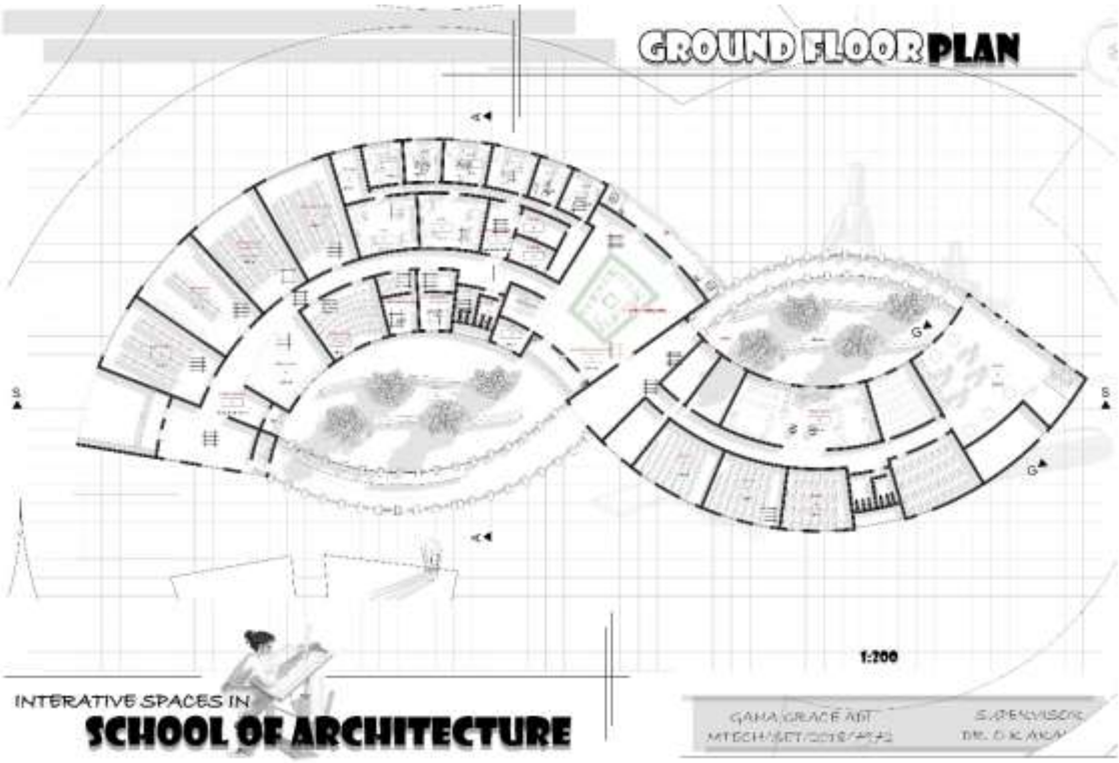
Appendix G: Case study 6

Appendix H: Concept analysis

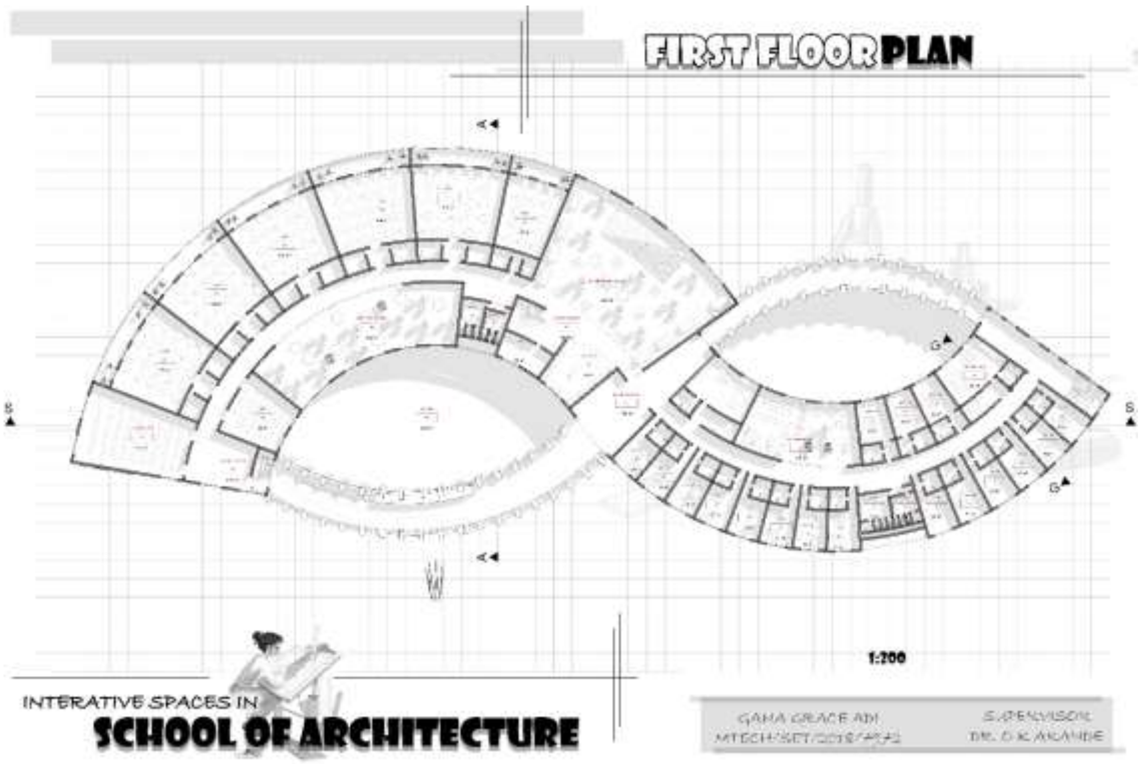


Appendix I: Proposed site plan

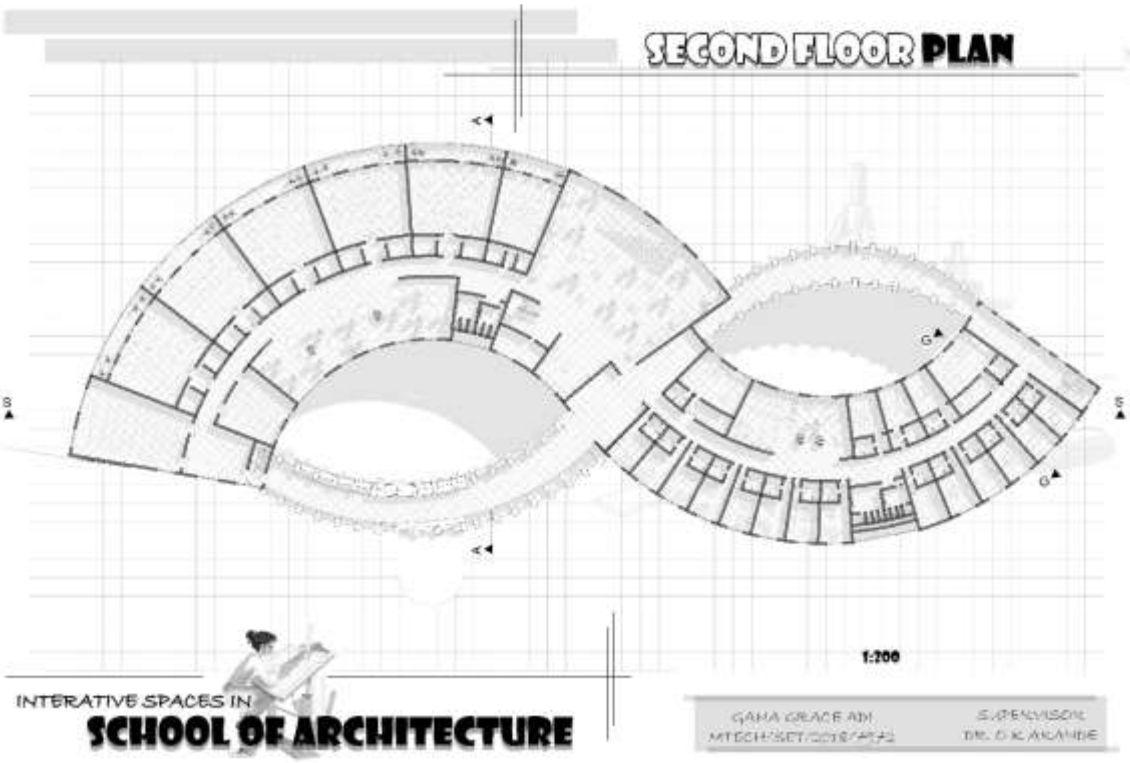
Appendix J: Proposed ground floor plan



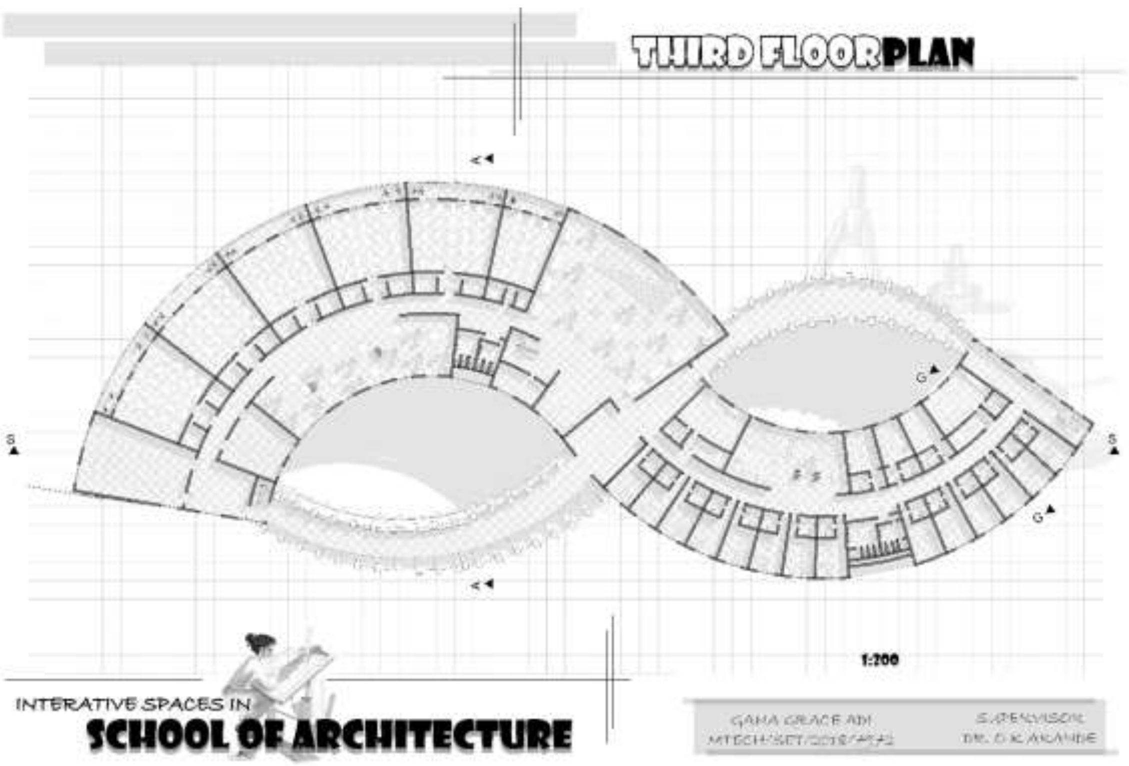
Appendix K: Proposed first floor plan



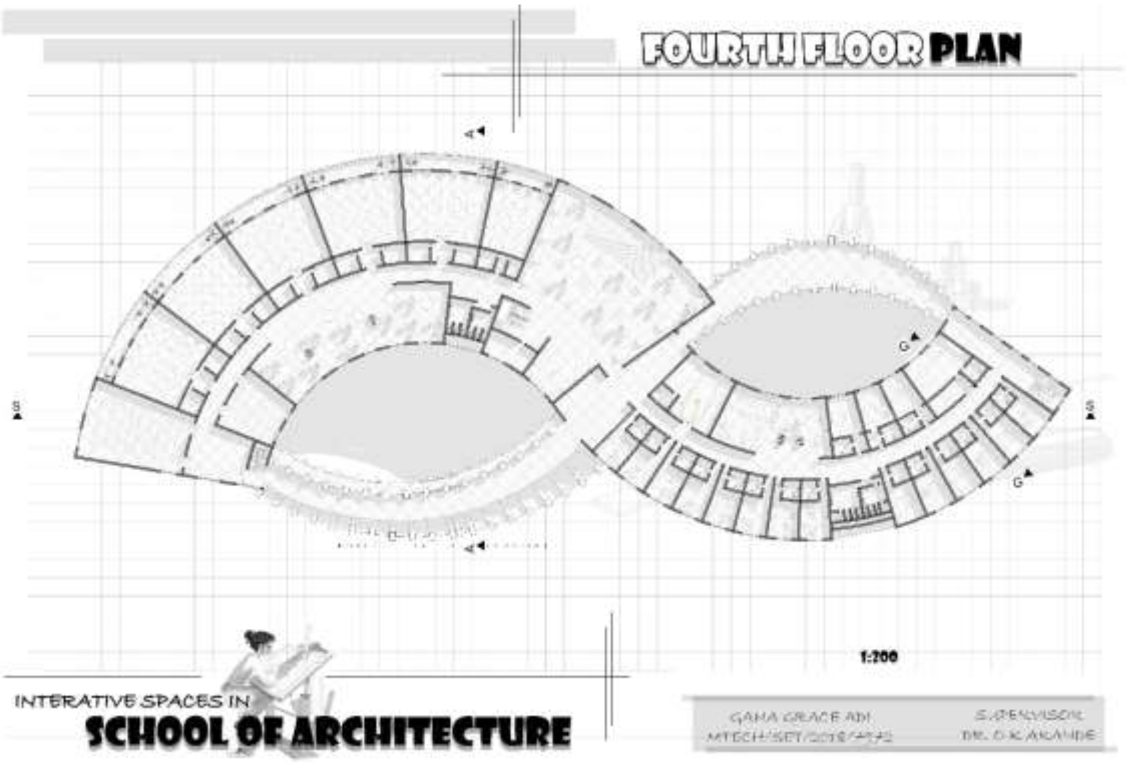
Appendix L: Second floor plan



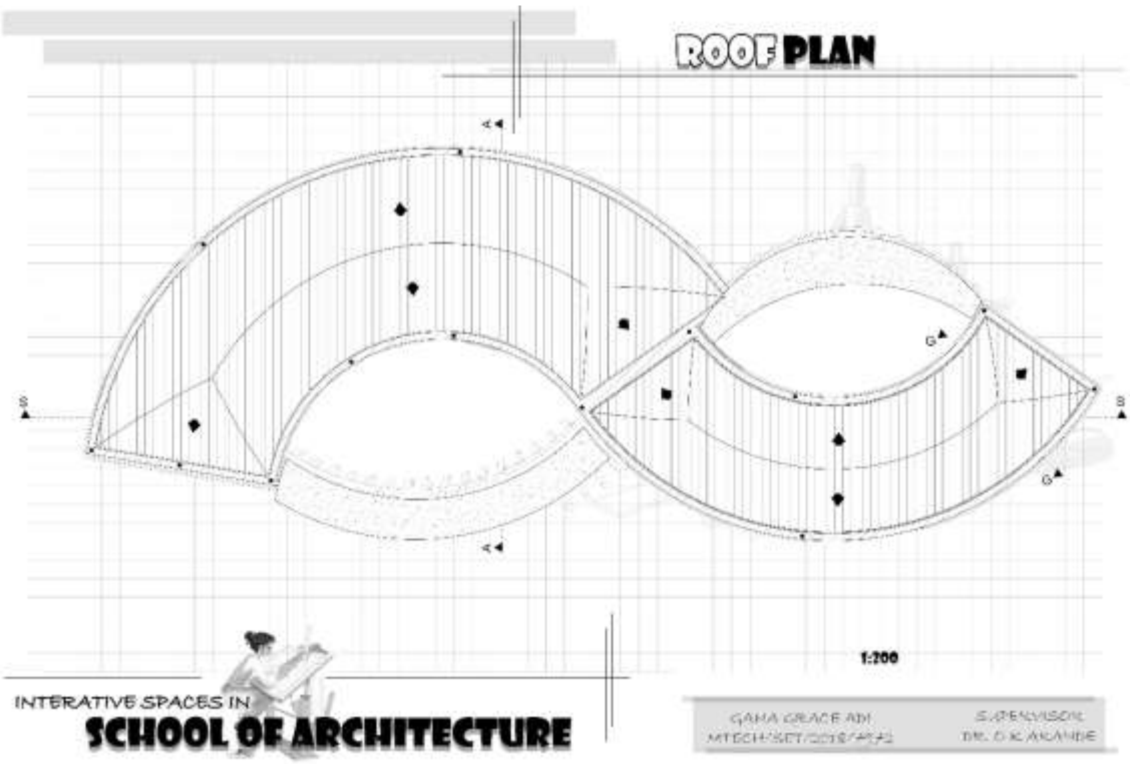
Appendix M: Proposed third floor plan



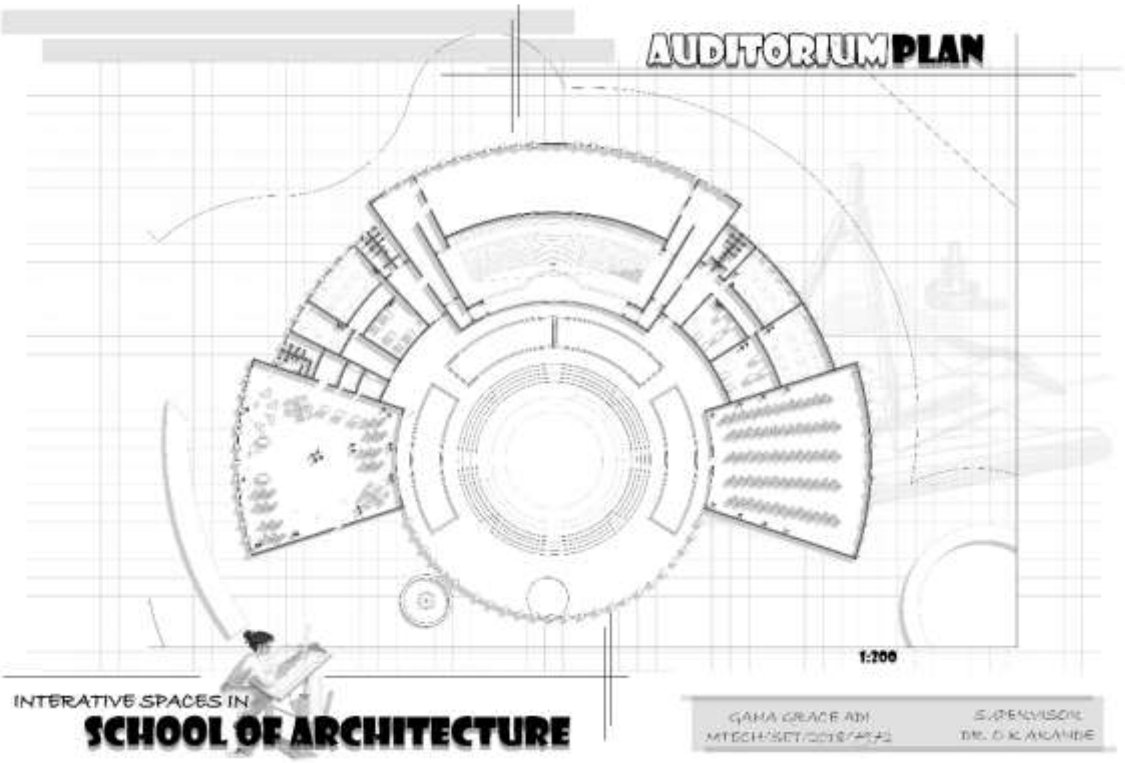
Appendix N: Proposed fourth floor plan



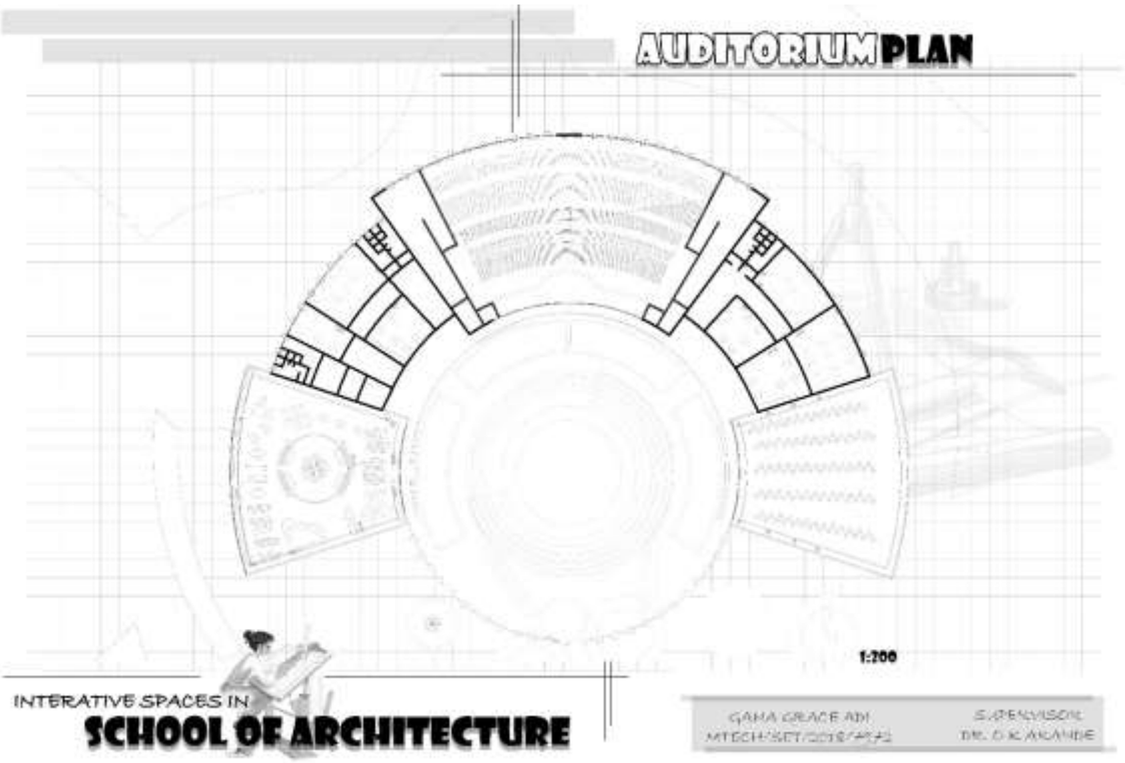
Appendix O: Proposed roof plan



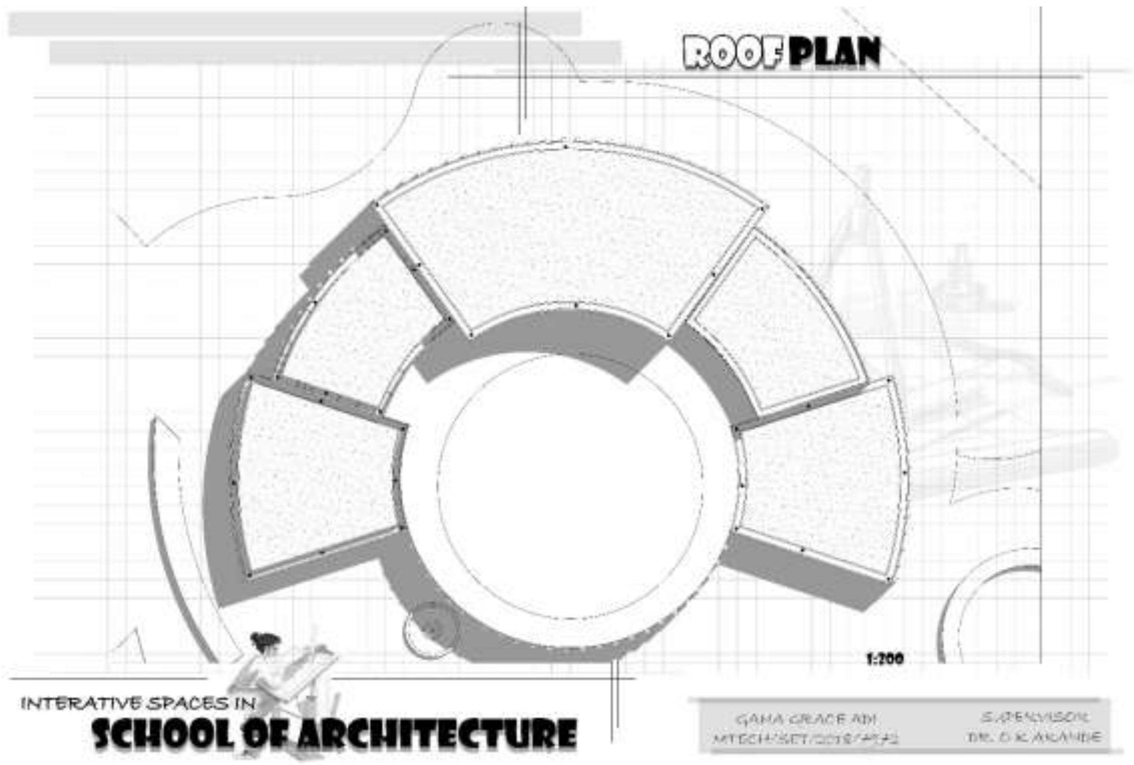
Appendix P: Proposed auditorium plan



Appendix Q: Proposed auditorium second floor plan



Appendix R: Proposed auditorium roof plan

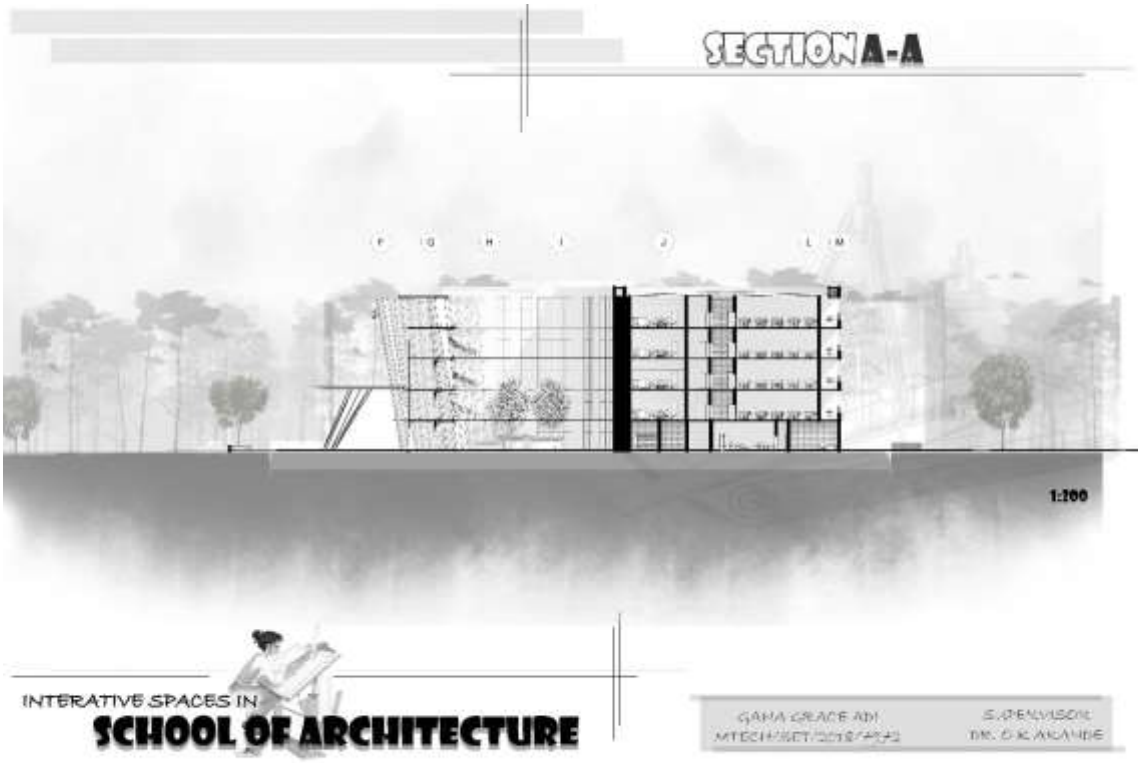


Appendix S: Proposed elevation

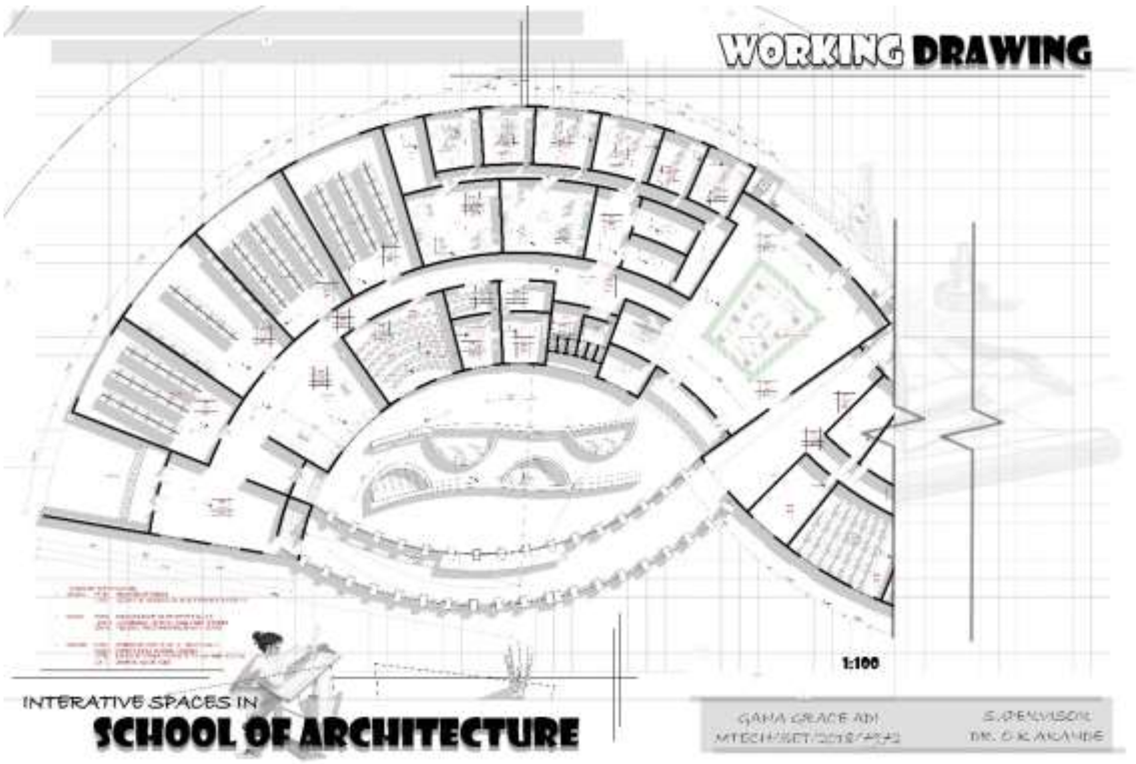
Appendix T: Proposed elevation

Appendix U: Proposed section s-s

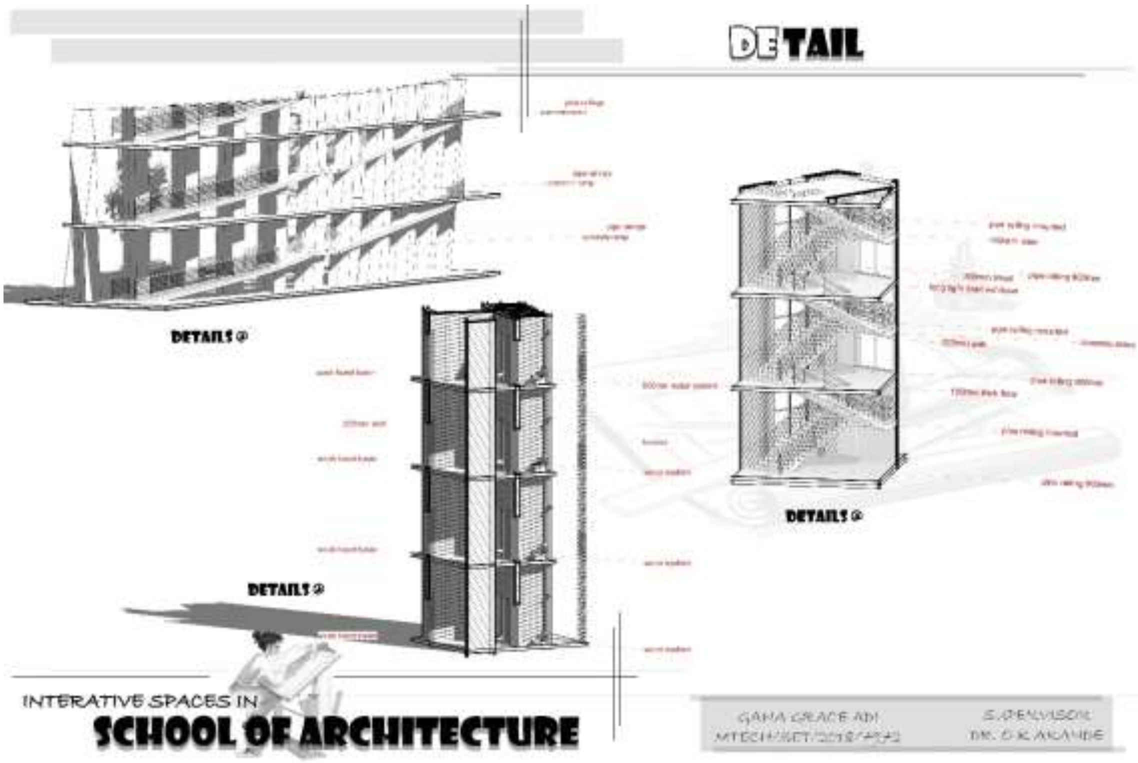
Appendix V: Proposed section a-a



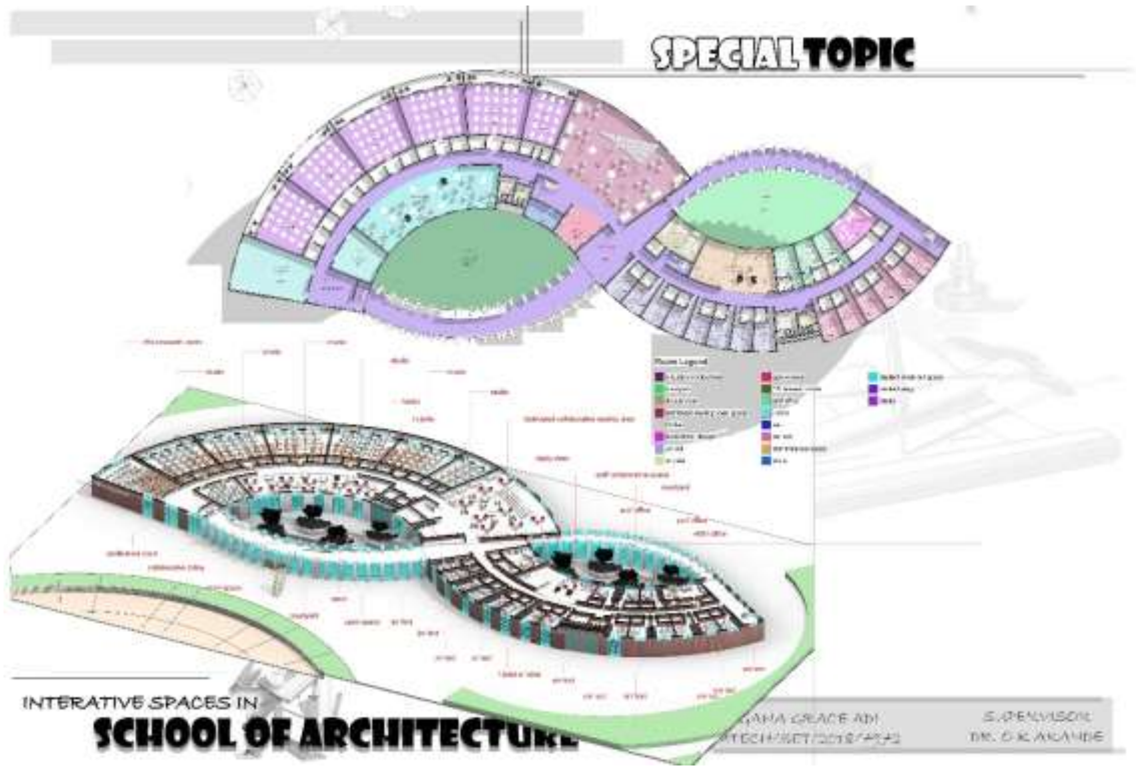
Appendix W: Working drawing plan



Appendix X: Detail



Appendix Y: Detail



Appendix Z: Perspective

Appendix Z: Perspective