

Effects of Curriculum on the Performance of Architecture Students in Building Structures in Southwestern Nigerian Public Universities

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ABSTRACT: *Students' performance in Building structures courses have been observed to be generally low with their corresponding inadequate application of Structures knowledge in Architectural designs. There are many factors that may be responsible for this in which the curriculum used to teach the students is inclusive. This issue has not been adequately investigated. This study therefore analysed the effects of curriculum on the performance of Architecture students in Building structures in Southwestern Nigerian public Universities, with a view to improving on the performance of the students. The study employed descriptive survey. Five public universities approved by the National Universities Commission and Architects Registration Council of Nigeria namely: FUTA, LAUTECH, OAU, UNILAG and OOU were purposively sampled. The curricula of these selected universities were collected and reviewed with past examination questions and results on Building structures courses. The study revealed that curricula of all selected schools were in line with NUC and ARCON standards. The questions given to students' during examinations were also standards and in line with the contents in the curricula in all selected universities. The study also revealed that the performance of the students in the courses was generally low across the selected universities. The study concluded that the curricula of schools selected are standard and good to train the students but should be re- evaluated to provide better alliance with the studio works (Architectural designs). The study recommended that topics not vital or relevant for students' development in the contents should be removed to reduce overloading of works on students. There is need to reduce calculations or reduce calculations given to students' during examinations to improve the performance of the students. Finally, periodical review and updating of curriculum are recommended to broaden the students' knowledge in order to train high quality, talented students in Architecture and to meet the present and future trend development globally.*

KEYWORDS: curriculum, performance, architecture students, building structures, public universities.

INTRODUCTION

The Building structures curriculum contains topics and contents to be used by teachers to teach the students in order to be able to apply knowledge of structures and solve structural problems in Architectural designs and constructions at large. It is used to train the students on

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the best ways to integrate structural elements such as: columns, slabs and beams into their designs so that the buildings will be safe, functional and add to the aesthetics of the building designs.

It also used to make the students become giants in the profession of Architecture and to be in high demand in the building industries. Furthermore, it gives them the ability to talk intelligently in the midst of structural Engineer, as a leader of building construction team on site and to be better Architects that are marketable globally in future. It provides background knowledge and skills to tackle the immediate structural problems during building constructions and be able to apply the knowledge when needs arise whether on site or firms.

Building structures curriculum is contained inside the handbook of Department of Architecture. It provides information on what to teach from the beginning of the program to the end and is a veritable source of information for both teachers and students. The contents therein must be followed strictly by teachers in order to achieve the aim of setting it out. It is the academic guide that highlights each of the topics to be taken by teachers in sequential order.

However, as important as Building structures courses are to the study of Architecture, Vassigh, (2005) and Oyadokun, (2021) noted that the curriculum contents and concepts are borrowed in a wholesale manner from engineering programs with little modification; this therefore, makes the Architecture students to be frustrated, uninterested and even intimidated. Thus, it is against this background that this study analysed the effects of curriculum on the performance of the Architecture students in Building structures in Southwestern Nigerian public Universities. This is with a view to improving on the performance of the students and better understanding of these courses.

LITERATURE REVIEW

Development of Building Structures in Architecture

Architecture is the art and science of designing and erecting buildings and other physical structures, ensemble of buildings, according to certain rules and proportions depending on the character and destination of the constructions. According to Wilkinson and Salama (2007), Architecture education is centered on the design studio in which the students learn to develop design proposals in tutorial conversation with their teachers.

Creativity in Architecture designs and structural solutions seem to have symbiotic relationships, both are inseparable because each has an effect on the function of the other (Robinson, 2001 and Oyadokun, 2021). During the era of the Beaux – Arts, students were told by their teachers to concentrate on building designs and ignore the structural aspect of the building and that Engineers were always in charge. This attitude was a primary factor to the decline and fall of the Beaux – Art system.

History revealed that school of Architecture was established in the United States of America (USA) around 1925 A.D. Since the beginning of that year, school had been re – thinking their programs to bring mathematics, mechanics and the science of structures into sharper focus

and into a clearer relationship with the design of space. New concepts of structures in Architecture were introduced and these brought freshness and creativity to Architecture and structures were raised from a superficial aspect of building to the grammar of Architecture. Salvadori (1947) became one of the most articulated spokesmen for this new kind of structures in Architecture, as a lecturer and a Professor in the school of Architecture at New York. Since then, building structures became an integral part of Architectural designs and the designs of these structures were primarily the responsibility of the Architects

Architect designed buildings and structures and it is the professional and ethical responsibilities of every practicing Architect to be competent in the matter concerning structural designs; therefore, the design of these structures is primarily the task of Architects.

The major reasons why students of Architecture Study Building structures according to Aniza *et al.*, (2010) include:

1. **To solve structural problem:** The students need to know how to solve structural problems, understand structural possibilities and limitations, understand how to determine the distribution of stresses and compute beam and column sizes for a simple class of buildings. They are to find it convenient to design and prepare construction documents for small buildings without utilising the services of an engineering consultant.
2. **To see building as structural systems:** The relationship between structural and material choices, their implications on Architectural designs proposal and to perceive Structure as contributing to Architectural designs are very important in building designs and constructions (Chistiane, 2013). Students of Architecture who want to acquire broad technical competence in Structure, materials applications and methods of construction, need better understanding of basic fundamentals of how Structure works as well as concepts and theories of Structure to do all these (Sineed, 2012).
3. **To learn various aspects of building structural elements, connections and to integrate Building structures into Architectural designs:** To ensure that students design building that are structurally efficient, structures that can withstand any stress or strain and to design structures that are stable, rigid, functional, durable and fulfill structural requirements. In addition, to be able to incorporate structural design learning with applied design skills. (Sandaker, Eggen and Cruvellier, 2011, Oyadokun, 2021).
4. **To talk intelligently to engineering consultants:** With the extent to which the engineering profession takes over the task of designing structures for buildings, the students should be able to discuss structural design issues with Engineers in as much as the Architects are the leaders of the design team. It will be very difficult to exercise this leadership role which involves the coordinating of all the designs and engineering works, specialists without possessing the basic knowledge about each area of building construction. It will also be difficult to successfully collaborate with Engineers on large scale projects without wide knowledge of basic principles of Building Structure. Students of Architecture need to know at a minimum, the essential vocabulary of Building Structure terms such as moment, shear, deflection, settlement in buildings and so on. Beyond that, insight into the behavior of structure is necessary unless they want to risk losing control over some basic decisions.

5. **They need a basic qualitative understanding of structural theory in order to design rational buildings:** Structure offers the Architecture students information about the beauty of construction, how the construction lives and resists the pressure of gravity. It fosters students structural design sensitivity to equip their abilities to analyse design boldly and express structural choice as part of Architectural designs.

Architecture students are expected to design structural elements from foundation to roof and analyse structural system and building elements. They are also expected to achieve certain competencies, define as a combination of knowledge, skills, attitudes that enabled them to work and be able to professionally approach each set of structural problems in a professional manner (Vjeran *et al.*, 2012, Oyadokun, 2021). Finally teaching of these courses is very important to prepare the students for the future challenges in building industries.

Approaches of teaching Building Structures: The teaching approach of Building structures is like a tree (Rosa, 2002, Oyadokun, 2021). The lectures, like the rigid trunk support all the structures, the flexible branches are the activities split in different directions in order to make teaching and learning effective and attractive and the roots are cultural and historical treatment because structures extend from the past to the present and into the future as a continuous process (Figure1).

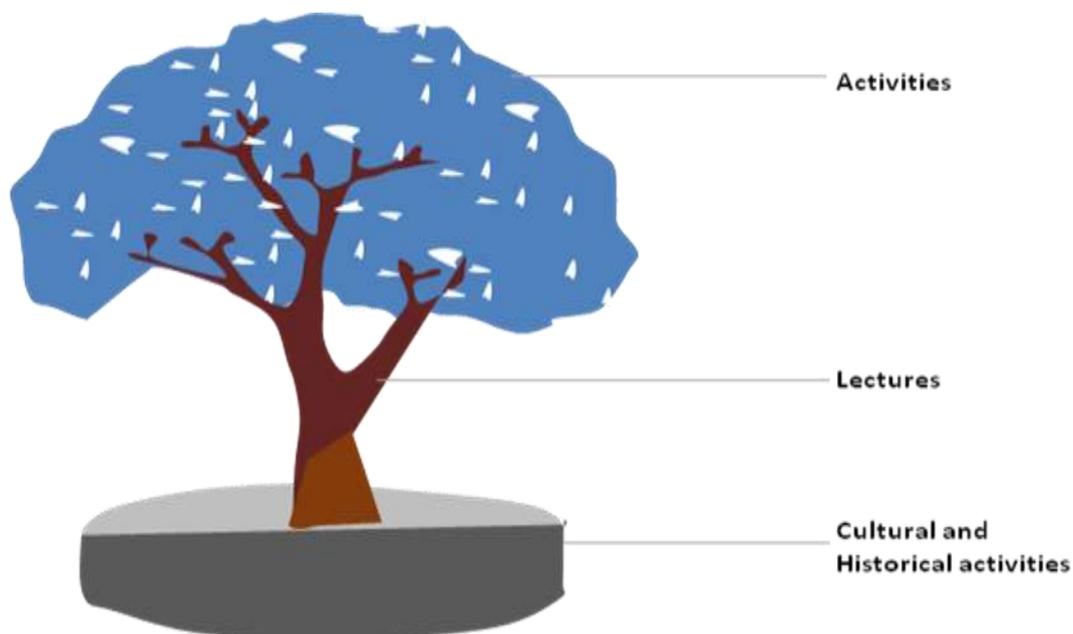


Figure 1: Approaches of Teaching Building Structures

Source: Authors Compilation, 2022

Building Structures Curriculum

This is the organised academic contents, knowledge and skills that students are expected to learn in the study of Building structures. It is a total guide learning and the combination of different training topics arranged in sequence to facilitate teaching and learning of the courses. Curriculum consists of what students will learn, how they will learn it, the role of the teacher and the framework in which teaching and learning will take place and also include

aims, objectives, teaching contents and strategies, assessment methods and other components of teaching and learning the courses in classroom.

The contents of courses in the study of Architecture in lower classes include the definitions, conceptualisation of basic principles of structural design, introduction to mechanics and design of Building structures. The objectives of structural designs, applications to architectural space, concurrent coplanar forces, triangles of forces and parallelogram of forces. Non-concurrent coplanar forces, link polygon and its applications, stress, strain, elasticity, Hooke's law, the modulus of elasticity, behavior of steel in tension, factor of safety and temperature stresses.

It also includes properties of sections, center of gravity, moment of inertia, parallel area principle, radius of gyration, theory of stress and analysis of trusses, joint method, method of sections and graphical method of trusses. Moments of forces and its measurement, conditions of equilibrium, resultant of forces and beam reactions. Others are bending moment and shear forces in beams, development of three moment equation and application, slopes and deflections, area moment method, frame structures, properties of influence lines for beams, computation of maximum moment, absolute maximum line shear and influence lines of trusses and settlement.

This is simply called at this level as Building structures or Architectural structure and theory of Building structures. It is more of calculations and very much related to Mathematics and Physics. Summarily, the curriculum for the lower classes in public universities in Nigeria can be represented in the Figure 2 below.

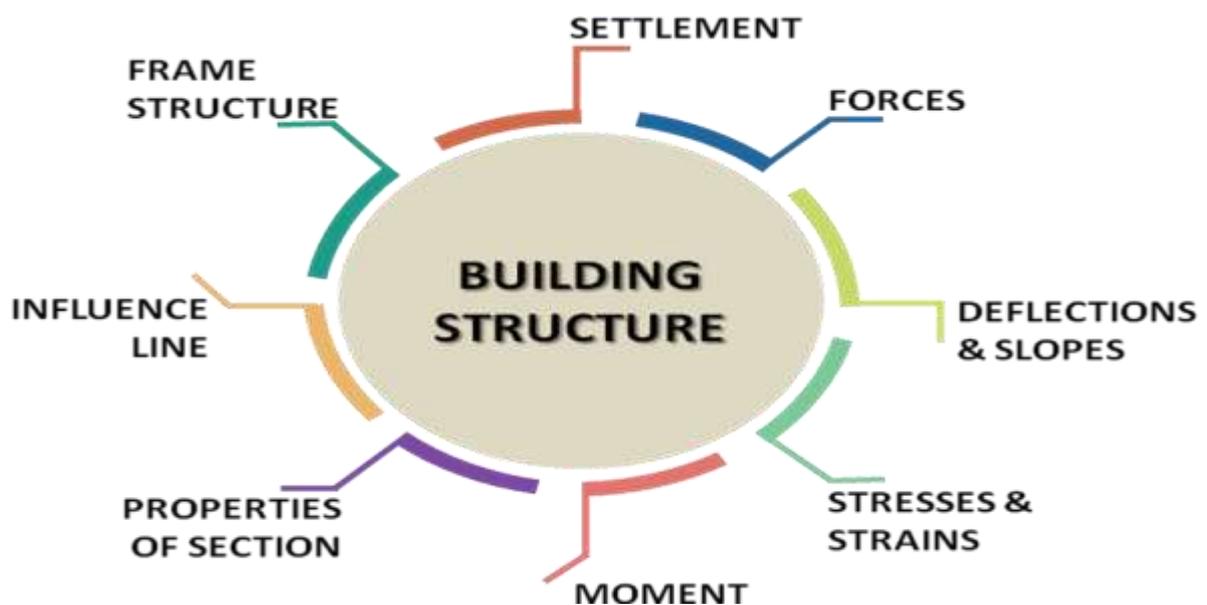


Figure 2: Building Structures curriculum at the lower level
Source: Authors Compilation, 2022.

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For the upper classes, the contents include: introduction to structural systems and forms system of loads, design of statistically determinate structures, trusses - stress and design, shape deflection equation, discussion on strength of material, loads on structures (estimation of beam, slab and roof loads). Modular ratio of design of reinforced concrete structure according to CP 110, CP 114 and BS 8110, singly reinforced concrete beams, flanged beams, doubly reinforced beams, columns, slabs, shear reinforcement in beams and curtailment of reinforcements.

Others include torsion in reinforcement, design of reinforced concrete columns, one way slabs, staircases, two-way spanning slabs and simple reinforced cement concrete foundation and finally, building design project. At these levels, it is called Building structural design.

METHODOLOGY OF THE STUDY

The study focused on the curriculum used to teach Architecture students in Building structures in public universities in Southwestern Nigeria. Five public universities in Southwestern Nigeria were sampled namely: Federal University of Technology, Akure (FUTA); Obafemi Awolowo University (OAU), Ile – Ife, Osun State; University of Lagos (UNILAG), Lagos; Olabisi Onabanjo University (OOU), Ago – Iwoye, Ogun State and Ladoké Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State.

These five universities were sampled out of twenty approved public universities schools of Architecture representing 20% of total approved schools of Architecture in Nigeria and 100% of total approved in Southwestern Nigeria by National Universities Commission (NUC) and Architects Registration Council of Nigeria (ARCON).

In this study, curricula or department handbooks of all selected universities were collected and the contents therein were assessed based on NUC and ARCON standards and whether in line or in isolation with Architectural designs contents. The study is not after the whole contents of the curricula but the Building structures courses aspect. The contents of the courses were observed in relation to Architectural designs contents. Past questions and results collected from selected Departments of Architecture on structures courses were examined if in line with the curricula contents or not. The performance of the students in the courses was assessed base on the results collected from selected and one supplied by the students' universities.

The students were requested to supply their grades on Building structures courses from second year to the previous semester of their study because teaching and learning of these courses started from second year in all the selected universities.

FINDINGS AND DISCUSSIONS

A critique of Building structures curricula of the selected universities revealed that:

1. It meets both local and international standards.
2. It meets NUC and ARCON standards.
3. All are approved by the senate of each university selected.

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4. All the selected schools started the courses at the early stage of students training. All started Building structures courses at 200 levels till final year class which is highly commendable.
5. The revisions of the curricula are done periodically by all selected schools and approved same by the senate.
6. The contents of the curricula of selected schools are in line with Architectural designs contents except that the teaching of the topics did not go together. For instance, a design assignment is giving to 200 level students in Architectural designs where students will apply column or beam but they have not done anything of such in Building structures so there is possibility of not applying these structural elements properly.
7. The study collected past examination questions and results from selected schools and it was revealed that the questions were in line with the curricula contents. Although, the questions were standard but the calculations therein were too many for Architecture students especially in LAUTECH. FUTA was better in this area by reducing the amount of calculations given to students during examinations.
8. The study revealed that in some schools of Architecture, students were receiving lectures on Building structures with Engineering students in the Department of Engineering such schools include OOU, OAU and UNILAG.
9. The study also revealed that majority of students did not have a copy of the curriculum or handbook in all the selected universities. This is not the best because having a copy will allow the students to prepare ahead of the class and give them the opportunity to know if the contents therein are completed by the teachers or not within the stipulated semester.
10. With all these findings stated above, the performance of Architecture students in Building structures generally was very low from the results reviewed.
It was not easy to really analyse the results because the grades supplied by the students were different from the grades collected from the various Departments, Secondly, not all the Departments released the results despite the fact that only matriculation numbers, semester and grades were requested and names should be excluded. On the part of the students too, not all of them supplied their grades and the one supplied not in line with results collected from departments.

Effects of Curriculum on Students Performance

Architecture is complex combining the arts, sciences of design, construction and services together. With this complexity, the study of Architecture encompasses many courses among which are Building structures courses (Oyadokun, 2021). Since the contents of Building structures emanated from Civil Engineering and brought to Architecture with little or no amendment, many students of Architecture find the courses difficult due to its abstraction and wrong perception, look at the contents as abstract because it contains calculations, formulas and structural requirements. These led to decline in students' interest and performance in the courses.

Many Architecture students had little knowledge background and disposition to master the mathematics skills required or needed in Building structures contents, as a result, they

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become uninterested and frustrated. Many failed to master the basic applied structural designs contents because of little knowledge of Statistics and Applied Physics that involved

They considered the course to be difficult, complicated and sometimes, not relevant thereby finding the courses difficult to progress from abstract principles to applications. These led to the loss of enthusiasm accompanying the learning of the courses and without enthusiasm, true knowledge is impossible.

Instructions in the contents were quantitative and to communicate basic concepts, require high – level mathematics nomenclature, these were problematic in the case of Architecture students. The curriculum failed to focus on Architecture students and address structural issues as an innovative and creative activity in a design project. Instead of courses to be a set of interesting challenges, it becomes a burden that the students must bear in order to get functional project. At times, students understood many ideas but confused in the applications because fundamental structural ideas were not properly understood which affected their creativity in Architectural designs.

Many of the students lack confidence to cope with the structural problems in Architectural designs and failed to link the Building structures knowledge and Architectural designs together because the two courses were not simultaneously learned together. Most of the students excluded issues of structures within the Architectural designs context. The central importance of structures and structural behavior as design elements were overlooked due to the parallel teaching and learning of the courses and all these generally affected the performance of the students in the courses.

Architecture students were aware that structural systems affect the aesthetics part of designs but lack of basic qualitative understanding of Building structures affected their designs. They struggled with the engineering – based approach for structures instructions which increasingly proved ineffective in the classroom. Most of the existing teaching materials were either geared towards the descriptive and qualitative methods which were insufficient for the architectural needs or remain highly qualitative and difficult to comprehend for the majority of Architecture students.

The course contents were good but the contents to be covered were too many within the stipulated periods coupled with various obstacles, such as strikes which reduced the workable periods in a year. Poor infrastructure facilities, unconducive learning environments and overpopulation of students contributed immensely to the low performance of students in the courses.

CONCLUSION

The curricula of all selected schools were in line with NUC and ARCON standards. The contents therein were too many, heavily loaded and not aimed or focused on Architecture students' needs. The questions given to students' during examinations were standards and also in line with the contents except that some schools need to reduce calculations given to

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students' during examinations. Summarily, the contents of the curriculum need to be reviewed to meet the needs of Architecture students for better performance.

The students need to understand the basic Building structures theory correctly which the curriculum must address so as to be able to apply the knowledge when necessary especially in designs and in solving structural problems in building construction. The world is developing at an increasingly rapid rate especially in terms of building construction and structural technology therefore; Architecture students should not be left out. Therefore, the need to review and re-evaluate the curriculum in order to improve on the performance of students in the courses.

Teaching is a challenge, learning is a challenge, combining both effectively is also a challenge (Damondharan *et al*, 2007, Oyadokun, 2021). Building structures courses are also challenging therefore, the curriculum must be designed to face the challenges. The improvement in the academic performance of the students in these courses is imperative because the courses play an active push to develop greater and future Architects. The courses should offer the students beauty of construction and not a burden of frustration. It should be a knowledge needed to excel academically and professionally in future.

Students of today will tomorrow graduate and practice in an ever more technologically complex environment and it is better they equipped themselves with the skills to effectively integrate Building structures knowledge into their designs which the curriculum must provide and address. Therefore, all stakeholders in Building structures courses should rise up to their responsibilities in order to improve and achieve better performance in the courses.

Recommendations

Based on findings and discussion of this study, the following recommendations are made in order to obtain better results in Building structures. Curriculum of Building structures should be re- evaluated to provide better alliance with the studio works and topics not vital for students should be removed to reduce overloading of works for the students and teachers.

There is need to reduce calculations in the curriculum or reduce calculations given to students' during examinations. Periodical review and updating of curriculum are recommended to broaden the students' knowledge in order to train high quality, talented students and to meet the present and future trend development. The department as a producer of future Architects have to develop curriculum to suit the growth of the students, the profession and building industries in Nigeria.

The curriculum should give room to practical or life projects problems for students to solve and proffer solutions to various Building structures problems especially on the analysis of formation and deformation of various structures. Problems commonly find in building should be used as examples with essential structural principles relate to Architectural designs.

Full uses of available academic materials as in the curriculum in order to improve teaching efficiency and to prepare the students well to meet fast developing building industry when

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they graduate. Building structures should be taught in a way that it becomes a source of inspiration to students and not a burden.

Good, sound knowledge and understanding of Mathematics and Physics subjects are great privilege to do well in the courses. This is very important for the students to flow very well with the courses which involve calculations. The parallel teaching and learning of Building structures and Architectural designs should be addressed by the curriculum in order to close or reduce the gap between the two.

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