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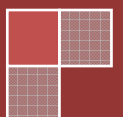
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## **Learning Difficulties in the Study of Structural Analysis in Tertiary Institutions**

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### **ABSTRACT**

In Education lies the bedrock of the future. Sustainability in education can be achieved through the transfer of knowledge and technology to the next generation and one of the vital ways of achieving this is through teaching in the classroom. Without proper dissemination of these knowledge and skills, there is a disconnection and the students are left without the proper foundation they should have in the first place. Several studies have shown that student experience difficulties in mathematical based courses. This study sought to identify the challenges students of structural analysis face and the factors responsible for these challenges. A survey of three institutions was carried out and data was obtained through the distribution of well-structured questionnaires to students that offered structural analysis from University of Lagos, Covenant University and Yaba College of Technology. Data obtained from this survey were analyzed using Statistical Package for the Social sciences. The results were presented in form of frequency tables using relative index importance index to get a clearer view of the most significant factors. Results from the factors affecting students learning difficulty of the course showed that, poor background (in physics & mathematics) from secondary school made the course difficult for them, their lecturers mode of delivery made the course uninteresting, and also the class sizes were also a problem. To curb this situation, it was recommended among other things, that lecturers should try as much as possible to deliver the course in creative ways that would entice the interest of the students. Secondary and primary school education should be improved, by investing in continuous workshops, seminars and training of teachers to improve their productivity, and lastly, public universities should admit the number of students they have enough resources to cater for, so as to reduce the class sizes.

**Keywords:** Education, mathematical based, learning difficulties.

### **INTRODUCTION**

There are several factors that have been identified as contributors to students learning difficulties in which includes, peer pressure, parental and home background, teacher's attributes, school environment and socio-economic status of the student (Riliwani, 2014).

However, it attention has been paid to the attributes of teachers as a critical factor influencing the academic performance of students. It is believed that the students success is hinged on the effectiveness and efficiency of the

teachers (Sabitu and Nuradeen, 2010). Therefore, how knowledgeable a teacher is and how well the teacher is able to adopt the apt strategies will play a significant role in the teaching process (Zarei and Sharifabad, 2012).

Parental and home background is another significant factor, because according to a saying charity begins at home, so no matter how effective or ineffective a teacher might be, the background given to a child (student) would always serve as a pulling or pushing factor.

Furthermore, the school environment is also another critical factor affecting learning especially in the developing nations of the world, due to poor facilities and lack of appropriate teaching aids. For examples, there are some public schools in Nigeria that cannot afford enough chairs for their students, hence some of them have to stand for hours stretch receiving lectures, some institutions do not even have the right textbooks and resources to stimulate the interest of the student, also other environmental factors like improper ventilation, inadequate lightning and a host of them contributes to the difficulty in learning. This singular factor is what distinguishes the performance of students in Africa to other developed nations of the world (Riliwani, 2014)..

### **Research problem**

Structural analysis being a combination of two core science subjects which are mathematics and physics have imposed a lot of difficulties on student (Johnson and May 2008), this proposition has been backed up by several researches like the engineering council of British (2000), which explains that Academics may encounter challenges of a weak foundation they may have had in mathematics and physics prior to their admission into a university. Johnson and May (2008) further expressed that one of the challenges encountered is the fact that an increasing number of students join a discipline without having an appropriate understanding of mathematics.

It has also been observed that architectural students have the highest number of failure in structural analysis. According to Herr (2013) the main challenge of structural education in architecture are the students trying to incorporate structural design into their applied design skills. This research sets out to empirically answer the bogging question of how students really respond to structural analysis and the difficulties encountered.

### **Significance of this Study**

Every sector in the world is experiencing tremendous changes, including the construction industry. Nowadays constructions which were previously deemed impossible are being made possible due to a better understanding of structural analysis and design. Since a good understanding of structural analysis is one of the brains, behind the great innovation in the construction industry, then it is important that students have a good knowledge of the course, so that they can become relevant in the construction industry, hereby having a successful career. This study would trigger this, by helping the student to identify what they feel about the course, the challenges encountered, and then appropriated solutions will be provided.

Furthermore, this study is of inestimable value to the respective institutions, as it will help them identify what student think about the course, the challenges the students are encountering, hereby creating a platform for them to know how to increase productivity hence improve the performances of the students at the same time.

Lastly, this research work will help the construction industry and society at large to boast of well-rounded graduates, who can withstand the ever-increasing changes taking place in the construction industry, through the adequate knowledge and application of structural analysis

### **Research Questions**

1. What are the factors responsible for difficulties student face in learning structures and determine the severity ranking?
2. What are the agreement ranking of students' responses and factors?

### **Research Objectives**

1. To identify the factors responsible for difficulties students, face in learning structures and determine the severity ranking.

2. To determine the agreement ranking of the learning difficulties students come across in the study of structural analysis, among Architecture, building, civil and quantity surveying programs.

## LITERATURE REVIEW

Structural analysis is an ancient craft and has been known to humankind since the onset of civilization. The earliest structures have included the pyramids built by Egyptians around 2000 B.C, Parthenon at Athens (2500 years old), these structures have gradually progressed to the Taj Mahal (350 years old), and Eiffel tower (120 years old) thereby testifying to the skill and the advancement human achievement. That these monuments are still standing speak to the great accomplishment of the craftsmen in the construction of large structures which invariably involve analysis and design.

Amazingly, these monuments were constructed not only without any computation but also without any theoretical concepts as we know it today (Pedron, 2006), but these masters used the knowledge of rules of proportion developed through experience and practical training. These rules of proportion were what developed over the years to form the fundamentals of mathematics and physics, so to say that these great feats achieved by these outstanding craftsmen were a proper understanding of mathematics and physics would not be an understatement. Having identified evidences from researchers that a faulty foundation in mathematics and physics, amongst others are the problems facing students' structural analysis skill, then it is best to deduce the causative factors.

Learning is difficult to define and there is scarcely one universally acceptable definition that has been acknowledged by researchers, theorists and practitioners (Shuell, 1986). In the same manner, students also vary, and hence there are differences in the difficulties encountered by them. In a research conducted by Felder and Brent, (2005) they noted that different students can be motivated by different things and each student possesses a unique attitude towards learning. They further observed that no two students are exactly the same as they have different backgrounds and upbringing and characteristics that make their individual approaches to studying unique.

The diversities of students' approach to learning and orientation to studying were examined by (Irfan and Shabana, 2012) they identified three approaches to learning, the surface approach, the deep approach and the strategic approach. Students who adopt a surface approach to learning usually dwell on facts but do not delve deep to understand reasons behind the facts such as origins and limitations. They are motivated to study solely to avoid failure thereby making their motivation extrinsic. The students who adopt a deep approach to learning go beyond memorizing the facts but rather dwell on understanding the intricacies of the material they are studying. Their desire to learn more is sparked by intellectual curiosity. This motivation is indeed intrinsic. The third group which consists of students that adopt the strategic approach to learning are a category that are efficient and well organized in their efforts, they know where they are in their studying and know the effort they need to put in to achieve the success they desire and attain their ambition.

Very obvious that if the difficulties encountered by students have different diversities, also parameters in judging the students' performances should also vary, the analyses of the students' performance would then help to get to the root of the difficulties student encountered.

Hansen, (2000) outlined two factors that affect students' academic performance. They are the internal factors which include class size, learning facilities, environment of the class, innate ability of the student, motivation, complexity of the course material, teachers' role in the classroom, technology used in the class and the exam system; and external factors, which constitute social economic factors, extracurricular activities, family problems. Further research conducted by Bangbade, (2004) shows that students performance may also depend on other factors such as gender and age differences.

School environment when analysed has a great role to play in difficulties students' encounter, the more conducive the environment, the lesser the difficulties students' encounter. Social environment could mean a conducive learning environment, availability of good teaching aids (computers, teachers, laboratories, libraries etc.) For example, temperatures above 80 degrees tend to produce harmful physiological effects that decrease work efficiency and output.

It was noted further, that poor ventilation interferes with students' ability to understand. Also decaying environmental conditions such as poor lighting, inadequate ventilation, inoperative heating and cooling systems etc. can affect the learning of students i.e. in any learning environment, comfort is vital to improving student's assimilation rates. Overcrowded institutions are a serious problem in many school systems. Crowded classroom

conditions not only make it difficult for students to concentrate on their lessons, but inevitably limit the amount of time teachers can spend on innovative teaching methods.

In a study on class size, (Ronald et al, 2001) observed that changing how students learn can be achieved by simply changing class size because it is believed that class size is pivotal to achieving a good learning experience. While the class size is important, there are other factors on which learning is dependent. These factors include the background of the student and the influence of the broader community.

Interest in the job fuels passion for the job and a lack of interest in a job will lead to the inability to be good at it. There is a relationship that exist between a teacher's interest in the job, knowledge of the the subject, ability to communicate effectively and the overall academic performance of the student (Riliwani, 2014). A research by (Wenglinsky, 2000) on how a teacher's experience affects a student's ability to learn showed that a positive relationship exists between the teacher's years of experience and effectiveness. This implies that an inexperienced teacher is less effective in passing knowledge across to students. Other researchers (Starr, 2002), (Schacter and Thum, 2004), Rivkin, Hanushek, and Kain. 2000). Also studied the relationship between students' academic performance and the teachers' skills and attribute and it was discovered that there exist a strong relationship between the three variables.

According to a research by Umar *et al.*, (2010), it was explained that cults, which are associations with organized structures have a way of looking out for the interest of their members can influence and impact positively or negatively the performance of a student who is its member. These cults entice prospective members with the perceived benefits they offer such as protection, popularity and even sometimes assistance in school fees payment. The problem usually arises when the student member does not strike a balance between the demands of his studies and the demands of the cult association because most times the promised benefit never get to the student members.

It was argued that students make educational decisions by calculating their costs, anticipated benefits, probability of success, and the attractiveness of alternative options (Breen and Goldthorpe, 1997). Because these aspects vary among socio economic status (SES) groups, the degree to which students of different socio-economic backgrounds view schooling as desirable varies as well, it was also maintained that student begin to understand at an early age about how the society is structured. They begin to become to be aware that the society rewards people or individuals of different SES differently, therefore these students of low SES families realize that they are likely to be exempted or excluded from desirable job and hence, they go through a process of disillusionment. As a result, these students expect a wide gap with age due to students' being less motivated and placing efforts into their academic activities.

## **METHODOLOGY**

### **Area of study**

The study was conducted in Covenant University, Ota and two Lagos universities, the first one which is University of Lagos, Akoka and Yaba School of technology. The reason for choosing these other two institutions in Lagos state universities was because one represented a federal government institution while the other represented a state institution.

### **Population of study**

The targeted population for this study were students in 100-500 level studying any construction related courses basically architecture, building technology, Civil Engineering and Quantity surveying in covenant university, university of Lagos, and Yaba College of technology.

### **Data collection instrument**

Data used for this research were obtained from using multiple choice structure questionnaires to answer the question of student's response to calculation based courses. The questionnaire was adopted from a rigorous review of the literatures used. The questions were in a 5-point Likert format ranging from (SD= strongly Disagree, D=Disagree, U= Unsure, A=Agree, SA=Strongly Agree) which were used to measure the respondent response and factors affecting the learning of structural analysis as a case study. the questionnaire consists of two sections.

### **Sample size and administration of the research instrument**

A sample consists of selected elements, subjects or observations from a given population. It is a finite part of statistical population of which properties are studied to gain information about the whole population. For the purpose of this research work, a survey was conducted and it was realized that all together in the three institutions

there were more than a thousand students in the courses. Therefore, for this research work 195 questionnaires were distributed and 164 were retrieved which is 84.10%.

### **Research instrument for data analysis using Statistical package for social sciences (SPSS)**

Statistical package for social science (SPSS) was used to process and analyse the information obtained from the questionnaire survey. Mean and agreement ranking were used to achieve objectives 2 and 3 as stated in chapter one by the use of SPSS. The result gotten would be made in a pictorial form for example pie chart and also frequency table for clarity of the analysis of the obtained data.

### **Descriptive tools**

These are the tools used for describing the entire population or samples. This helps to show the relationships among the variables and other significant features. These tools are very useful in conveying quick impression of any clustering variations and possible trends in the value of variation. An example of such tools collected in the analysis of this data includes charts, frequency, percentages and measure of central tendency.

## **ANALYSIS AND DISCUSSION OF RESULT**

### **Demographic distribution of respondents**

In the first section, the personal data of structural analysis students were acquired through the self-administered questionnaires. Information such as gender, institution, levels and departments were analysed. The following were discovered

Covenant University had 77 respondents; university of Lagos (UNILAG) had 47 respondents while Yaba School of technology had 40 respondents. The following data shows that Covenant University had the highest respondent for the study, owing to the fact that it was the researcher's institution.

In order to get accurate information, and views from different sides, the entire department offering structural analysis were included in the research work. From the figure above building technology had 36.27% of the respondents, followed by civil engineering with 33.33%, also Architecture had 25.49% and lastly quantity surveying with 4.90% of the total respondent. The department of building technology has the highest number of respondents for this research work.

It was also observed that 100 level respondents had the lowest percentage at 4.90%, followed by 200 level respondents with 7.84%, 300 level respondents with 17.65%, 400 level respondents at 24.51%, then 500 level respondents which carries the largest percentage at 45.10%.

The reason 500 level respondents had the largest percentage was because the researcher assumed that, the respondents had spent quite a considerable time doing structural analysis, therefore with their experience they could provide accurate information.

The gender distribution of the respondents was as follows; it indicated that the male gender has 65.69% while the females have 34.31%. From this distribution, the male gender had a greater population than the females, the reason for this is not far-fetched as the construction industry is male dominated.

### **Factors responsible for learning difficulties amongst covenant university respondents, University of Lagos and Yaba College of Technology.**

The factors were divided into positive and negative factors with the positive affecting their success and understanding of the course, structural analysis. The negative factors on the other hand related directly to the reasons for the difficulties experienced in the study of the course. The factors were ranked according to the responses obtained from each university. And the results are displayed in tables 1 and 2 below.

**Table 1 Negative factors causing learning difficulties amongst covenant university, University of Lagos and Yaba College of Technology respondents.**

FACTORS	Covenant university	Rank	UNIVERSITY OF LAGOS	Rank	YABA COLLEGE OF TECHNOLOGY	Rank	Remark
The prior background I had makes it difficult for me to understand structural analysis	3.77	1 <sup>st</sup>	3.59	2 <sup>nd</sup>	2.33	7 <sup>th</sup>	Negative factor
The Lecturers' mode of delivery makes the course uninteresting	3.56	2 <sup>nd</sup>	3.38	3 <sup>rd</sup>	2.5	5 <sup>th</sup>	Negative factor
The class is too large and I am unable to follow	1.85	7 <sup>th</sup>	3.62	1 <sup>st</sup>	4.04	1 <sup>st</sup>	Negative factor
I have a solid mathematical background but struggle with the basics of structural analysis	3.4	4 <sup>th</sup>	3.28	4 <sup>th</sup>	3.58	3 <sup>rd</sup>	Negative factor
I have a poor mathematical background and it makes it difficult for me to understand the subject	3.25	6 <sup>th</sup>	2.97	7 <sup>th</sup>	3.63	2 <sup>nd</sup>	Negative factor
My physics background from my secondary school education is poor and therefore an obstacle to understanding structural analysis	3.27	5 <sup>th</sup>	3.28	4 <sup>th</sup>	3.28	4 <sup>th</sup>	Negative factor
The lecturer is not able to communicate the subject area clearly and I find it difficult to keep up	3.5	3 <sup>rd</sup>	3.28	4 <sup>th</sup>	2.38	6 <sup>th</sup>	Negative factor

From the table 1, it can be observed that the major problem encountered by the public institution is the class size while for Covenant university that represents a private institution, the major problem is the prior background of the student as the class sizes are regulated. Closely related in agreement is the ability of the student to relate structural analysis with his/her basic knowledge of mathematics and physic. Despite the solid mathematical background, they still struggle with understanding basic structural analysis. This problem of not being able to understand the course could be closely tied to the mode of delivery by the lecturers and the inability of the lecturers to communicate the subject area. Poor mode of delivery will fail to spark interest of students and that will translate to their poor performance in the course.



**Table 2 Positive factors causing learning difficulties amongst covenant university, University of Lagos and Yaba College of Technology respondents.**

<b>FACTORS</b>	<b>Covenant university</b>	<b>Rank</b>	<b>UNIVERSITY OF LAGOS</b>	<b>Rank</b>	<b>YABA COLLEGE OF TECHNOLOGY</b>	<b>Rank</b>	<b>Remark</b>
I have no problem understanding the basic structural concepts	2	6 <sup>th</sup>	3.38	1 <sup>st</sup>	3.5	2 <sup>nd</sup>	Positive factor
The Lecturer has no problem communicating and expressing himself/herself	3.27	3 <sup>rd</sup>	3	2 <sup>nd</sup>	3.54	1 <sup>st</sup>	Positive factor
There are practical examples provided in class that makes it easy to understand the concepts and principles of structural analysis	3.29	2 <sup>nd</sup>	2.79	5 <sup>th</sup>	2.79	6 <sup>th</sup>	Positive factors
The lecturer takes time to solve examples in class to give us a better understanding of the subject area	3.6	1 <sup>st</sup>	3	2 <sup>nd</sup>	3	5 <sup>th</sup>	Positive factor
The tools for teaching structural analysis are available and we are exposed to them	3.19	4 <sup>th</sup>	2.69	6 <sup>th</sup>	3.08	4 <sup>th</sup>	Positive factor
We are exposed to the use of computer softwares to aid in structural analysis	2.24	5 <sup>th</sup>	3	2 <sup>nd</sup>	3.33	3 <sup>rd</sup>	Positive factor

The table 2 shows a summary of positive factors ranked amongst Covenant University, university of Lagos and Yaba School of technology. From the above table, it can be observed that the ability of the lecturer to communicate

the subject area and expose the students to examples ranked highest among Covenant University responses. This will help with the students' performance in the course. In the public schools, their main concern is understanding the basics of the course but in the private school, their understanding was hinged on the lecturers taking time to explain and work some example in order to help with their comprehension.

## CONCLUSIONS

1. The major problem most students are facing was as a result of faulty background, especially in the core science subjects (physics, mathematics, chemistry) which is a stumbling block to them understanding the course
2. Class sizes is a problem, especially to the public universities as most of them inferred that they are unable to follow up and concentrate when lectures are going on, due to the large crowd. This is in agreement with (Ronald et al, 2001; Westerlund, 2008; Bedard & Kuhn, 2008)
3. A teacher's ability to communicate the subject area and engage the class will help with the students understanding the course and performing well in the course. This is in agreement with (Bangbade, 2004; Starr, 2002; Schacter and Thum, 2004; Rivkin, Hanushek, and Kain. 2000).
4. Exposure of students to computer aided software, that would help their understanding and appreciation of the course.

## RECOMMENDATIONS

The following are recommended to minimize learning difficulties students encounter in construction measurement.

1. Secondary and primary school educations should be improved, by investing in continuous workshops, seminars and training of teachers to improve their productivity. Also there should be continuous monitoring and evaluations of teachers' performance, in order to ensure that students are well informed.
2. Public universities and higher institutions should restrict their admissions to the number of students they have enough resources to cater for, so as to reduce the class sizes. Should in case they want to admit quite a number of students they should ensure that they are divided into groups and given different lecture times.
3. Lecturers should try as much as possible to deliver the course in creative ways that would entice the interest of the students. This entails a balance between theory and practical, in which could be achieved by showing students life model of how some structural concept works. Also the classes should be interactive so as to reduce anxiety and fear.
4. Also, there should be provision for computer aided software, examples of which are. These computer soft wares simplify the work of the lecturer and hastens the understanding of the students, as it translates the whole structural concept from abstract to reality, boosts the creativity of the student, and lastly helps students to solve real life problems.

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