Journal of Scientific Research & Reports

17(2): 1-12, 2017; Article no.JSRR.29862
ISSN: 2320-0227

Improving Education Outcomes in Engineering & Technology Domain: A Case of Faculty of Engineering, Nnamdi Azikiwe University, Awka

C. M. U-Dominic[1*], H. C. Godwin[1] and N. C. Igbokwe[1]

[1]Department of Industrial and Production Engineering, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2017/29862
Editor(s):
(1) Prinya Chindaprasirt, Professor, Khon Kaen University, Thailand.
Reviewers:
(1) Imran Aslan, ingöl University, Turkey.
(2) Mei-Ying Wu, Chung-Hua University, Taiwan.
Complete Peer review History: http://www.sciencedomain.org/review-history/22301

Case Study

Received 30th September 2016
Accepted 24th November 2016
Published 15th December 2017

ABSTRACT

The occupational influx of foreign expatriates in the country and the technical preference of these foreign competitors over our indigenous engineers have shown that most of our university outputs do not bring forth the presumed outcome. This odd position has limited us further from the global technological theatre, and has been a contentious issue in various academic symposium and conferences. The research was conducted to examine the university system's operational strategies and their underlying teaching policies. Some of the notable variables that has link with the output quality of students in the university system were assessed in the study. The input variable (staff: student ratio) and some of the process variables were examined. An exponential model was developed, and used to determine the appropriate staff requirement in the faculty of Engineering, in accordance with the National university commission's specified staff -to-student benchmark ratio. A qualitative method of investigation was used in assessing the process variables, and four hypotheses were generated from the study. The outcome of the study has widely disclosed a dysfunctional feedback system in the faculty, lack of technology support initiatives, inappropriate teaching methods, lack of proper academic guidance and counseling supports. The researchers in this study now likened these weak outcomes as part of the drawbacks in producing highly prolific engineering graduates in the society at large.

*Corresponding author: E-mail: bukkyudom@yahoo.com;

Keywords: Academic guidance and Counseling; staff to student ratios; feedback system/structure; teaching approach; innovative policies.

1. INTRODUCTION

The context of engineering education is changing, and engineers of the future needs a new set of skill [1], hence improving engineering education entails acquainting the students with engineering practices by replicating real-world situations in the classroom environment. Since its historical beginning, the purpose of technology and engineering education was to provide all students the knowledge, skills, and abilities to function in a technological world [2] Civilized nations of the world capitalize on their vast knowledge on technological possibilities to better and improve their economic situation, and offer varying engineering services for a royal sum to nations with deficient tools and manpower to improve their technical know-how. The crux of the Nigerian challenges is on age-long lapses with the trending technologies, and that of educational nonchalance in building educational framework that can make good with the prevailing academic deficiencies in the system, and to put forth academic platform that can produce meaningful graduates that will meet up with the technological challenges of the 21th century. As the world is upgrading every seconds of the day, many countries look forward for better alternatives to strengthen their economic growth [3], thus the need for engineering graduates students to master a wide range of expertise [4]. The economic strength of every nation depends on the wealth of their export potentials, both in human, and in natural capacities, thus the valued need for continuous improvement in the educational sector becomes relevant. In general, Nigeria tertiary institutions that deliver services need to broaden their examination of productivity from the conventional organization-oriented perspective, and incorporate varying procedural approaches with respect to the expected societal and technological relevance. Universities as presumed stronghold institution established to produce sound graduates with the necessary tools that will sustainably position them to the response and demands for efficiency and effectiveness peculiar in other public and private organizations have been found wanting in their mode of knowledge transfer. A progressive review should always be done on education system/policies, to examine the curriculum and resources in accordance with some prescribed criteria [5]. The quest to ensure that the form of instruction strategies used in universities in teaching engineering subjects be made relevance and responsive to the shifting technological demands of the 21st century begot the study.

Technology and engineering education is committed to preparing students for employment and/or continuing education opportunities by teaching them to understand design, produce, use, and manage the human-made world in order to contribute and function in a technological society [6]. Engineering requires applying content knowledge and cognitive process to design, analyze and troubleshoot complex systems in order to meet society needs [7]. An important dimension of quality in higher education is the quality of the outcome achieved [8]. Higher education system and accreditation agencies along with their constituent bodies must collaborate with industries and share the best practices, update their academic research programme and equip with contemporary latest technology in order to be relevant in the global market [9]. Educators and their institutions should continue to embrace new initiatives such that the graduates they are producing are responding to the needs of employers and the challenges of the 21st century [10]. However, media and studies quite often point out the discrepancy between societal needs for employees and the specialist prepared by universities [11]. [12] Posit that most of the engineering graduate students have difficulties integrating into labor market. The need to assess our educational systems to unveil some of the reasons why most engineering graduates from our higher institutions are qualified as technically unproductive, deficient with the pre-requisite skills needed to stand valued and compete globally in their various engineering field, brought a heap of concerns that co-precipitate to this study. The scope and focus of this study is rooted on the assessment of some of the systems variables and the classroom environment. The output assessment is left-out in this study due to its complexities as value added which is a better measure of real output in an organization is practically impossible because the anticipated monetary worth of the outputs are not certain. It is pertinent to understand the state of some variables (input and process variables) in the university environment and their contributions to the overall improvement of engineering students and graduates.

Training of technical personnel's in Nigeria has witnessed difficult challenges ranging from inadequate facilities, poor funding, non-availability of adequate human capacity, poor staff training, and brain drain [13]. Unemployment experienced in Nigeria is structural in nature in the sense that many graduates are unemployed for lack of prerequisite skills needed to fill vacant posts [14]. Knowledge and skills of future employees should be constantly developed in order to be in line with change [15]. There is an existing gap between the skills needed by employers and those that recent university graduates have [16]. Engineering and technology framework in Nigeria needs to be fortified starting from cradle, firstly by taking a proper assessment of the present educational conditions and the present position of engineering subjects in our nation's educational goals. Engineering discipline is a programme that calls for strong continuous assessment policies and close student-teacher learning relationship. However, the operational teaching policies in engineering subjects in the universities had long deviated off from the course of compelling teachers to pay adequate attention to supervision, academic counseling and heavy continuous assessment, and now grossly based on formal teaching and personal research. In engineering profession, weekly student assessments; one-to-one academic counseling in research and supervision; workshop demonstrations and special tutorials are more important than formal lecture hours [17]. Thus, it is imperative to note that productivity can improve in the university system if and only if there is an improvement in its units, through the enforcement of the needed operational policies. As the national policies of the universities advocates for a continuous performance improvement that can yield to the expected academic outputs continually, so are some parameters and variables needed to be in check in the faculty of engineering Nnamdi Azikiwe University Awka in order to keep the system adequately functional. The operational policies of universities in the country were so reluctant to accommodate appropriately all the teachers' activities whose time duration directly depends on the number of students the teacher attends to. These activities as were classed into two divisions are; the students consulting- during which the student's visits the lecturer for various forms of academic and administrative counseling, and the lastly the students assessment which encompasses continuous assessment of all students in practical's, research thesis and dissertations, laboratory exercises, grading of semester examination scripts, processing of semester results, computing of student's academic transcripts per semester, etc.

Projecting adequate university teaching staff requirements is one of the chosen approaches towards continual performance improvement in the university system, and has been an important measure for human resource requirement in the university system. To meet up with the aforementioned activities whose time duration directly depends on the number of students the teacher attends to, appropriate staff workload of each staff are to be known. Adequate university teaching staff requirement can be related with a typical dynamic job shop situation, where the teacher is viewed as an operating machine [17]. Based on his description, a teacher has a unique assignments to offer to the student, and stands as a machine, while the students are viewed as jobs. The university teaching staff requirement similar to the described job shop situation are always faced with the problem of determining the appropriate workload of each staff, which will maximize the utilization of man-hours while minimizing in-process inventory as a result of large population of the students waiting to be attended to by the lean number of teaching staff [17]. In addition to the earlier mentioned benefits of projecting adequate teaching staff requirements, workload of teachers is advised be known on time, to avoid teachers fatigue as a result of the heavy student consulting and assessment workload.

The contribution of this study is to explore some of the variables that affect quality outcomes of engineering graduates in Nigeria through proper assessment on the optimal use of labor and other factors that contribute to poor teaching learning experience in the university system. The aim here is to modify a human service system in order to elicit desirable attributes and have it controlled to perform several functions that will benefits the entire discipline through assessment of some of the system's variables.

2. METHODOLOGY

This study was more objective in describing all the observed conditions, and was conducted in phases. In the early phase of the study, the classroom environments were carefully observed, and the outcome of this careful observation yielded to a design proposal on the existing classroom configurations. An exponential growth model of the form $A = A_0 e^{kt}$ was developed, to predict student population for proper assessment of the input variable (staff to student ratio). Information on the undergraduate headcounts of full-time students enrolled in the faculty of Engineering from 2010-2015 academic sessions was gotten from the office of the Director, Academic Planning unit of the institution. The academic staff population in the faculty was collected from each of the departments through their secretaries. These academic staff population from each of these departments were collated, and the total population of academic staff in the faculty for 2015/2016 session was tentatively gotten. With the NUC recommended staff to student ratio of 1:15, the associated number of staff requirement, and the academic staff mix by rank in the Engineering was obtained (number of lecturers = 45% of S_T, number of Senior Lecturers 35% of S_T, number of Professors / Readers = 20% of S_T, where S_T is the calculated number of academic staff needed in the faculty). In the second phase of the study, a qualitative research methodology was used. The qualitative mode of investigation was used to elicit information from students in terms of these process variables feedback structure, teaching method, academic guidance and counseling, teacher-student relationship and technology support programs. This qualitative approach was used to generate concrete ideas and substantive hypothesis that would propelled for further research study for proper generalization which is beyond the scope of this work. An open-ended interview question was used by the researchers to capture important antecedents and outcomes of interest that might not surface when surveyed with pre-determined questions. The choice of respondent used in the study was based on certain criteria (The focused group were randomly selected; five students from each department, and as part of our selection criteria, year one and year two students were excluded from this study due to inter-faculty courses offered which may likely affect responses on some of the tested variables) and was limited to a smaller sample (n= 45) of people. The finding on the qualitative study was presented in a tabular format, and was used to establish four theories as a basis for further investigation.

2.1 Model Assumption

1. That the steady growth rate of the student's population continues.

3. RESULTS and DISCUSSION

3.1 Assessment on the Input Variable / Projection of Adequate Staff Requirement

All the information used in the study was assumed to be accurate in terms of the student's headcounts and academic staff statistics gotten from the departments. The necessary information needed to develop the exponential model were properly collated and tabulated in the Tables 1 and 2.

Using an exponential growth model of the form;

$$A = A_0 e^{kt} \quad (1),$$

to model the population distribution of the students over the years/academic sessions.

A_0 is the population of students in 2011 and t at 2011 = 0, A is the population of the student at time t, which is in 2016, t is the number of years after 2011, from the graphical representation, A0 = 2535,)

$$A = 2535e^{kt} \quad (2)$$

Table 1. Headcount of full-time student enrolment in the faculty of engineering from 2010/2011 to 2015/2016 academic sessions

S/N	Academic session	YR 1	YR2	YR3	YR4	YR5	$\sum_{1}^{5} yr$
1	2010/2011	554	566	396	507	512	2,535
2	2011/2012	644	581	566	393	507	2,691
3	2012/2013	716	668	581	566	396	2,927
4	2013/2014	574	759	668	581	566	3,148
5	2014/2015	552	613	759	668	581	3,173
6	2015/2016	555	598	613	759	668	3,193

(Source: Office of the Director Academic Planning Unit-Nnamdi Azikiwe University Awka -2016)

Table 2. Academic staff population in the faculty of engineering- (2015)

Departments in faculty of engineering	Academic teaching staff (FTAs + Ads)
1. Chemical	$P/_R$= 6, S_L = 3 L = 10 =19
2. Agric & Bio Resources	$P/_R$= 5, S_L = 5 L = 4 =14
3. Industrial & Production	$P/_R$= 4, S_L = 3 L = 6 = 13
4. Mechanical	$P/_R$= 2, S_L = 3 L = 8 =13
5. Electrical	$P/_R$= 4, S_L = 5, L = 8, 17
6. Materials & Metallurgy	$P/_R$= 4, S_L = 5, L = 5 = 14
7. Electronics & Computers	$P/_R$= 5, S_L = 4, L = 11 = 20
8. Polymer & Textile	$P/_R$= 2, S_L = 2, L = 5 = 9
9. Civil	$P/_R$= 5, S_L = 1, L = 7 = 13
Total number of academic staff in the faculty	$\sum =$ 132

(Source- survey data collected across all the departments in the faculty of Engineering-2016. Note: FTAs = full time academic staff, Ads = Adjunct teaching staff, $P/_R$ = number of professors/readers S_L = number of senior lecturers, and L= number of lecturers)

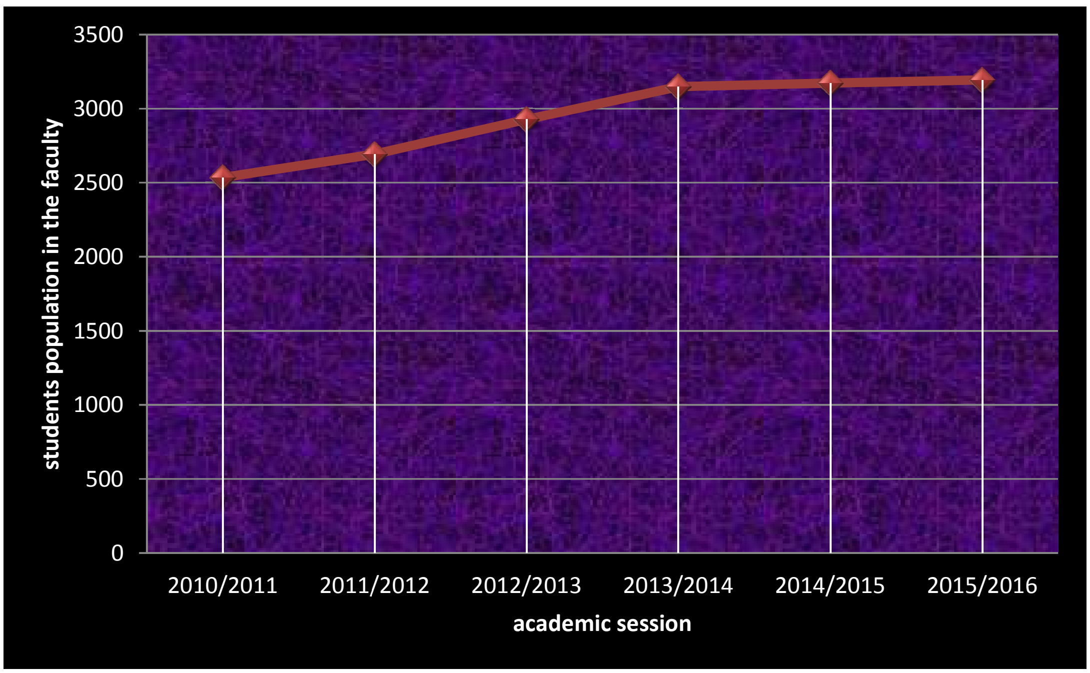

Fig. 1. Graphical representation of student's population in the faculty over academic sessions (yrs.)

Given that the population of students in 2016 is 3193, i.e. A = 3193 and t = 5 (from year 2011 through 2016)

$$3193 = 2535e^{k.5}$$

$$3193 = 2535e^{5k}$$

$$e^{5k} = \frac{3193}{2535}$$

$$lne^{5k} = ln\frac{3193}{2535}$$

$$5k = ln\frac{3193}{2535},$$

$$k = \frac{ln\frac{3193}{2535}}{5} = 0.046$$

k >0, indicate a growth.

$$A = 2535e^{0.046t} \quad (3)$$

Projecting the student population for 2016/2017 academic session; t = 6

$$A = 2535e^{0.046(6)}$$

$$A = 2535e^{0.276}$$

A = 2535(1.3178) = 3340

Using the NUC recommended staff to student ratio of 1:15, the expected academic staffs mix by rank in the faculty of Engineering with the student's record in 2015/2016 academic session;

$$N = \frac{3193}{15} = 213$$

I. Expected number of lecturers **(L)** = $\frac{45}{100}\ x\ \frac{213}{1} = 96$

II. Expected number of Senior lecturers (**S_L) =** $\frac{35}{100}\ x\ \frac{213}{1} = 75$

III. Expected number of Professors / Readers (**$P/_R$) =** $\frac{20}{100}\ x\ \frac{213}{1} = 42$

With the projected number of students in 2016/2017 academic session, the associated number of academic staff required:

$$N= \frac{3,340}{15} = 222.7 = 223$$

The expected academic staffs mix by rank in the faculty of Engineering with respect to the projected population of students in 2016 / 2017 academic session;

IV. Appropriate number of lecturers that will be needed **(L)** = $\frac{45}{100}\ x\ \frac{223}{1}$ = 100

V. Appropriate number of Senior lecturers that will be needed (**S_L**) = $\frac{35}{100}\ x\ \frac{223}{1}$ = 78

VI. Appropriate number of Professors/ Readers that will be needed (**$P/_R$**) = $\frac{20}{100}\ x\ \frac{223}{1} = 45$

Comparing the projected number of academic staffs requirement of 223 ($P/_R$ = 45, S_L = 78, L = 45) in the year 2016/2017 academic session to the number of academic staff in the year 2015/2016 which is 132 ($P/_R$ =37, S_L = 31, L = 64), you will notice that an additional number (91) of academic staff is required in the faculty ($P/_R$ = 8, S_L = 47, L = 36).

In the second phase of the study, the student's response from the open-ended interview questions were carefully collated and properly enlisted in Table 3.

3.2 Assessments on the Process Variables

The condition of some process variables in the faculty was assessed with the use of research questionnaire on target respondents.

From Table 3, the grouped responses revealed a fine blend of coherent responses, and were used to generate four important hypotheses from the study:

A. Category I:-

H1: inappropriate feedback structure/ mechanism in the faculty.

B. Category II: -

H2: Students lack proper academic guidance and counseling support.

C. Category III:-

H3: Poor teaching approach and use of inappropriate teaching methods.

D. Category IV:-

H4: Dormant technology initiative programmes in the faculty to attract collaboration with the faculty, and research development bodies.

3.3 Classroom Configuration Analysis

3.3.1 Existing classroom configuration (Fig. 2)

A classroom that is functioning successfully as a third teacher will be responsive to the students interests, provide opportunities for students and foster further learning and engagement. The existing classroom design fall short of the basic classroom design principles [18]. The basic principles of proper classroom design is on path with a philosophical approach that a proper classroom should facilitate students engagement, facilitate student collaboration, facilitate connection between teachers and students, incorporate appropriate technology, and should as well have a flexible physical arrangement [19]. [20] Identified in their work, some of the ergonomic challenges present in classroom environment and further provide efficient solutions that can assist to knock down these physical barriers and enhance the student's ability to focus on learning and promote inclusion. In addition to this notion, [21] acknowledged the potency of organized classroom environment on student/teachers performance. The writers extensively studied varying classroom environments and were able to identify some classroom factors that hinder

Table 3. Categorization of responses to the open-ended interview question

Categories	Respondent responses
(1). Feedback structure	➢ It takes a longer time for students to assess their test scores. ➢ Most lecturers do not publish/made public student's continuous assessment scores. ➢ Most results are not published on time. ➢ Students are not assessed at the end of every taught Instruction.
(2). Academic guidance / Consulting	➢ Students are not accorded proper attention apart from formal teaching hours in the classroom. ➢ Student's course registration forms are not well scrutinize during course registrations by teaching staffs. ➢ most lecturers view it as disturbance and encroachment on their time for student's to come forth with academic issues after formal classroom teaching.
(3). Teaching Methods	➢ Much attention on theoretical studies with poor integration of practical expositions. ➢ Lack of exposures through exhibitions and excursions to Practically assimilate taught instructions. ➢ Most lecturers always struggle to complete their lectures topics at the nib of exams, probably when the exam time table is out. ➢ Poor utilization of various teaching methods. ➢ Eagerness among some lecturers to exhaust their lecture periods without weighing whether the students understood the contents/concepts of the taught instruction.
(4). Technology Initiative programs	➢ Lack of partnership program, and collaboration between the faculty and research development bodies.

(Comments of the research respondents on some of the specific problems in the faculty of engineering in the areas of academic guidance and counseling, feedback structure, teaching methods, and technology support programmes)

proper learning experience; and which one of these factors are poor seating positions. They also assert from their study that some classroom seating arrangements promote positive student-student and teacher-student relationship. However, a lot of distracting factors that affects learning were observed in the study, and some of these were acoustic distraction caused by closeness of lecture halls, the large class size, and small classroom space, seat configurations, etc. Most of the classrooms were too narrow and deep, and this is a big challenge for students seating at the rear positions of the classroom. Visual learning aids are not used most often during lectures; and coupled with the depth of these classrooms; some of the students seating at the rear hardly see the text on the marker board. The distance from the marker-board to the students seating at the first row, is small (1.82 m) which is not in the recommended range for proper sighting. Seating arrangements and the type of seats found in some of the lecture halls were grouped in this study as a major source of distraction during classes. The observed seats were movable seats that can accommodate about 6 to 7 students in a row. There are no provisions of walkway at the back of each row for the students to easily exit from without disturbing his/her neighbor. The seat position affect's the teacher from properly navigating the classroom environment as there were no clear spaces between the rows, and this makes learning environment teacher- centered.

3.3.2 Proposed classroom configuration (Fig. 3)

A rectangular classrooms should be designed so that the length is one and half times the width $(L = 1\,{}^{1}/_{2}\ width)$ or 2 times the width of the room. Width and length of classroom designs should not exceed by far the recommended standard distance in order to maintain acceptable viewing angles for projected materials and for information written on the marker board. Classroom designs are usually developed by different universities and individual disciplines for their own use, considering their own peculiar circumstances. They are designed according to instructional needs and not according to building limitations. However, regardless of the method of instruction being used, an appropriate classroom learning environment will allow students to see anything presented visually, to hear any audible presentation free from noises and distortions, and to be physically comfortable. Provisions are made during classroom designs for specialized equipment for persons with disabilities. Seats are arranged to optimize the most common types of instructional assignments that the students will be engaged in. The type and kind of Seat

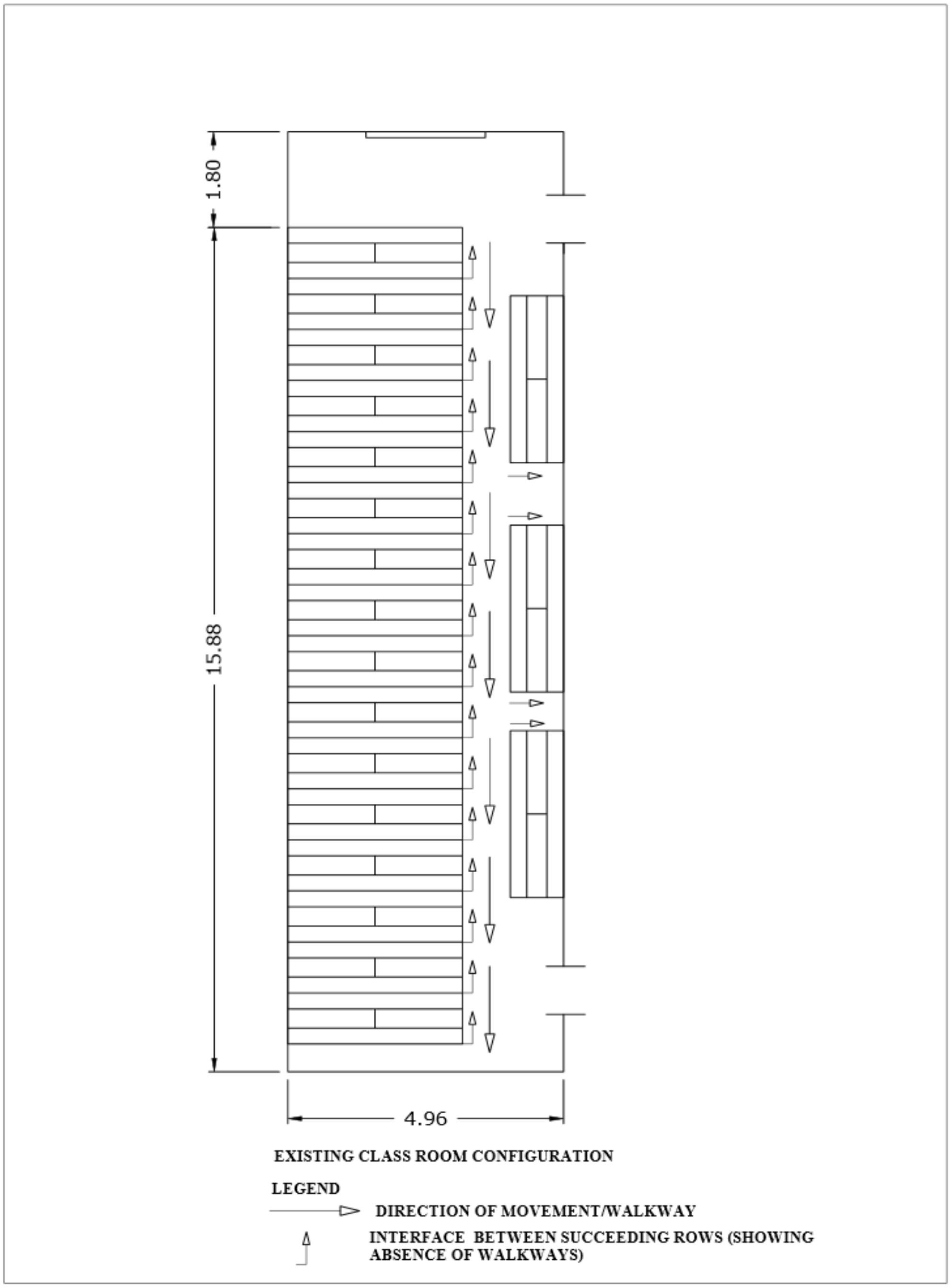

Fig. 2. Existing classroom configuration

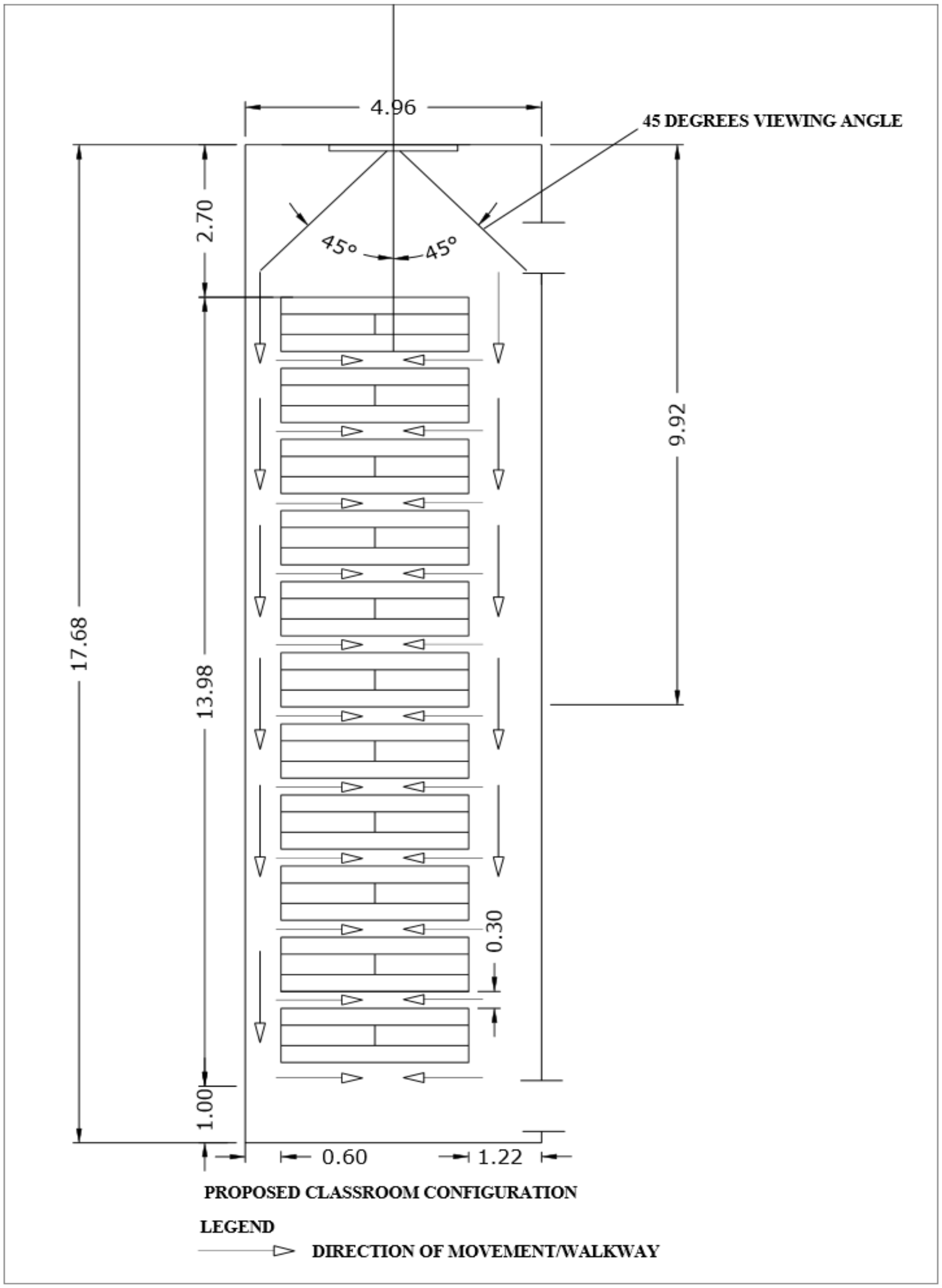

Fig. 3. Proposed classroom configuration

configuration should be considered with respect to the available space. Better sight lines can be achieved through proper seating arrangement, and a result of this, all seats must be located within a 90 degree viewing angle from the center of the projection screen [22]. A vertical viewing angle at the first row should preferably be maintained at about 25 degrees human eye and can rotate about 25 degrees upwards and 35 degree downwards without moving the neck joint [23]. The walk ways, which is the clear distance between the back of a seat and front of the seat directly behind it, should not be less than 0.3 m across all rows. In addition, Classrooms should be narrow enough to permit all seats to be within the 90 degree viewing angle from the front wall, but no narrower. Rooms that are too narrow and deep make it hard for students and instructors to interact. From the proposed classroom configuration, the distance from the marker board was maintained at 2.70 m (D_{fr} = 2 times the width of the marker-board, where D_{fr} is the distance from the marker board to students sitting at the first row). At this distance, sight angles for students sitting at the first row would be within the horizontal viewing angle of 45 degree and vertical viewing angle of 25 degree. At this range, the students sitting on the first low will still be physically comfortable sighting the board without causing strain to their neck. A lot of modifications were made on the existing classroom spaces, and from the proposed design, with the measured average on the existing seat width of 1.9 m and walkway width of 0.3 m, the maximum seat that can be contained in this classroom space is 11. Walking Spaces of 0.3 m were provided between rows for easy movement of both the teacher and the students. However, with the measured width of 4.96 m, it will be appropriate to partition the class length at 9.92 m, going by the standardized length to width proportion of classroom design ($L = 2x\,width$). At this width to length dimension of 4.96m: 9.92m, the maximum number of seats that would be contained within the classroom space is six. At this distance, students at the rear will be viewing the texts on the board with no difficulty, and the classroom will not be deep to hinder students and instructors interaction. From the proposed drawing, 1.22 m clear distance is maintained at the door side of the proposed design for students/teachers traffic. A clear distance of 1.00 m is provided at the back of the classroom, so the students can walk in the class without distracting both the students and teachers. A clear distance of 0.60 m is also provided at the left-side of the classroom for easy navigation through the class spaces.

4. CONCLUSION

Concerted efforts should be geared towards improving continuously on the educational strategies used in teaching of engineering subjects in the faculty. The report of the study has first shown dearth of workforce needed to propagate an efficient learning strategy in the faculty of Engineering. Secondly, the later phase of the study has also suggested for a revamp in the teaching strategies now in use; clamoring for a balanced integration of what is now in place and more resourceful approaches. Operational strategies that will allocate more hours (attention) to all the teachers' activities whose time duration directly depends on the number of students the teacher attends to, other than the current preference on formal teaching in the university was proposed in the study. The poor state of the process variables should be well looked into in other to institute a formidable educational structure, effective enough to be churning-out engineering graduates with the relevant skills to compete favorably in every environment. It is pertinent to always reckon with the fact that most nations with limited gross domestic products now focus in boosting their human development index statistics, and so shall we as a developing nation in order to meet up with the global technology demands.

5. RESEARCH LIMITATION

1. Due to time constraint, small sample group was chosen on qualitative part of this study, and which may limit wealth of information that could have been made available when larger sample size are taken for the same study.

6. RECOMMENDATIONS

1. Method of teaching engineering subjects in the faculty of engineering should be made more engaging by integrating the conventional lecture approach with approaches like, problem-based approach, demonstration approach, and brainstorming approach.
2. Guidance and counseling roles and responsibility should be made more pronounced in the faculty.
3. Curriculum system should be improved on, and physical learning environment should be made more conducive for proper learning. From the study, existing classroom space is too deep, considering the type of the floor and the narrow width, a small classroom design that will house up to 50 students will be appropriate because of the nature of the physical structure. It is pertinent to note that when rooms are too narrow and deep, it become hard for students and instructors to interact. For a rectangular classroom structure with flat-floor and of 4.96 m width, the expected design length of the classroom should be maintained at ($\boldsymbol{L = 2\ x}\ width$) 9.92 m.

DISCLAIMER

This manuscript was presented at the international conference held at the faculty of Engineering Nnamdi Azikiwe University Awka on september 07 2016.

Available link is "https://webcache.googleusercontent.com/search?q=cache:WxgXufGhNr0J:https://www.researchgate.net/profile/Chukwuebuka_U-Dominic/publications+&cd=1&hl=en&ct=clnk&gl=in"

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Myrick RD. Pennstate & the sub-committee of the university committee of Instructional facilities: classroom & technology design and construction minimum requirements; 2009. Available:clc.its.psu.edu/sites/default/files/content-classrooms/GPC-Requirements-041713.pdf (Accessed 01 November 2016)
2. Strimel G, Grubbs ME. Positioning technology and engineering education as a key force in STEM education. Journal of Technology Education. 2016;27(2).
3. Ekpobodo OR. Role of engineering education in Nigeria economic development. European Journal of Contemporary Economics and Management. 2014;1(1). Available:elpjournal.*eu*/wp-content/uploads/2016/03/1-1-9.pdf (Accessed 12 August 2016)
4. De Leon AT. Research in and outside the classroom: Training engineers without borders. World Transactions on Engineering and Technology Education. 2016;14(1). Available:www.wiete.com.au/journals/WTE&TE/.../Vol.14...1%20(2016)/18-De-Leon-A.pdf (Accessed 02 September 2016)
5. National Science Board. Moving forward to improve engineering education; 2007. Available:http://www.nsf.gov/pubs/2007/nsb07122/index.jsp (Accessed 01 November 2016)
6. Utah State Office of Education. Technology and Engineering education: Hands-on, minds-on education; 2010. Available:http://pltw.umbc.edu/ (Accessed 01 November 2016)
7. Brophy S, Klein S, Portsmore M, Roger C. Advancing engineering education in P-12 classrooms. Journal of Engineering Education; 2008. Available:http://www.k12science.org
8. Wam J, Tranter P. Measuring quality in higher education: A contemporary approach. Quality in Higher Education. 2001;7(3):191-198.
9. Mohanty A, Dash D. Engineering education in India: Preparation of professional engineering educators. Journal of Human Resource and Sustainability Studies. 2016;4:92-101. Available:http://dx.doi.org/10.4236/jhrss.2016.42011
10. Craddock D. Education projects manager at engineers without border UK; 2016. Available:www.ewb-uk.org/complexproblemineducation (Accessed 02 September 2016)
11. De lang M, Gesthuizen M, Wolbers MHJ. Youth labour market integration across Europe. The Impact of cyclical, structural, and institutional characteristics. European Societies. 2014;16(2):194-212. Available:http://dx.doi.org/10.1080/14616696.2013.821621
12. Grinevica L, Rivza B, Kovalevs R. Youth social inclusion trends in the Latvian labour market. Socialinial Tyrimai/Social Research. 2015;1(37):57-66. Available:pjp-eu.coe.int/...Social_Inclusion_2015.../7d184d78-539b-4c49-8e40-089349dea2b8 (Accessed 02 November 2016)
13. Uwaifo VO. Technical education and its challenges in Nigeria in the 21st century: International NGO Journal. 2010;5(2):040-044. Available:http://www.academicjournals.org/ingoj (Accessed 14 November 2016)
14. Pitan OS. Towards enhancing university graduate employability in Nigeria. Journal of Sociology Soc Anth. 2016;7(1):1-11. (Accessed 14 November 2016)
15. Kumpikaite V, Glinska E, Aslan I, Mihi-Ramirez A. Intercultural study. Inzinerine Ekonomika-Engineering Economics. 2016; 27(2):195-204.

Available:http://dx.doi.org/10.5755/j01.ee.27.2.13586
16. Giles L, Campbell M. The productivity and skills challenge. Industrial and Commercial Trainings. 2003;35(3):99-103. Available:http://dx.doi.org/10.1108/oo197850310470311
17. Charles-Owaba OE. Organizational design: Quantitative approach. 2nd ed. Ibadan: Oputuru Books; 2002.
18. Capacity building series, July 2010 special edition, No. 27, The Third Teacher: designing the learning environment for mathematics and literacy, K to 8. Available:https://www.google.com.ng/?gws_rd=ssl#q=2.%09Capacity+building+series%2C+July+2012+special+edition%2C+No.+27%2C+The+Third+Teacher:+designing+the+learning+environment+for+mathematics+and+literacy%2C+K+to+8.+ (Accessed 28 August 2016)
19. Centre for the enhancement of Teaching and Learning Georgia Institute of technology teaching for Learning 2009: A philosophical Approach to classroom design- five basic Principles. Available:http://www.cetl.gatech.edu (Accessed 28 August 2016)
20. Kelley M, Phillips C, Persuad L. Ergonomics in the classroom: Position for learning; 2013. Available:www.gatfl.gatech.edu/.../3/.../IDEAS_2013_Ergonomics_-_Position_for_Learning.pdf (Accessed 12 August 2016)
21. Godwin HC, Iwuchukwu AO. Engineering mathematics issues in University Education: A review. International Journal of Engineering Research & Technology (IJERT). 2013;2(6). ISSN: 2278-0181
22. National universities commission. Benchmark minimum Academic standards for undergraduate programmes in Nigerian Universities: Engineering Technology; 2007. Available:http://www.udusok.edu.ng (Accessed 29 July 2016)
23. Ing AHW (Piet) Van der Zanden. Readability in classrooms; 2014. Available:homepage.tudelft.nl/9c41c/Readability_in_classrooms.pdf

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/22301