

# DEVELOPMENT OF A RAPID MENTORING SCHEME FOR MANAGING LARGE CLASSES IN ENGINEERING DEPARTMENTS

F. Idachaba

*Covenant University (NIGERIA)*

## Abstract

The large number of candidates applying for the limited number of available slots in Engineering departments in Universities in Nigeria has resulted in an over population in these classes. This coupled with the lack of attraction the academia has had to young graduates over the years has resulted in a shortage of lecturers in many of engineering departments. This trend is however being reversed as the downturn in the labour market especially in the choice industries such as the oil and gas, banking and telecommunications is now causing young graduates to consider careers in the academia. This sudden influx of young graduates into the academia has led to an improvement in the students to staff ratio but the lack of experience of the young faculty in managing large classes or lecture delivery is threatening both the quality of teaching and learning the students are exposed to. This paper proposes a rapid mentoring scheme where the senior faculty teach the large classes while simultaneously mentoring the younger faculty. The senior faculty will be responsible for the development of the curriculum, course materials, test and examination questions and also teaching the large classes. The younger faculty will be responsible for developing the tutorial questions and answers which will be vetted by the senior faculty, they will also be responsible for taking the tutorial classes and marking the test and examination question papers. The senior faculty will teach the large classes with the junior faculty in attendance both to learn the principles of class management and undergraduate teaching and also help with class control. The class is then broken into smaller groups and assigned to the different younger faculties assigned to the senior faculty for the course and they will undertake the tutorial sessions. These sessions are to be held within the same week so as to reinforce the lectures undertaken within the week. The key benefits of this system include the fact that the students will benefit from the quality and experience of the senior faculty. The senior faculty will have sufficient support to introduce simulations or demos into the class, the junior faculty will receive mentoring as well as an opportunity to deepen their understanding of the course through the setting of the tutorial questions. The students will have a more personal interaction in the smaller groups with the younger faculty during the tutorial sessions and be able to ask questions which they couldn't ask in the larger class. The system is capable of providing a rapid mentoring path for young faculty while enabling the students benefit both from the experience of the senior faculty and the availability of the younger faculty resulting in very high quality engineering education

Keywords: Mentoring, Engineering graduate, Engineering Faculty.

## 1 INTRODUCTION

Engineering has over the years been the course with one of the highest subscriptions by candidates seeking admission into Universities in Nigeria. This is evidenced by the high application rates during the University entrance examinations conducted by the Joint Admission and Matriculations Board (JAMB) in Nigeria. The data from JAMB shows that the high application results in a high admission rate for engineering in most universities across the nation. One key reason for the high subscription to engineering is the fact that career prospects for the engineering profession is very bright with offers coming from the oil and gas sector, telecommunication and the banking and finance sectors.[1][2][3][4][5]

## 2 METHODOLOGY

The methodology utilized in the work comprise of a study of the application statistics for federal universities in Nigeria. Most applications are directed at the federal universities due to the low cost school fees associated with these institutions. The rapid mentoring scheme was developed following the review of the staff mix in the Engineering programs of most universities. The application statistics for 2011-2013 applications to federal universities in Nigeria as obtained from the JAMB is shown in tables 1-3.[6]

**Table 1.** 2011 Application statistics to federal Universities.

S/N	Faculty	Female	Male	Total
1	Administration	130,667	120,933	251,600
2	Agriculture	11,004	13,601	24,605
3	Arts/Humanities	59,401	47,270	106,671
4	Education	34,658	26,552	61,210
5	Eng/Tech/Environment	16,390	119,088	135,478
6	Environment	6,066	54,356	60,422
7	Law/Legal	40,930	40,578	81,508
8	Medicine	118,758	86,104	204,862
9	Pharmacy	4,948	4,156	9,104
10	Science	84,644	123,557	208,201
11	Social Sciences	134,815	172,668	307,483

**Table 2.** 2012 Application Statistics into federal universities.

S/N	Faculty	Female	Male	Total
1	Administration	105,372	94,551	199,923
2	Agriculture	12,510	13,553	26,063
3	Arts/Humanities	59,136	49,187	108,323
4	Education	36,586	27,133	63,719
5	Eng/Tech/Environment	22,512	180,268	202,780
6	Environment	318	1,300	1,618
7	Law/Legal	42,733	41,722	84,455
8	Medicine	131,479	91,534	223,013
9	Pharmacy	1,278	581	1,859
10	Science	83,810	126,419	210,229
11	Social Sciences	148,004	182,886	330,890

**Table 3.** 2013 Application Statistics into federal Universities.

S/N	Faculty	Female	Male	Total
1	Administration	95,817	104,434	200,251
2	Agriculture	18,953	19,020	37,973
3	Arts/Humanities	65,422	66,868	132,290
4	Education	38,192	51,112	89,304
5	Eng/Tech/Environment	194,026	23,890	217,916
7	Law/Legal	45,701	46,868	92,569
8	Medicine	103,775	152,720	256,495
10	Science	150,811	93,623	244,434
11	Social Sciences	222,131	174,951	397,082

From the data on tables 1-3, the courses with the highest subscription rates are

- 1 Social Sciences
- 2 Sciences

- 3 Medicine
- 4 Engineering
- 5 Arts and Humanities
- 6 Administration

## 2.1 Lack of faculty in Engineering Education in Nigeria

The oil and gas industry is one of the highest paying industries globally and Nigeria is not an exception. The bulk of its recruitments are engineers and this has resulted in the influx of young engineering graduates to the Oil industry working either in the mainstream oil and gas industries or the related service industries. The influx of young Engineering graduates to the industry in search of better salaries and working benefits has led to a dearth in the number of engineering graduates available to take over from the retiring professors in the Universities. The various downturns in the oil industry occasioned by the drop in oil prices and the saturation of the markets has resulted in young graduates returning to the academia in search of jobs [7][8]

The influx of young faculty into the academia is a welcome development but the nature of the academia is such that there is a level of expertise and subject mastery required for faculty to teach effectively. In most cases, young faculty are employed and assigned to teach classes. When these faculty arrive at the classes to meet a large class size, they realize that class management is a critical part of the job description. The cultural disposition of the academia in Nigeria is such that professors often times assign their classes to these younger faculty and focus on the graduate courses thus leaving the students at in the hands of the young/new faculty. The young faculty may be very smart but the lack of proper mentoring skills teaching methods results in the students being poorly taught and the resultant graduates being of low quality.

## 2.2 Large Classes

These are classes with populations exceeding the approved minimum class size. When these classes are assigned to new younger faculty, it usually overwhelms them as they have to both teach the course and manage the class. This challenge is further compounded if there are no public address and/or multimedia systems in the class. The Rapid Mentoring Scheme (RMS) proposes the allocation of this class to a senior faculty while two or more junior faculty are assigned to the course to be mentored by the senior faculty.

## 2.3 Current practice for teaching large classes in Engineering

The current practice of teaching large classes includes the following

- 3-4 faculty assigned to the course
- Each faculty teaches his/her module
- The other faculty support with the class management
- Each faculty contributes to the examination questions and marking

This is represented in figure 1

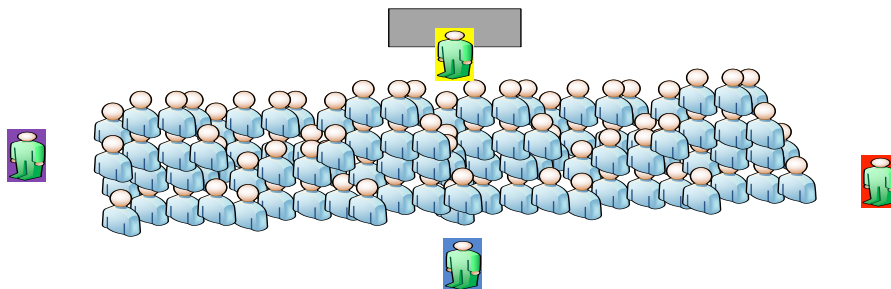


Figure 1: Large classes

As shown in the diagram in figure 1, each faculty teaches his own module and focuses on his part of the course. While this satisfies the requirement for co teaching as is the standard in a number of institutions, it has its specific limitations which include:

- Large number of students per class
- Minimal student/teacher interaction
- Class venues not designed to handle such numbers
- Challenges with class management due to the large number of students
- The quality and depth of teaching varies depending on the teacher of the module
- Student performance is usually poor due to minimal student /teacher interactions
- Minimal hands-on problem solving
- Poor lecturer utilization as the teacher focuses only on the module assigned to him/her
- Lecturers are not able to explore creative approaches to teach due to the large class size

### 3 RESULTS

#### 3.1 Rapid Mentoring scheme

The rapid mentoring scheme is aimed at harnessing the experience of the professor or the senior academic and transferring these skills to the younger faculty such that both the students and the younger faculty benefit from the experience and expertise of the senior faculty.

The scheme is shown in figure 2

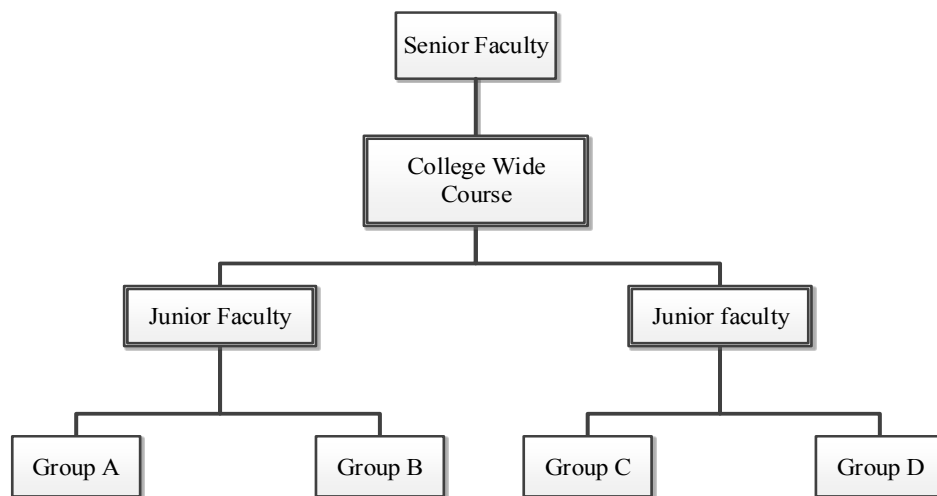


Figure 2. Rapid Mentoring Scheme.

The diagram in figure 2 shows the basic block diagram for the implementation of the rapid mentoring scheme. The college wide course is selected as it a course offered by several students from different department and as such its population should be high. The junior faculty work with the senior faculty and are mentored by the senior faculty such that they learn the basic principles of class management and are also grounded in the course. The key responsibility of the team members are listed below.

##### 3.1.1 Senior Faculty

- 1 Teaches the course
- 2 Mentors Junior faculty while teaching the course
- 3 Develops Lecture slides
- 4 Vets tutorial questions
- 5 Sets test and examination questions

- Determines the course project and any associated practical

### 3.1.2 Junior faculty

- Sets and Develops tutorial slides
- Marks all assignments, quizzes and exam questions papers
- Attends the class with the senior faculty
- Teaches the tutorial classes
- Solves problems during the tutorial classes

The specific break down of the program is described in the following sections

## 3.2 Large class (Umbrella Class)

This class is manned by the most experienced faculty who teaches the course basics and lays a foundation. The course is taught using simulations and demos to provide sufficient grounding and grasp of the principles to the students and also the young faculty. One key advantage of this mode of teaching is that it provides a leveling ground for the new faculty such that it helps to make up for the deficiencies if any in the training of the young faculty from their different schools. This is shown in figure 3.

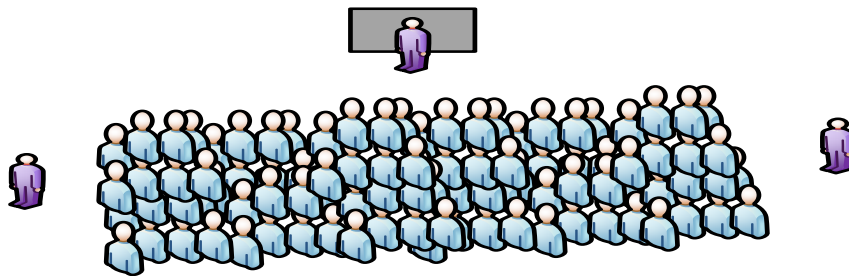


Figure 3: The Large/Umbrella class.

## 3.3 Tutorial classes

The younger faculty each take their tutorial classes where the focus is solely on problem solving. The number of tutorial classes will be determined by the number of junior faculty available. All the tutorial classes use the same problems and the same slides to ensure uniformity. The diagram for 2 and 4 tutorial classes are shown in figure 4 and 5.

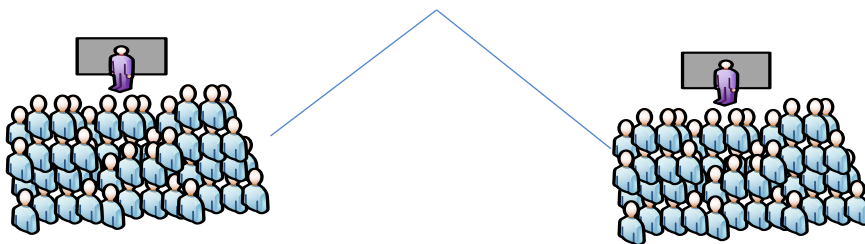


Figure 4: 2 Tutorial classes.

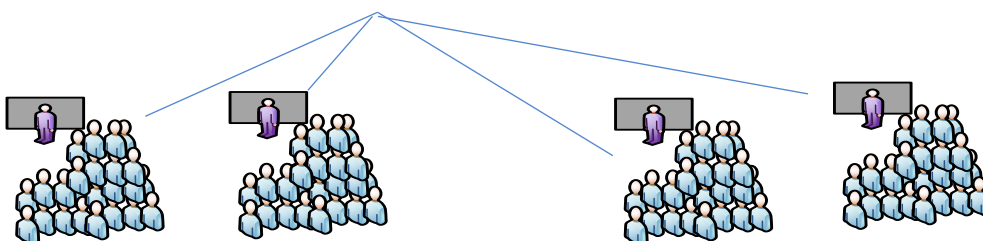


Figure 5: 4 Tutorial classes.

### 3.4 Rapid Mentoring Scheme: Mode of operation

The mode of operation of the rapid mentoring scheme is shown below.

- The lecturers all work together to plan for the course.
- The students are grouped according to their programs to avoid clashes with other courses
- The most experienced faculty prepares the slides for the lectures and teaches the main class all semester
- The course modules are shared between the other faculty who will prepare solved questions and tutorials for the different modules of the course.
- While the main lecturer teaches a topic at the beginning of the week, the other lecturers are in the class to help with the class control and to also know where the main lecturer stopped during the lectures.
- The different groups meet at different venues and all use the same tutorial material.
- The faculty can reverse roles as the session changes such that the lecturer in charge of tutorials for one session can take over the teaching in the second session
- If the main faculty is absent any of the other faculty can step in to take the main lectures

A sample of the course delivery plan is shown in Table 4. The four tutorial classes all utilize the same problems for the tutorial sessions and the sessions must be held to support the topic taught by the senior faculty during the class lecture at the beginning of the week

*Table 4. Sample Course Delivery plan.*

Week	Module	Class Lecture	Four Tutorial classes			
			Class A	Class B	Class C	Class D
<b>Week 1 and Week 2</b>	Module 1	Amplifiers	Solved Problems on Amplifiers	Solved Problems on Amplifiers	Solved Problems on Amplifiers	Solved Problems on Amplifiers
<b>Week 3</b>	Module 2	Biasing	Solved Problems on Biasing	Solved Problems on Biasing	Solved Problems on Biasing	Solved Problems on Biasing
<b>Week 4</b>	Module 3	Classes Of Amplifiers	Solved Problems on classes of amplifiers	Solved Problems on classes of amplifiers	Solved Problems on classes of amplifiers	Solved Problems on classes of amplifiers
<b>Week 5</b>		Test 1				
<b>Week 6 and Week 7</b>	Module 4	Power Amplifiers Design	Solved Problems on amplifier design	Solved Problems on amplifier design	Solved Problems on amplifier design	Solved Problems on amplifier design
<b>Week 8</b>		Mid Semester				
<b>Week 9</b>	Module 5	Multistage amplifiers	Solved Problems on Multistage Amplifiers	Solved Problems on Multistage Amplifiers	Solved Problems on Multistage Amplifiers	Solved Problems on Multistage Amplifiers
<b>Week 10</b>	Module 6	Multistage amplifier circuit applications	Solved Problems on multistage Amplifier circuit application	Solved Problems on multistage Amplifier circuit application	Solved Problems on multistage Amplifier circuit application	Solved Problems on multistage Amplifier circuit application
<b>Week 11</b>	Module 7	Power supply design	Solved Problems on Power supply design	Solved Problems on Power supply design	Solved Problems on Power supply design	Solved Problems on Power supply design
<b>Week 12</b>		Revision for Exam	Revision for Exam	Revision for Exam	Revision for Exam	Revision for Exam

### **3.5 Benefits**

The benefits accruable for the deployment of this scheme is listed below.

- Potential for improving the quality of teaching available to students from the faculty
- Standardization of teaching quality and materials
- Improvement in the assimilation of the students as will be evidenced by the results at the end of the semester
- Improvement in the quality of understanding and mastery of the course by the young lecturers

The system provides for peer review and monitoring by the different lecturers teaching the course

## **4 CONCLUSIONS**

There is an increasing demand for admission into Engineering across Universities in Nigeria and the advent of the Private and state universities has not been able to cater for this demand. These universities still rely on the limited number of senior engineering professors. The utilization of this mentoring scheme will enable the young faculty receive the required mentoring and grounding while they undertake their PhDs and also support in the teaching of the courses assigned to them under the mentorship of the Professors. This approach will result in the rapid improvement in the quality of the newer faculty, a standardization of the lecture materials and an improvement in the quality of teaching available to the students

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