International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 7 Issue 9 Ver II || Sep 2018 || PP 68-74

An algorithm for efficient allocation of courses to lecturers for effective teaching

Anichebe Gregory Emeka

Abstract: *The academic performance of a student in a tertiary institution is a function of two variables: (i) ability of a student being taught very well in school, and (ii) ability of a student coping with his/her Course of Study. The later case is not considered in this work because very many students enroll for the course of study they have the academic potential of studying at the university as justified by the entry requirements satisfied by them during Admissions. For the former case, on the other hand, available literature showed that allocation of courses to lecturers is not efficiently carried-out in many tertiary institutions in Nigeria and beyond. Some lecturers hold on to certain courses almost indefinitely (whether they teach those courses well or not) for certain selfish reasons. Again, courses are allocated to lecturers based on academic ranks alone without due consideration of other factors like: area of specialization, assessment of lecturer's performance in class by students, etc. All these militating factors are pointers to poor academic performance of students in school. This work therefore develops an algorithm that can be used to allocate courses efficiently to lecturers for effective teaching. The algorithm incorporates the following factors: lecturer's rank, years of experience, area of specialization, his/her percentage performance in class, and pairing of two or more lecturers to a course. These factors will definitely introduce dynamism and efficiency in the course allocation process so that the best lecturers for any given course can be determined by calculated values from the above factors, and not merely by face-recognition that is being currently practised.*

Key words: *academic performance, students, lecturers, tertiary institutions, Nigeria, course allocation, algorithm, rank, years of experience, area of specialization, percentage performance in class, lecturer's assessment, pairing of lecturers*

Date of Submission: 07-09-2018 Date of acceptance: 24-09-2018

I. Introduction

The academic performance of a student is used as a yardstick for determining the progression of a student from one level of study to another. According to [1], At the end of each academic year, your faculty assesses your academic performance and determines your eligibility to continue studying your course. If you have made satisfactory progress, you will be assigned the status of "Good standing". You will then be permitted to re-enrol [for a higher level of study]. If you have failed to make satisfactory progress, you may be placed on probation, suspended or excluded

From the foregoing, it implies that lecturers should, on their own part, teach the students effectively to enable the students excel in their academic pursuits. The author in [2] described effective teaching as, "the extent to which a teacher is able to encourage students' understanding of the subject-matter to enable them improve on their academic performance". Available literature however showed that the academic performances of students are deteriorating in many tertiary institutions in Nigeria and beyond. According to [3], the boss of NUC (National Universities Commission of Nigeria) expressed worry over the high rate of poor academic Degrees obtained by students on graduation. The observation carried out by the author in [4] showed that,

Most students cannot stay focused throughout a lecture. After about 10 minutes their attention begins to drift, first for brief moments and then for longer intervals, and by the end of the lecture, they are taking-in very little and retaining less

The author therefore suggested that students' attention can be maintained by a lecturer throughout a class session by periodically giving them something to do (like asking them questions, giving them class exercises, etc). This view was supported by [5] who stated that teaching is a bidirectional communication in which students should be active participants in the process.

The observation technique carried out by the researcher showed that may lecturers perform poorly in communicating facts, ideas, skills, and techniques needed for good understanding of the courses they are teaching. This is largely due to two main factors: (i) some lecturers are not very proficient in the courses assigned to them, and (ii), some of the lecturers are lacking teaching skills.

In this work, therefore, the researcher developed an algorithm that can be used by tertiary institutions for allocating courses efficiently to lecturers for improved teaching. The algorithm uses the following five

factors for determining the best lecturers for course allocation: lecturer's rank, years of experience, area of specialization, students assessment score of a lecturer's class performance, and pairing of two or more lecturers to a course. The algorithm makes it very difficult for a lecturer to have fixed courses assigned to him/her since his/her overall performance rating in class will be calculated from the above five factors at the end of every semester, and which certainly will vary. This, therefore, brings more seriousness and competition amongst the lecturers for improved knowledge and better teaching techniques.

II. Literature Review

Very minimal efforts have so far been made by researchers in designing an automated system for allocating courses to lectures efficiently. The authors in [6] proposed a system whereby courses can be allocated to lecturers based on their preferred courses with respect to their areas of specialization. This is a bold step towards efficient course allocation. However, the system did not go further to assess the performance of a lecturer on the course(s) assigned to him/her to justify his/her continuous teaching of the course(s), or whether there is a need for some readjustments. This is why [2] is of the opinion that inasmuch as students are being assessed by lecturers (through tests, quizzes, assignments, practicals, and exams) to ascertain their academic performances, lecturers should equally be assessed by students to ascertain their teaching performances in class. The author suggested the use of the following yardstick for assessing a lecturer: (i) level of understanding of the course, (ii), ability to relate the subject to other disciplines or to practical use, (iii) attitude of the lecturer to students such as (a) punctuality in class, (b) being audible in class (c) writing legibly in class, (d) ability to ask and answer questions, and (e) being enthusiastic/humorous in class. This work utilized all these excellent ideas by the author in order to make the developed algorithm more efficient.

According to [7], course allocation problems should continuously attract the interest of researchers in the quest for the best approach for assigning courses properly to lecturers for improved teaching. The algorithm developed in this work is therefore subject to improvement from other renowned researchers to actualize this objective.

III. Methodology

According to [8], "the methodology of a research paper shows the 'work plan' or blueprint used by a researcher for solving a research problem". The work-plan bothers on the method of data collection and analysis.

The methodology for this research is therefore structured as follows:-

Research method
Selection of participants
Data collection
Data analysis, and
Sample output

3.1 Research method

'Research method' refers to the technique used for data collection. The research method used in this work is "Observation technique" as well as 'Secondary data' (or Documentary data) technique obtained online about the allocation of courses to lecturers, and lecturers' teaching performances.

3.2 Selection of participants

This refers to the key-players for the research. Here, the following factors were considered:-

- *Description of participants:* This includes the following:
  i. the Head of Department (HOD) that will allocate courses to lecturers at the beginning of each semester of an academic session.
  ii. The lecturers that will submit detailed information about their academic qualifications, ranks, years of experience, and areas of specialization to the HOD for storage at the database for course allocation
- *Selection criteria:* Every academic staff of any given Department is eligible to be allocated a course to.
- *Target population:* This includes all the academic staff of a Department that are not on sabbatical leave, maternity leave, sick leave, or on secondment.
- *Sampling method used:* The entire population of 'N' academic staff of a Department that are not in any kind of leave or secondment would be selected for course allocation.

3.3 Data Collection

The data that would be collected by the HOD for course allocation should be grouped into two. These are:- (i) courses and (ii) lecturers

- *Courses:* the following data should be collected about **Courses**: course code, course title, credit load, course level, subject area, and semester.
- *Lecturers*: the following data should be collected about **Lecturers**: Lecturer's name, staff number, gender, academic qualification, rank, years of experience, and areas of specialization.

3.4 Data Analysis

'Data Analysis' gives a detailed account of the technique used for storing and arranging data for processing as well as the technique used for processing data in order to obtain a result or finding.

Here, an algorithm will be developed for allocating courses efficiently to lecturers for effective teaching. The steps for the development of the algorithm are outlined below.

Step 1: Let all the subject areas (or areas of specialization), S_i, i = 1to n, offered by a Department be represented by the sample space, S, as shown in fig. 3.1.

S = subject areas (or areas of specialization)

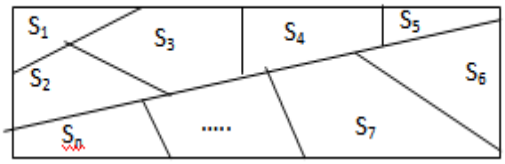

Fig. 3.1 a partition of all the subject areas of a given Department

Step 2: Every lecturer in the Department must select at least two different subject areas from 'S' such that the following condition holds:-

i. The total number of subject areas is exhaustive of 'S'; that is,
$S_1 \cup S_2 \cup S_3 \cup .... \cup S_n = S$

ii. The various subject areas chosen by the lectures are overlapping in 'S'; that is,
$S1 \cap S_2 \cap S_3 \cap ..... \cap S_n = O/$

Step 3: Courses will be assigned to lecturers based on the following four criteria:-

1) Lecturer's rank
2) Area of specialization
3) Years of experience
4) Percentage teaching performance in class

Step 4: The following pre-conditions should be used in allocating courses to lecturers :-

1. No lecturer should be assigned more than three courses in a semester
2. There should be two or more lecturers per course for more effective teaching. The first lecturer should be a ***senior lecturer***, and would be assisted by a ***junior lecturer*** (and possibly other lecturers if there are more than two)
3. The category of a *senior* and *junior* lecturer shall be as follows:-
   Junior lecturer = *Lecturer III to Lecturer I*
   Senior Lecturer = *above Lecturer I*
4. 60% of a course should be taught by the senior lecturer, while the remaining 40% should be taught by the junior lecturer (and possibly other lecturers if there are more than two). Also the grades for the course should be returned according that proportion.
5. The following criteria can be used by students for assessing the percentage performance of a lecturer is a class
   a) Punctuality to lecture (1%-100%)
   b) Being audible in class (1%-100%)
   c) Level of understanding of the course (1%-100%)
   d) Real-life application of the subject being taught (1%-100%)
   e) Being enthusiastic/humorous in class (1%-100%)

Step 5: Assumptions made: The following assumptions were made with respect to course allocation, as shown in table 3.1

Table 3.1 scaling factors used for Course Allocation

Lecturer's Rank	**Scaling factor**
Junior lecturer	40% = 0.4
Senior lecturer	60% = 0.6
Years of experience	**Scaling factor**
Junior lecturer	< 5 years = 20% = 0.2 years - < 10 years = 35% = 0.35 >= 10 years = 45% = 0.45
Senior lecturer	< 10 years = 25% = 0.25 10 years - < 15 years = 35% = 0.35 > 15 years = 40% = 0.4
Average % teaching performance in class	**Scaling factor**
Junior lecturer	1% - 100% (0.01-1.00)
Senior lecturer	1%-100% (0.01 – 1.00)

Step 6: Calculations on how to determine a lecturer to be assigned a given course

Suppose three senior lecturers (John, Mary and Andrew) of the same area of specialization are to be considered for a particular course allocation (say COM 324 - software Engineering in computer science Department), and we have the following information about them:-

Lecturer's Name	**Staff number**	**Rank**	**Area of specialization**	**Years of Experience**	**Average percentage teaching performance**
John	SS1012	Senior lecturer = 0.6	Software Engr.	13yrs = 0.35	71%= 0.71
Mary	SS1467	Senior lecturer = 0.6	Software Engr.	9yrs = 0.25	74% = 0.79
Andrew	SS1359	Senior lecturer = 0.6	Software Engr.	16yrs = 0.4	62% = 0.62

$$\text{Overall rating for John} = \frac{(0.6 + 0.35 + 0.71) * 100\%}{3} = 55.33\%$$

$$\text{Overall rating for Mary} = \frac{(0.6 + 0.25 + 0.74) * 100\%}{3} = 53\%$$

$$\text{Overall rating for Andrew} = \frac{(0.6 + 0.4 + 0.62) * 100\%}{3} = 54\%$$

Comparing the above computed values, we can see that 'lecturer John' has the highest percentage rating of 55.33%. COM 324 will therefore be allocated to him. The same scenario applies in determining that of a junior lecturer.

Step 7: The algorithm for course allocation

From what have been discussed so far, the following algorithm for course allocation can be written:-

1. **Select** all the courses (course code, course title, subject area, etc.) from the ***Course*** *table*

1.1 while record.next( )

{

// allocate a selected course to a senior lecturer as follows:-

1.1.1 **Select** from the ***senior lecturer table*** the particulars of all the lecturers whose area of specialization[1] Or area of specialization[2] = subject area of the selected course

1.1.2 Use table 3.1 to determine the overall rating of each of the selected lecturers

1.1.3 Sort the ratings in descending order (from highest to lowest)

1.1.4 Use the following loop to assign the selected course to the lecturer with the highest rating:-

for (i = 1 to n (where 'n' is total number of lecturers in sorted order))

{

Check the *course allocation table* to determine if lecturer[i] has already been assigned a total of 3 courses

if Not, assign the selected course to the lecturer, and store the information on the *course allocation table*

Exit loop

Else

Continue (with the loop)

}

1.1.5 Determine the junior lecturer to assist the senior lecturer as follows:-
Select from the ***junior lecturer table*** the particulars of all the lecturers whose area of specialization[1] Or area of specialization[2] = subject area of the selected course

1.1.6 repeat steps 1.1.2 to 1.1.4 above

} // *select another course in the result-set*

2. Check whether there is any lecturer that has not been allocated a course to, as follows:-

2.1 Select all the lecturers' data from the ***senior lecturer table***

2.1.1 while record.next( )
{

If lecturer's ***staffNo*** is Not in the ***course allocation table*** Then
allocate a course to the lecturer based on his/her area of specialization, and store the information on the ***course allocation table***

} // *select another staffNo in the result-set for a check*

2.2 select all the lecturers' data from the ***junior lecturer table***

2.2.1 while record.next( )
{

If lecturer's ***staffNo*** is Not in the ***course allocation table*** Then
allocate a course to the lecturer based on his/her area of specialization, and store the information on the ***course allocation table***

} // *select another staffNo in the result-set for a check*

3. Display the ***course allocation table*** to see the allocated courses to lecturers
4. End

Fig. 3.2 An Algorithm for efficient allocation of courses to lecturers for effective teaching

3.5Sample output

Given tables 3.2 and 3.3 that contain information about **lecturers** and **courses**, the resulting table 3.4 that shows the allocation of courses to lecturers can be obtained from the two tables by applying the algorithm of fig 3.2 (assuming the overall rating for each lecturer has already been determined.

Table 3.2 a sample LECTURER table

Name	**staffNo**	**Rank**	**Date of Appointment**	**Area of Specialization-1**	**Area of Specialization-2**	**Overall Rating**
Peters F.J	SS1208	Professor	14/06/1992	Computer Hardware	Software Engineering	*Already determined*
Anichebe G.E	SS1214	Professor	22/11/1994	Artificial Intelligence	Internet Programming	*Already determined*
James S.B	SS1270	Professor	28/12/1994	Theoretical Computing	Database Management	*Already determined*
Emmanuel C.O	SS1293	Professor	13/09/1995	Software Engineering	Computer Programming	*Already determined*
Queen F.G	SS1302	Reader	22/03/1996	Computer Systems	Database Management	*Already determined*
Fortune L.Q	SS1334	Reader	30/10/1996	Theoretical Computing	Computer Networks	*Already determined*
Clifford A.E	SS1356	Senior Lecturer	11/11/1998	Software Engineering	Computer Programming	*Already determined*
Kanu S.S	SS1382	Senior Lecturer	19/06/1999	Computer Systems	Theoretical Computing	*Already determined*
Winifred O.Z.	SS1395	Senior Lecturer	17/09/1999	Database Management	Software Engineering	*Already determined*
Aniagolu Z.D	SS1466	Lecturer1	02/03/2001	Computer Programming	Artificial Intelligence	*Already determined*
Hamma R.U	SS1471	Lecturer1	18/05/2002	Internet Programming	Computer Systems	*Already determined*
Onyema W.L	SS1477	Lecturer1	26/07/2002	Computer	Software	*Already determined*

				Programming	Engineering	
Kizito D.P	SS1493	Lecturer1	30/12/2004	Theoretical Computing	Artificial Intelligence	*Already determined*
Bondi V.A	SS1502	Lecturer1	30/12/2004	Theoretical Computing	Computer hardware	*Already determined*
Sandra P.K	SS1528	Lecturer II	04/10/2009	Theoretical Computing	Computer Systems	*Already determined*
Nnamani E.V	SS1532	Lecturer III	16/08/2012	Software Engineering	Computer Networks	*Already determined*
Ngozika W.B	SS1544	Lecturer III	23/07/2014	Software Engineering	Computer Hardware	*Already determined*

Table 3.3 a sample COURSE table

Course code	**Course title**	**Subject area**	**Credit load**	**Semester**
COM102	Computer programming 1	Computer Programming	3	1
COM114	Systems Analysis & Design	Software Engineering	2	1
COM171	Intro. to Digital Electronics	Computer Hardware	3	1
COM225	Web Technology	Internet Programming	3	1
COM202	Object-Oriented Programming	Computer Programming	3	1
COM256	Computer Troubleshooting	Computer Systems	2	1
COM312	Database Design	Database Management	3	1
COM324	Software Engineering	Software Engineering	3	1
COM356	Operating System	Computer Systems	2	1
COM313	Compiler Construction	Theoretical Computing	3	1
COM351	Data Structure	Theoretical Computing	3	1
COM425	Data Comm. & Networks	Computer Networks	4	1
COM418	Artificial Intelligence	Artificial Intelligence	4	1
COM411	Numerical Methods	Theoretical Computing	4	1
COM415	Operation Research	Theoretical Computing	4	1

Table 3.4 a sample ALLOCATION OF COURSES TO LECTURERS

Lecturer's Name	**Rank**	**Course code**	**Course title**
Clifford A.E	Senior lecturer	COM102	Computer Programming I
Aniagolu Z.D	Lecturer 1	COM102	Computer Programming I
Emmanuel C.O	Professor	COM114	System Analysis & Design
Nnamani E.V	Lecturer III	COM114	System Analysis & Design
Peters F.J	Professor	COM171	Intro. to Digital Electronics
Bondi V.A	Lecturer I	COM171	Intro. to Digital Electronics
Anichebe G.E	Professor	COM225	Web Technology
Hamma R.U	Lecturer I	COM225	Web Technology
Emmanuel C.O	Professor	COM202	Object-Oriented Programming
Onyema W.L	Lecturer I	COM202	Object-Oriented Programming
Kanu S.S	Senior Lecturer	COM256	Computer Troubleshooting
Sandra P.K	Lecturer II	COM256	Computer Troubleshooting
Winifred O.Z	Senior Lecturer	COM312	Database Design
Bondi V.A	Lecturer I	COM312	Database Design
Clifford A.E	Senior Lecturer	COM324	Software Engineering
Ngozika W.B	Lecturer III	COM324	Software Engineering
Queen F.G	Reader	COM356	Opearating System
Ngozika W.B	Lecturer III	COM356	Opearating System

Kanu S.S	Senior Lecturer	COM313	Compiler Construction
Sandra P.K	Lecturer II	COM313	Compiler Construction
James S.B	Professor	COM351	Data Structure
Kizito D.P	Lecturer I	COM351	Data Structure
Fortune L.Q	Reader	COM425	Data Comm. & Networks
Nnamani E.V	Lecturer III	COM425	Data Comm. & Networks
Anichebe G.E	Professor	COM418	Artificial Intelligence
Aniagolu Z.D	Lecturer I	COM418	Artificial Intelligence
Fortune L.Q	Reader	COM411	Numerical Methods
Bondi V.A	Lecturer I	COM411	Numerical Methods
James S.B	Professor	COM415	Operation Research
Nnamani E.V	Lecturer III	COM415	Operations Research

IV. Summary and Conclusion

Using multiple variables such as lecturer's rank, areas of specialization, years of experience, and percentage teaching performance in class for developing a "course allocation algorithm to lecturers" brings more precision in determining the best lecturers for a given course. This in turn creates room for the school management to easily ascertain the serious lecturers and the dullards for awards and proper punishments respectively. All these will gear towards improving the academic performance of students, and to a better society in general.

References

[1]. The University of Western Australia, "Academic Progression Explained", available at: https://ipoint.uwa.edu.au/app/answers/detail/a_id/37/~/academic-progression-explained [accessed on: February 21, 2018]
[2]. Adeyemo, E.O. "Lecturers' Perception towards students Assessment of their Teaching Effectiveness in a Nigerian University", International Journal of Psychology and Behavioral Sciences, vol.5 No.5, pp 184-192, doi: 10.5923/j.ijpbs.20150505.02
[3]. "Grading Systems in Nigerian Tertiary Institutions; Searching for the Right Standard", available at: http://blogs.flexisaf.com/grading-systems-in-nigerian-tertiary-institutions-searching-for-the-right-standard/ [accessed on: April 26, 2018]
[4]. Richard M.F and Rebeca B., "How to Improve Teaching Quality", Quality Management Journal, 6(2), 9-21 (1999), available at: www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/TQM.htm
[5]. Angela C., Damian C., and Graham F., "Techniques for effective Tertiary Teaching", available at: www.users.monash.edu/~domain/papers/HTML/TeachingTechniques.html [accessed on: March 23, 2018]
[6]. Fairuz R, Youagenraj K.S., and Zuraidy A., "Course Allocation System for lecturers", International Journal of Computer Applications (0975-8887) volume 180-No.22, Feb., 2018
[7]. "Design and Implementation of Departmental Course Allocation System", available at: https://iproject.com.ng/computer-science/design-and-implementation-of-departmental-course-allocation-system/index.html [accessed on: 14 August, 2018]
[8]. Anichebe G.E, "Using ICT in Combating Age Falsification Syndrome in developing countries", E-Governance Conference Proceedings-Covenant University Ota, Ogun State Nigeria, June 6-8, 2018

Anichebe Gregory Emeka "An algorithm for efficient allocation of courses to lecturers for effective teaching"International Journal of Engineering Science Invention (IJESI), vol. 07, no. 09, 2018, pp 68-74