Database Design Skills Need for Proficiency of Computer Science Students in Federal Universities in South-South, Nigeria

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ABSTRACT

It is observed by the researcher that Computer Science graduates are deficient in database design skills need for job creation. This deficiency in skills is not unconnected with the performance gap between what the national benchmark for Computer Science in Nigerian universities requires and what graduates of Computer Science can perform. The main purpose of this study was to determine the database design skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria. Two research questions and two null hypotheses were raised and formulated respectively to guide the study. Descriptive survey design was adopted to guide the study. The population of the study consisted 581 Computer Science lecturers and students in five federal universities offering Computer Science as a discipline in South-south, Nigeria. A sample of 236 lecturers and students was selected using a multi-stage sampling using stratified sampling and Taro Yamane formula; random sampling was employed to pick the selected lecturers and students. The researcher-developed instrument titled "Database Design Skills Need (DDSN)" questionnaire was used to collect data for the study. The instrument was face validated by three experts, one from the Department of Curriculum Studies, Educational Management and Planning, two from the Department of Vocational Education, all in the Faculty of Education, University of Uyo. Item discrimination method using Cronbach Alpha technique was employed to determine the internal consistency of the instrument and a reliability coefficient of .92 was obtained. Copies of the research instrument were administered by the researcher on the sample of 236 respondents out of which 229 representing 97% were returned and were used for analysis. Mean was used to answer the research questions and t-test statistic was used to test the null hypotheses at .05 level of significance. The findings revealed that, database normalisation, database programming skills are highly needed for proficiency of Computer Science students in Federal Universities in South-South, Nigeria. It is recommended among others that the Federal Ministry of Education through National Universities Commission (NUC) should re-design Computer Science curriculum specifically database design contents with practical-oriented concepts so that students will acquire the needed skills to design database for industries thereby creating jobs for themselves after graduation.

KEYWORDS: Database, Database design, Skills need, Normalisation, programming.

Introduction

Many university graduates of computer science are observed to be deficient in computer science skills such as programming, database design, networking, web development, algorithm development, and computer hardware maintenance, among others. These graduates further lack such database design skills as database security management, database normalisation, database entity-relationship modelling, database programming, database web development, data structures and algorithms development, multimedia databases, and general database applications skills, which are essential skills for database design and development. It is also observed that there is a performance gap between the skills needed by computer science graduates to be effective and productive on the job and what the students can perform upon completion of their four- or five-year degree programme at Nigerian universities. This gap implies that graduates of computer science may not be able to effectively engage in the job market or embark on any computer science-related venture that can create jobs for themselves and their counterparts.

According to Akpan, Ebieme, and Ekaenang (2014), a database is an organised collection of interrelated files stored on a computer. These authors furthered that database software such as Microsoft Access is used to collect, store, and manage massive amounts of data on individuals in an organisation. Databases and database technology have a major impact on the growing use of computers. Databases play a critical role in almost all areas where computers are used, including business, electronic commerce, engineering, medicine, genetics, law, education, and library science. Most organisations in Nigeria today depend to a large extent on database systems for the storage of data and information about their organisation's activities. Some of these organisations and databases include the National Youth Service Corps (NYSC) database, the Nigeria Police database, the Nigeria Army database, university databases, the Independent National Electoral Commission (INEC) database, the Civil Service Commission database, the N-Power database, the student database, the hospital database, the Joint Admission and Matriculation Board (JAMB) database, the National Universities Commission (NUC) database, and the West Africa Examination Certificate (WAEC) database, to mention but a few.

Database design is defined as the process of capturing the requirements of applications in a particular domain, mapping them onto a database management system, and tuning the implementation. There is a general agreement on the decomposition of database design into four steps (Batini, Ceri, and Navathe, 2002; Elmasri and Navathe, 2004; Ullman, 2002): requirements specification, conceptual design, logical design, and physical design. A requirement specification consists of eliciting requirements from users. Conceptual design develops requirements into a conceptual model (for example, the E-R model). The output of this step is called a conceptual schema. Logical design translates the conceptual schema into the data model (for example, the relational model) supported by the target database management system. Physical design transforms the logical schema into a physical schema suitable for a specific configuration. Traditionally, this activity has been based on the normalisation of individual relations (Beeri, Bernstein, and Goodman, 2008). Databases are usually designed by experts known as database designers. These designers could be practitioners in their industries.

Database designers are responsible for identifying the data to be stored in the database and for choosing appropriate structures to represent and store this data. These tasks are mostly undertaken before the database is actually implemented and populated with data. It is the responsibility of database designers to communicate with all prospective database users in order to understand their requirements and create a design that meets these requirements. In many cases, the designers are on the staff of the database administration and may be assigned other staff responsibilities after the database design is completed. Database designers typically interact with each potential group of users and develop views of the database that meet the data and processing requirements of these groups. Each view is then analysed and integrated with the views of other user groups. The final database design must be capable of supporting the requirements of all user groups.

Computer science lecturers in Nigerian universities are equally practitioners in the field of databases, as some of them are consultants to some industries where databases are mounted. Computer science students are trainees in database design, and they need the skills to be able to design and implement functional databases for organisations. With the right skills acquisition, students are capable of creating jobs in the field of databases, thus contributing their quota to national development. In the context of this study, database design skills need refers to computer science students' skills needs in database design. The variables considered in this study include database normalisation and database programming.

However, classical normalisation cannot characterise a relational database as a whole. Thus, redundancies and update anomalies can still exist in a set of normalised relations. Two lesser-known normal forms were defined to integrate the interaction of constraints in the database and detect redundancies (Goh, 2002; Ling and Goh, 2002; Ling, Tompa, and Kameda, 2000). Nowadays, relational database design goes through two phases: first, conceptual (ER) schema design, and second, translation into a relational schema. Conceptual models, rather than the relational model, provide a more precise and higher-level description of data requirements and constitute the starting point for logical design. According to Caplice and Ponce (2017), database normalisation is a fundamental component of database management related to organising data elements into relational tables in order to improve data integrity and reduce data redundancy. Database normalisation prevents data inconsistencies, wasted storage, and incorrect and outdated data. Tutorialspoint (2017) clarified that the database normalisation process ensures an efficient organisation of data in database tables, which results in guaranteeing that data dependencies make sense and also reducing the space occupied by the database via eliminating redundant data. The source added that this process is divided into three "normal forms, each of which represents the guidelines for how the database structure is designed or organised at that particular level. It is possible, however, to go beyond the 3rd Normal Form to the 4th, 5th, and so on in large and complicated databases, yet research shows that normalising a database to the 3rd Normal Form is sufficient.

According to Adeniyi (2005), "programming" is the act of coding in a given language to instruct the computer to solve a problem. A programming language is a set of specialised notations for communicating with the computer system; typical examples are BASIC, FORTRAN, COBOL, PASCAL, and C++ programming languages. Programming is fast becoming a necessary skill for university graduates. This is not just because of the

increasing demand for computer science and information technology professionals in the workplace but also because knowledge of at least the basic programming constructs is becoming more essential in many jobs. Furthermore, programming helps to develop key transferable skills for applying logic and reasoning to problem solving, something that benefits learners regardless of their final career destination. Over the past few years, most enterprises have become used to managing their information via electronic databases. Now, due to the popularity and accessibility of the World Wide Web, people are tending to retrieve information from web-based applications, either by companies or individuals. All these require programming skills to develop and bring to reality. This trend results in the use of databases for the storage of all types of information. Since databases provide the ability to store information in an organised fashion with easy access and retrieval, more and more web-based systems are relying on the database server to support the storage of certain information. Finally, with the application of distributed system theory, the different parts of such a system can run on multiple computers, which provides us with an easy and convenient way to enhance development and maintainability.

Purpose of the Study

The main purpose of the study was to determine the database design skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria. The study sought to:

1. determine database normalisation skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria.
2. determine database programming skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria.

Research Questions

This study provided answers to the following research questions:

1. What are the performance gaps in database normalisation skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria?
2. What are the performance gaps in database programming skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria?

Research Hypotheses

Ho_1: There is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria.

Ho_2: There is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database programming skills need for proficiency in Federal Universities in South-South, Nigeria.

Research Procedures

This study employed a descriptive survey design. This study is a descriptive survey because the researcher collected data from a large sample of respondents in Federal Universities in South-South, Nigeria, on database design skills needed for proficiency among Computer Science students. The design was therefore appropriate for this study, as it tended to obtain opinions from lecturers and final-year students of computer science at federal universities in the South-South on the database design skills needed by them for proficiency in database design. The independent variable in the study is the need for database design skills, which was further broken into two independent sub-variables: database normalisation and database programming. These variables were measured in this study because it is assumed that when students acquire skills in them, they will be able to design databases, thereby creating jobs for themselves on the completion of their programme.

The population of this study consisted 581 final year students and lecturers in five federal universities offering Computer Science discipline in South-South, Nigeria between the period of 2021/2022 academic session. The states are; Akwa Ibom, Cross River, Bayelsa, Rivers, and Edo state. The students' population in this study is considered as trainees in database design while the lecturers are adjudged to be database designers and practitioners. For the purpose of this study, the lecturers are the benchmakers while the students are to attend to the benchmark set by benchmakers in this study.

The respondents in the study consisted 236 comprising 146 final year Computer Science students and 90 Lecturers drawn from the population of 581 students and lecturers in 5 federal universities offering Computer Science in South-South, Nigeria. Taro Yamane formula was employed to obtain the sample of the study, the computation yielded 236 which were converted to percentage (41%). This 41% of final year students and lecturers respectively from each university was finally selected by random sampling. A multi-stage sampling method was used to select the sample of the study. This was done by stratifying the students and lecturers' population into five strata representing the five federal universities. The decision by the researcher to adopt 236 as a sample is supported by Krejcie and Morgan (1970) in Akpomi and Ordu (2009) who presented a table for various levels of population with their corresponding sample.

The researcher-developed instrument titled "Database Design Skills Need" (DDSN) Questionnaire was used in collecting data for the study. The instrument was meant for both Computer Science lecturers and Computer Science students. Both Computer Science lecturers and students responded to the performance ratings. The questionnaire is divided into two parts, that for Computer Science lecturers and that for Computer Science students. Each of these parts is sub-divided into two (A and B). Part 'A' contained the personal data of the respondents. Part 'B' contained the statements on the independent sub-variables which were grouped into two sections. Section 'A' solicited information from the respondents on database normalisation skills. Section "B" sought information on database programming skills. Each section of the questionnaire contained ten items. It should be noted in this study that all items used for the study questionnaire come from database design and information retrieval curriculum for Computer Science as developed by National Universities Commission (NUC). Responses

were made on a four-point rating scale as follows: Very High (VH) 4 points, High (H) 3 points, Averag (A) 2 points, Low (L) 1 point

Two validates were from the Department of Vocational Education and one from the Department of Curriculum Studies, Educational Management and Planning, all in the University of Uyo. These validates were requested to go through the draft copies of the instrument and make necessary corrections. The corrections, suggestions and recommendations of these validates were incorporated into the instrument. The decision by the researcher to adopt face validation is based on the remark by Kerlinger (1973) in Ukwuije and Obowu-Adutchay (2012) that validation by others is an effective method for face validation of research instrument.

Item Discrimination method was employed to establish the reliability of the research instrument. This method involves people performance in each item (Udoh, 2014). This method of reliability is associated with the use of Cronbach alpha formula. According to Udoh (2014), when the options in the items are on scale such as strongly agree, agree, disagree and strongly disagree, Cronbach Alpha coefficient is applied. The author furthered that the method involves finding variance of all individuals' scores for each item and then add these variances across all items. In order to use this method to establish the reliability of the instrument, the instrument was trial-tested on randomly selected 30 Computer Science Lecturers and Computer Science students respectively in Federal Universities in South-South, Nigeria who were part of the population but were not part of the main study. Cronbach alpha reliability formula was used to determine the internal consistency of the instrument which stood at 0.92. This coefficient justified the instrument reliable enough for the study.

The copies of the research instrument were administered by the researcher on the sample of 236 Lecturers and final year students of the Department of Computer Science in the five federal universities in South-South, Nigeria with the help of research assistants from those universities. The research assistants were briefed who helped the researcher to administer and collect the completed copies of the questionnaire within a space of two weeks. The lecturers' questionnaire was administered individually while the students' questionnaire was administered in a group. Out 236 copies of the questionnaire administered, only 229 copies were successfully collected and were correctly filled which represented 97% returns rate. Data from the copies collected were use for analyses. The seven (7) copies not collected and those not correctly filled representing 3% were disposed off through recycling.

The data collected was analysed using the mean to answer the research questions. The weighted mean for each skill performance expected by Computer Science lecturers was represented by (XE) while the weighted mean for each skill performance of Computer Science students was represented by (XP). The difference between the two means (x), that is, (XN) was determined to indicate the Performance gap, which could yield either a positive or a negative value. The independent t-test was used to test the two null hypotheses at 0.05 level of significance.

Decision Rule

(a) Where the value of performance gap has a positive value (+), it was indicated that there is skill need for database design because the level at which the skill is

required is higher than the level at which Computer Science students can perform it.

(b) A negative (-) value for the performance gap implied that there is no skill need for database design because the level at which the Computer Science students can perform the skill is higher than the level at which it is required.

(c) Zero (0) indicated that there is no skill need because the level at which the skill is required is the same as the level to which the Computer Science students can perform.

In testing the null hypotheses, the calculated t–value was compared with t-critical value. When the calculated t-values were greater than or equal to the t-critical value, the null hypotheses (HO) were rejected in favour of the alternative hypotheses.

Results and Findings

This section presents the results of data analysis based on research questions and null hypotheses.

Research Question 1: What are the performance gaps in database normalisation skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria?

Table 1: Summary of Performance Gap Analysis of Mean Responses of Computer Science Students in Database Normalisation Skills Need for Proficiency n = 229

S/N	Items	$\overline{XE}$	$\overline{XP}$	$\overline{XN}$	Rmk
1	Decompose database into First Normal Form	3.58	2.09	1.49	SN
2	Decompose database into Second Normal Form	3.52	1.91	1.61	SN
3	Decompose database into Third Normal Form	3.36	1.84	1.52	SN
4	Decompose database into Forth Normal Form	3.32	1.76	1.56	SN
5	Set primary key field	3.51	2.43	1.08	SN
6	Establish foreign key	3.67	1.79	1.88	SN
7	Set composite key	3.65	1.81	1.84	SN
8	Set database file descriptions	3.71	1.98	1.73	SN
9	Define schemas related for database decomposition	3.79	1.73	2.06	SN
10	Define data types, fieldname, field width/field type	3.67	1.87	1.80	SN

Key XE = Mean of Expected Performance, XP = Mean of Performance by students, XN= Mean of Performance Gap, SN = Skills Need, Rmk = Remark, DB = Database

The data presented in Table 1 indicate that all the identified items on database normalisation skills have their performance gap to be positive value (1.08 to 2.06), indicating that students' performance level is below what is required as indicated by the lecturers. The result implies that Computer Science students need skills on all the identified database normalisation for proficiency.

Research Question 2: What are the performance gaps in database programming skills need for proficiency of Computer Science students in Federal Universities in South-South, Nigeria?

Table 2: Summary of Performance Gap Analysis of Mean Responses of Computer Science Students in Database Programming Skills Need for Proficiency n= 229

S/N	Items	$\overline{X}E$	$\overline{X}P$	$\overline{X}N$	Rmk
1	Link database with Java	3.38	2.54	0.84	SN
2	Connect database with Php	3.38	2.32	1.06	SN
3	Connect database with Perl	3.52	2.31	1.21	SN
4	Connect database with C++	3.52	2.37	1.15	SN
5	Connect database with Visual Basic 6.0	3.40	2.52	0.88	SN
6	Connect database with Visual Basic.Net	3.50	2.17	1.33	SN
7	Manage MYSQL database with the WAMP server	3.51	2.08	1.43	SN
8	Connect database with Dreamweaver	3.68	1.88	1.80	SN
9	Set conditions for information retrieval	3.69	2.13	1.56	SN
10	Use exception handling to throw errors from DB	3.45	1.99	1.46	SN

Key XE = Mean of Expected Performance, XP = Mean of Performance by students, XN= Mean of Performance Gap, SN = Skills Need, Rmk = Remark, DB = Database

The data presented in Table 2 indicate that all the identified items on database programming skills have their performance gap to be positive value (0.84 to 1.80), indicating that students' performance level is below what is required as indicated by the lecturers. The result implies that Computer Science students need skill on all the identified database programming for proficiency.

Research Hypothesis 1: There is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria.

Table 3: Summary of t-test Analysis on the Difference in the Mean Responses of Computer Science Lecturers Expected Performance Rating and Students Performance Rating in Database Normalisation Skills Need for proficiency in Federal Universities in South-South, Nigeria

S/N	Database normalisation skills	Group	N	$\overline{X}$	SD	t-cal	t-crit	Dec
1	Decompose database into first normal Form	Lecturers Students	84 145	3.58 2.09	.496 1.12	11.60	1.96	S
2	Decompose database into second normal Form	Lecturers Students	84 145	3.52 1.91	.502 .054	13.19	1.96	S
3	Decompose database into third normal Form	Lecturers Students	84 145	3.36 1.84	.614 1.01	12.46	1.96	S
4	Decompose database into forth normal Form	Lecturers Students	84 145	3.32 1.76	.584 .937	13.80	1.96	S
5	Set primary key field	Lecturers Students	84 145	3.51 2.43	.503 1.05	8.81	1.96	S
6	Establish foreign key	Lecturers Students	84 145	3.67 1.79	.499 .914	17.40	1.96	S
7	Set composite key	Lecturers Students	84 145	3.65 1.81	.478 .844	18.41	1.96	S
8	Set database file description	Lecturers Students	84 145	3.71 1.98	.454 1.03	14.62	1.96	S
9	Define schemas related for database decomposition	Lecturers Students	84 145	3.79 1.73	.413 .844	20.90	1.96	S
10	Define data types, fieldname, field width/field type	Lecturers Students	84 145	3.67 1.87	.474 1.10	14.29	1.96	S

S = Significant, df = 227, Significance @p<.05 Source: Field Work (2018)

Table 3 gives the summary of the t-test analysis comparing the difference in the mean responses of Computer Science lecturers' expected performance and students performance rating in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria. The result shows that the difference in the responses of the two groups were statistically significant in all the ten items on database normalisation skills with (calculated t-values ranging from 8.81 to 20.90, and Critical t-value of 1.96 at 227 df). Since all the calculated t-values are greater than the Critical t-value of 1.96 at .05 alpha level, it implies there is a significant difference in the mean responses hence, the null hypothesis which states that there is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria is rejected.

Research Hypothesis 2: There is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database programming skills need for proficiency in Federal Universities in South-South, Nigeria.

Table 4: Summary of t-test Analysis on the Difference in the Mean Responses of Computer Science Lecturers Expected performance Rating and Students Performance Rating in Database Programming Skills Need for Proficiency in Federal Universities in South-South, Nigeria

S/N	Database Programming Skills	Group	N	$\overline{X}$	SD	t-cal	t-crit	Dec
1	Link database with Java	Lecturers	84	3.38	.489	6.44	1.96	S
		Students	145	2.54	1.13			
2	Connect database with Php	Lecturers	84	3.38	.489	8.32	1.96	S
		Students	145	2.32	1.11			
3	Connect database with Perl	Lecturers	84	3.52	.548	9.57	1.96	S
		Students	145	2.31	1.08			
4	Connect database with C++	Lecturers	84	3.52	.526	8.77	1.96	S
		Students	145	2.37	1.14			
5	Connect database with Visual Basic 6.0	Lecturers	84	3.40	.583	7.18	1.96	S
		Students	145	2.52	1.04			
6	Connect database with Visual Basic.Net	Lecturers	84	3.50	.611	10.76	1.96	S
		Students	145	2.17	1.03			
7	Manage MYQL database with the WAMP server	Lecturers	84	3.51	.570	11.53	1.96	S
		Students	145	2.08	1.06			
8	Connect database with Dreamweaver	Lecturers	84	3.68	.519	16.37	1.96	S
		Students	145	1.88	.924			
9	Set conditions for information retrieval	Lecturers	84	3.69	.490	12.76	1.96	S
		Students	145	2.13	1.06			
10	Use exception handling to throw errors from database	Lecturers	84	3.45	.629	11.02	1.96	S
		Students	145	1.99	1.12			

S = Significant, df = 227, Significance @p<.05 Source: Field Work (2022)

Table 4 gives the summary of the t-test analysis comparing the difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database programming skills need for job proficiency in Federal Universities in South-South, Nigeria. The result shows that difference in the responses of the two groups were statistically significant in all the ten items on database programming skills with (calculated t-values ranging from 6.44 to 16.37, and

Critical t-value of 1.96 at 227 df). Since all the calculated t-values are greater than the Critical t-value of 1.96 at .05 alpha level, it implies there is a significant difference in the mean responses hence, the null hypothesis which states that there is no significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database programming skills need for proficiency in Federal Universities in South-South, Nigeria is rejected.

Findings of the Study

The result of data analysed reveals the following findings based on research questions answered and null hypotheses tested.

1. Computer Science students need database design skills in all identified items on database normalization for proficiency in Federal Universities in South-South, Nigeria.

2. Computer Science students need database design skills in all identified items on database programming for proficiency in Federal Universities in South-South, Nigeria.

3. There is a significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria.

4. There is a significant difference in the mean responses of Computer Science lecturers' expected performance rating and students performance rating in database programming skills need for proficiency in Federal Universities in South-South, Nigeria.

Discussion of Findings

The findings of this study are discussed based on the specific purposes of the study:

Database Normalisation Skills Need for Proficiency of Computer Science Students

The results of finding revealed that there is a gap in the performance level of the computer science students in database normalisation skills as compared with the basic level of expected performance. Also, the t-test analysis revealed that there is a significant difference in the mean responses of computer science lecturers expected performance rating and students performance in database normalisation skills need for proficiency in Federal Universities in South-South, Nigeria. Although, inculcation of database normalisation skills is among the focus of database design as enshrined in Computer Science curriculum, the result of the findings clearly shows that students are yet to attain the expected level of database normalisation skills for proficiency. Hence, organisations depending on database management and retrieval could be frustrated in the near future if nothing is done. This is because database normalisation skills can help graduates of Computer Science to normalise database, hence, skills acquired could be employed to create jobs.

The result of the findings of the study is in support of Hoffer, Prescott and McFadden (2002), who maintained that students encountering the process of data

normalisation for the first time find it difficult to understand the concepts of anomalies and dependencies and consequently are not able to normalise a given set of unnormalized data. The findings of the study is also in consonance with the assertion by Jones and Rama (2006), who also maintained that database normalisation is always difficult to present by most lecturers to students and that it is often difficult to motivate students to learn database normalisation because of the dry and theoretical way in which it is presented in textbooks and classes.

The findings of the study add support to the assertion by Folorunso and Akinwale (2010), who affirmed that students in tertiary academic institutions find it difficult to learn the subject of database design theory, and in particular, the database normalisation process, as the normalisation algorithms often require extensive relational algebraic backgrounds that most Computer Science students lack. Relational data model theory (normalisation) tends to be complex for the average designer, and students will always want to avoid it. Thinking along this direction, Gaikwad, Kadri, Khandagle, and Tava (2017) submitted that database normalisation is a complex theoretical process that is hard to understand by learners, which does not facilitate encouraging people to learn it. In the same vein, the findings of the study also agree with the assertion of Wingenious (2005), who earlier confirmed that, besides being a complex subject to learn, database normalisation is a critical part of an effective database design, which is vital in guaranteeing data integrity and eliminating data redundancy in a database system. The ability to normalise databases would help students apply such skills to prevent data inconsistencies, wasted storage, and incorrect and outdated data. While data normalisation skills are highly needed by students for effective database design, lecturers find it difficult to motivate students to learn them, as observed by Alappanavar, Grover, Hunjan, Patil, and Girnar (2013), because they consider this subject to be dry and purely theory-based. On the contrary, lecturers should encourage students to practice database normalisation through practical-oriented lectures, as this will reduce the complex nature and abstract concepts to practical and design-based concepts, which would help students employ such skills in creating jobs.

Database Programming Skills Need for Proficiency of Computer Science Students

The results of finding revealed that there is a gap in the performance level of the Computer science students in database programming skills as compared with the basic level of expected performance. Also, the t-test analysis indicated that there is a significant difference in the mean responses of Computer Science lecturers expected performance rating and students performance in database programming skills need for proficiency in Federal Universities in South-South, Nigeria. The possible reason for the performance gaps could be that the students might not have been exposed to every aspect of database programming skills in the curriculum. Perhaps, for Computer Science students to succeed in designing databases, they require adequate exposure to database programming skills, to enable them to put up programming code that will drive databases, especially in a competitive environment.

The results of the findings of this study is buttressed by Ala-Mutka (2010), who opined that learning to program is generally considered hard and that programming courses often have high dropout rates. In the same vein, Schmitt and Aflaki (2003) also reported that in a study, Biggs (2009) found that students attend a university "not out

of a driving curiosity about a particular subject or a burning ambition to excel in a particular profession but to obtain qualifications for a job. According to Biggs, the students have a less developed background of relevant knowledge; they come to lectures with few questions and only to put in sufficient effort to pass. The author also reflected on a finding related to students' performance from the statistical evidence of the 2006/2007 to 2009/2010 academic session for programming language examination results, which revealed poor performance. The performance gap and even poor performance in database programming revealed in this study is in support of an earlier finding by Field (2001), who found that most students choose to seek their computer education by concentrating on the softer, less technical aspects of computing and more on the general business aspects of the field, than on the technical aspect (programming), which is a combination of Computer Engineering and Computer Science. The findings of the study imply that for Computer Science students to bridge the performance gap created by their lack of skills in database programming, the lecturers will need to re-train them in an environment that is a replica of the environment in which they would subsequently work.

Conclusion

On the basis of the findings of this study, it is concluded that there is a performance gap in database design skills need for proficiency of Computer Science students as against the national benchmark set for Computer Science in Nigeria universities. It is further concluded that Computer Science students need database design skills in respect of database security management, database normalisation, database entity-relationship modeling, database programming, database web development, data structures and algorithms development, multimedia database, and general database applications for effective database design. Furthermore, Computer Science lecturers and students are observed to be differing significantly in their mean responses on database design skills need for proficiency in Federal Universities in South-South, Nigeria.

Recommendations

In line with the findings of the study, the following recommendations are made:

1. The Federal Ministry of Education through National Universities Commission (NUC) should re-design Computer Science curriculum specifically database design content with practical-oriented concepts so that students will acquire the needed skills. Skills acquired would be utilised in job creation by students.

2. The National Universities Commission (NUC) should emphasize the importance of hands-on-practice lectures during its periodic visit for accreditation in the various departments of Computer Science in Federal Universities in Nigeria.

3. The Federal Ministry of Education through National Universities Commission should train and re-train Computer Science lecturers especially those who lecture database design courses in the skill areas identified in this study so that they will be adequately equipped to engage students in practical-oriented lectures.

4. The lecturers in the Departments of Computer Science at various universities should organise periodic lectures, workshops and seminars to both students and lecturers on the importance of database design to national development, such lectures will encourage students and lecturers to go for further training on database design skills acquisition. Skills acquired in such workshops could be employed in creating jobs.

5. The Federal Government through the Federal Ministry of Education should equip all Departments of Computer Science laboratories with working computer systems and database application packages for effective teaching of database design in the Federal universities.

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