An Object-based Model for Assessment of Quality of Teaching in Institutions of Higher Learning in Nigeria: A Case of the Federal University of Technology Owerri, Nigeria

Wilson Nwankwo, M.Sc., MBA, PMP, MIEEE (Corresponding Author)
Global Scan, 5b Oko Awo street, Victoria Island, Lagos, Nigeria.
Email: willyscnn@yahoo.com
GSM: +2349090218703, +2348037636067

Fidelia Udoka Eze, Ph.D
Dept. of Information Management Technology,
Federal University of Technology, Owerri, Imo State, Nigeria.
Email: drezeudof@yahoo.com
GSM: +2348037723003

Abstract

In most learning Institutions in Nigeria, the quality of teaching delivered by Lecturers/Teachers are not usually given the attention it requires and where such is done, it is often done in a crude way using semi-automated approaches. This research is conceived to examine how Information and Communications Technology could be employed to collect data for the assessment of quality of teaching delivered by Teachers/Lecturers in the Institutions of higher learning in Nigeria. To achieve this, this research studies a University of Technology in the South-East of Nigeria, conceives and designs an object-oriented model for harnessing the relevant data needed to conduct such assessment into a central database. This system can be used to submit feedbacks on the performances of the Lecturers and also enable educational administrators view statistics of submissions. As the data is collated in a central database, analytical tools could be employed in conducting further analysis on Lecturer performance evaluation to drive advanced decision making.

Keywords: Assessment of quality of teaching, Databases, Web Application

1. Introduction

1.1. Background Information

One of the factors that is usually considered important in the grading or rating of an Educational Institution is the level of knowledge or skill/manpower which the Institution has capacity to develop and impact on the recipients. The major direct recipients are usually students who are enrolled to pursue one academic program or the other. In an Institution where emphasis is placed on the general development of students, academic policies are implemented to track the performance of such students as they make progress in their various programmes. As students are at the receiving end, it may not be unusual to infer that the knowledge or skill acquired by a student during the learning period is a direct function of what is offered by the Institution in question. Knowledge or skill transfer process is usually engineered by the teachers/lecturers, who are the direct agents or representatives of the Institution. The quality of what is offered to the students will determine the performance of the students during and after the training period.

In the light of this, emphasis must be placed on the how the chain of activities during the knowledge transfer period is conducted. As lecturers play a key role in training and evaluating the performance of students, students in the other hand can also evaluate the performance of lecturers, in that regard, a balance is maintained which could lead to the attainment of the required developmental goals set by the Institution. The process whereby students are given the responsibility to provide relevant information on their learning experience in a given period as regards to the lectures or teaching received may be regarded as "an assessment of the quality of teaching". The assessment is done in respect of a specific course undertaken by a student usually in a semester or term. To enable students contribute in this activity, a medium is created to assist in the collection and submission of data regarding the learner's experience. The type of medium used is usually dependent on each Institution. In many cases, physical forms are made available to students, which they are required to complete and return to the indicated authority within an Institution.

There are three levels of higher Institutions in Nigeria namely: Colleges of Education, Polytechnics, and Universities. Many Colleges of Education follow a particular administrative structure; the same is true for Polytechnics and Universities. There are however, marked similarities among the three tiers. The Colleges of Education has the National Certificate of Education (N.C.E) as their premier academic award though some award degrees in affiliate with the Universities. The Premier award in the Polytechnics is the Higher National Diploma (H.N.D.), whereas the Universities generally award various classes of degrees. Though these Institutions differ in their scope, the ultimate goal at each tier is to develop human capacity in line with the National Policy on Education

As we are living in the Information revolution age where Information Technology has become part of every sector of the society to the extent that the success or failure of an organization, Institution, or business is adjudged by the standard of Information Technology infrastructure on which its policies and activities are implemented or executed. Every facet of an organization revolves around an information architecture; which forms a bridge between the past and the future, containing knowledge of the past (i.e., observations and trends), knowledge of the future (i.e., predictions and prognostications) and perhaps decisions about the way things "ought" to be. The emergence of the internet, client-server technologies, and databases, has revolutionized the way things are done. The collection, collation, analysis and reporting processes have shifted from the conventional manual ways involving the use of physical files, forms and storage cabinets to the use of more sophisticated technologies such as web and database technologies.

Web technologies as compared to single-user applications; have gained more acceptance to people in various Institutions since it eliminates the location restrictions usually seen as a major problem associated with single-user or standalone systems.

In this paper, we examine how lecturers are assessed in Institutions of higher learning in Nigeria. We identify the strengths and weaknesses of the systems employed. We also present the design of a model/prototype web application which can be used to collect, collate, analyze and store the various data that may be needed to assess the performance of lecturers.

1.2. Objectives and rationale

This paper is aimed at designing database-driven system, which will support the assessment of quality of teaching procedures in an Institution of higher learning. To achieve this, we employed the following objectives:

i. To study a famous Institution of higher learning in Nigeria in order to ascertain challenges and problems faced by the persons involved in the assessment of quality of teaching process;

ii. Identify the data sources, frequency of occurrence, processing platform, storage formats as they affect the above process; and design an object-based model system that will support these processes

1.3. Importance of this paper

The Nigeria National Policy of Education was launched in 1977. Though it has undergone several reviews till date, the main goals of tertiary education remains oriented towards:

i. Contributing to national development through high level relevant manpower training;
ii. Developing and inculcating proper values for the survival of the individual and society;
iii. Developing the intellectual capability of individuals to understand and appreciate their local and external environments;
iv. Acquiring both physical and intellectual skills which will enable individuals to be self- reliant and useful members of the society;
v. Promoting national and international understanding and interaction.

Arising from the goals of tertiary education, the [1] stipulated that University Education will make optimum contribution to national development by intensifying and diversifying its programmes for the development of high level manpower within the context of the needs of the nation.

In the light of the foregoing, the Nigeria's Vision 20:2020 (NV2020) project which is designed to identify and upgrade to international standards, key aspects of the Nigerian economy such as: agriculture, the polity, infrastructure, education, manufacturing, information and communication technology, so as to propel Nigeria to become one of the world's 20 leading economies by the year 2020, comes to the fore.

The policy on education revolves much around manpower development that is, equipping students in our Institutions of higher learning with appropriate knowledge and skills for economic development.

To drive academic programmes that will achieve the policies requires accurate and concrete information, which should be extensive enough to provide insight on every lecturer as regards performance and assessment. It is worthy of note that the relevant data generated from the assessment of the quality of teaching could also be used to conduct a comparative analysis on the performance of the students in the various courses they have undertaken. When a lecturer attains a high assessment score on a particular course, there is the tendency that the students that undertook the same course taught by the lecturer would perform above average. A system that could provide this information would indeed support the intelligent decision making by Educational administrators whereby decisions could be made regarding which lecturer teaches what course, which lecturer requires further training or assistance, and which course requires additional support staff. There is no doubt that decisions taken by these authorities (administrators) would have far reaching effect on student development, which is at the centre of the national policy on education in Nigeria.

1.4. Scope

The assessment of the quality of teaching is imperative and plays an excellent role in both staff and student programmes. It is believed that a model designed to cater for this function in one Institution could be adopted in the other. In this paper, the areas of investigation, which are prerequisites to the assessment of quality of teaching function, are: Course registration, Course allocation, Semester Examinations, and Student performance. The terms 'teacher', 'lecturer' and 'academic staff' are used interchangeably in this paper and should be construed as same.

We regard each area identified above as a sub-system or sub-domain. As each area contributes to the assessment process, the challenges as regards data capture, format, processing, storage and utilization of the stored data are studied and documented.

2. Methodology And System Design

2.1 Overview

To develop a software system requires the selection of a coherent suite of methods that is, a methodology. Methodology may be defined as a framework that is used to structure, plan, and control the process of developing a system. We adopted the object-oriented analysis and design methodology (OOADM). Object-oriented analysis and design is the method that leads us to an object-oriented decomposition [2]. By applying object-oriented design, a software that is resilient to change and written with economy of expression, is created. The object-oriented analysis and design methodology, like other standard software methodologies, operates on a lifecycle model. The lifecycle model as described by [3] is shown in Figure 1. It comprises two segments: the real world representation and the computerized model which reflects the real world environment. The real world model includes the requirements which must be satisfied by the users of the system and a simple description of the processes through which the users achieve the requisite goals on the system. The various requirements are discovered during system analysis.

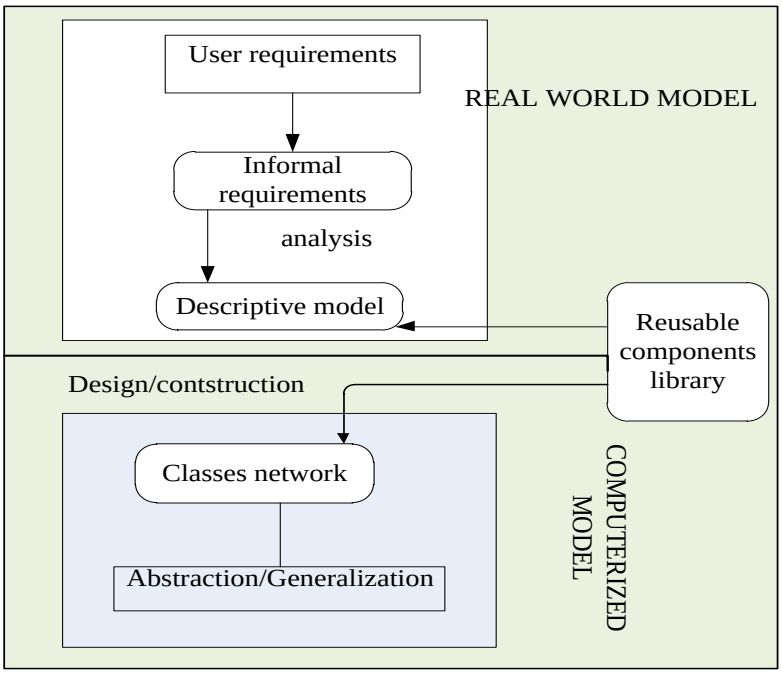

Figure 1. The object-oriented analysis and design lifecycle [source: Nerson, 2006]

2.2 Materials and Methods

The materials and methods usually include all apparatuses, techniques and procedures employed during a research. The methods and materials used in this project are described in the subsections following.

2.2.1. Documentation.

To understand the real world model, which is, how the assessment of quality of teaching is done in the University, requires a careful observation and documentation of the various tasks performed in the system. In this study, we observed and documented how data flows in and out of the sub-systems identified above. In object-oriented terminology, every participating entity in the real world model is regarded as an object. For

instance, students, lecturers, courses, etc. are objects. Objects possess both static and dynamic characteristics. The static characteristics are the attributes or properties whereas the dynamic characteristics are the actions performed by the objects and usually called the methods. Objects in a domain interact with each other giving rise to various forms of interrelationships such as: association, aggregation, composition and inheritance. A detailed discussion on these relationships that exist among objects is beyond the scope of this paper.
However, the following areas were covered:

i. Student registration, course registration, course allocation, assessment of quality of teaching process;
ii. Databases/Data warehouses (if any) and other programs used;
iii. The physical forms used(if any);
iv. Challenges posed by the present system.

2.2.2. Development tools.

The tools that were used for analysis and development are: Microsoft Visual studio; Pentaho data integration (Kettle), and Microsoft SQL Server.

2.3. Analysis of the existing system

The term system is derived from the Greek word ‘systema’, which means an organized relationship among functioning units or components.
A system is therefore ‘a collection of organized activities that exist for some purpose' or 'structures which exhibit order'. The key words in the definition are organization, order and purpose. These words are crucial in understanding systems; they are not a random collection of elements, they are something that is organized to deliver specific goals/objectives; systems have a 'purpose'. From the above definition, an organization such as a University may be called a system. The totality of procedures in an organization also fits into the definition of a system. A system may be hard or soft. Soft systems include entities and organizations, whereas, hard systems include computer software, hardware, etc. System analysis is the process of gathering and interpreting facts, identifying problems, and using the information to recommend improvements to the system.
To detect whether or not challenges and problems exist, we specified the following:

i. The actors (who does what or plays a role in the system);
ii. The business process model (what happens in the system or what is going to happen in the new system) using an activity diagram;
iii. Use cases (what the participants are doing in the system or what the users/participants will be doing with the new subsystem);
iv. The interaction, that is, the sequence of activities and collaboration (interaction among two or more classes or objects);
v. Classification (classes of objects/entities, their attributes, relationships and methods) using class diagrams.

Actors**:** The actors involved in this system are: Students, Lecturers, Head of Department (HOD), administrative officers/statisticians in the Office of the Vice Chancellor.
The requirements for participating in the assessment of quality of teaching process are:

i. A participating student in the assessment process must have been duly registered for an academic programme and must have registered the course(s) for which an assessment is to be submitted in the given academic session;

ii. The course for which an assessment is to be submitted must have been allocated to a Lecturer by the Head of a department though not in all cases;
iii. The student collects a physical form, completes and returns it to the office of the Vice Chancellor for further actions.

How is the assessment of quality of teaching done at present?

The assessment of the quality of teaching delivered by a given academic staff as it affects a particular course is based on the overall responses from anonymously completed 'assessment of quality of teaching' forms(questionnaire) distributed to students from the Vice Chancellor's office. The responses capture the student's level of satisfaction on a taught course as reflected by the graded questions in the questionnaire. The questionnaire at present is a physical form comprising of a number of questions grouped into different sections. Each question has an option. The options are graded accordingly using the likert-type scale. The highest scale is 4 and the lowest is zero (0). The responses on each form are computed to give an average score. The overall score on a course is computed as a percentage of the cumulative scores by all students who had undertaken the course in the semester.
For a detailed analysis we employed use cases, activity diagrams and class diagrams.

2.4. Use case analysis

A use case is a functionality the users need from the system. In other words, a use case models the behaviour of a system at a lower level whereas activity diagrams models the behaviour of a system at a higher level. In object-based analysis, use cases are also used to depict the requirements analysis process. The functionalities defined by a use case are represented using the use case diagram. A use case diagram usually shows the relationships between the actors and use cases. When we say what an actor did (does), that's a use case. The 'Actors' represent external entities of the system, which can be people or things that interact with the system. For example, in this paper, the actors include: the lecturers, administrators and lecturers. The use case diagram of the present system is shown in figure 2. The diagram shows the actors that take part in the assessment of quality of teaching function. The student registers a course, which is assigned to a lecturer (or lecturers). At the end of the semester, when the teaching activity has been concluded, the student collects physical questionnaires, completes and sends them back to the administrative office where such forms are collated for recording and analysis.

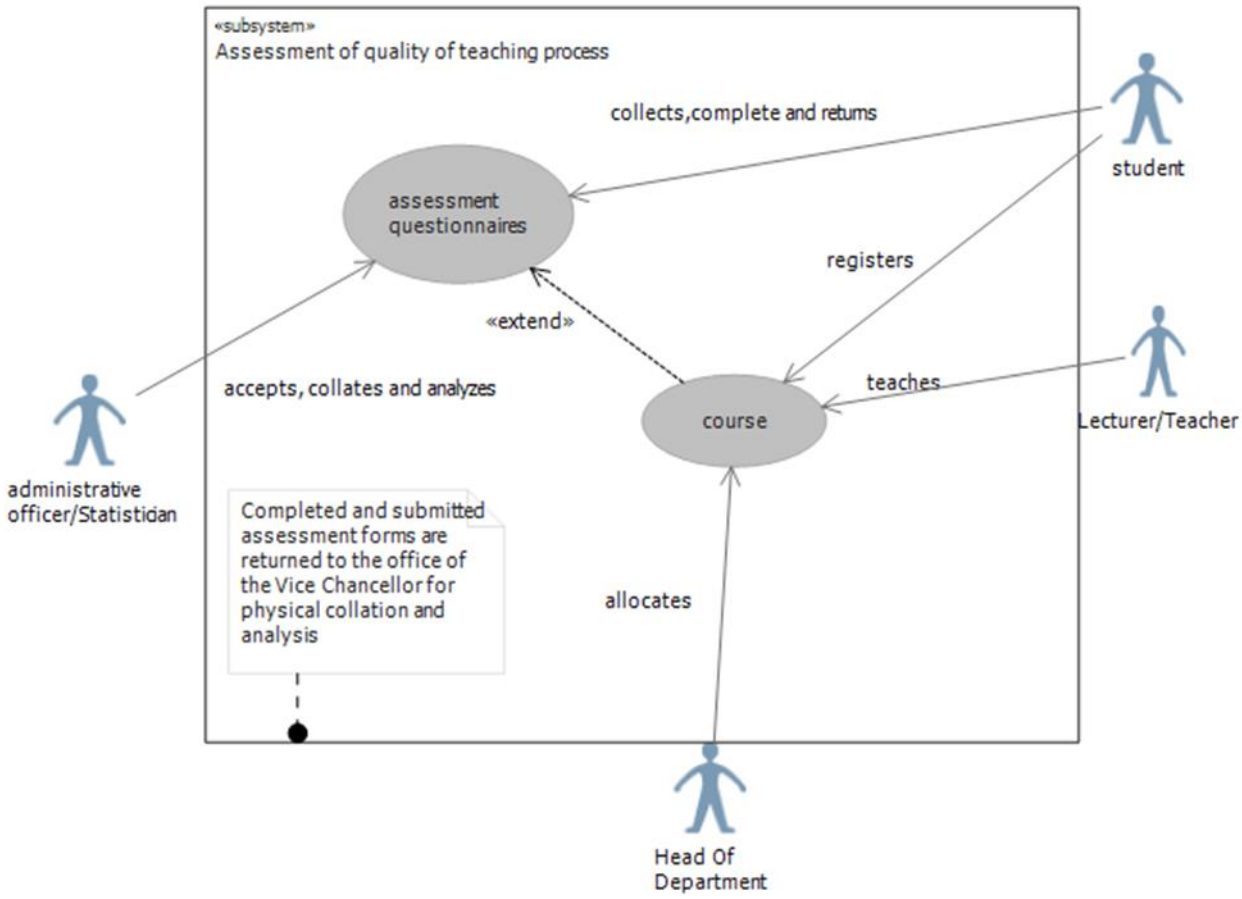

Figure 2. Use case diagram of the existing system.

2.5. Challenges in the existing system

The problems identified include:

i. Students regard the collection and completion of the forms(questionnaires) as a heinous task and are often discouraged from doing so since the non-completion does not attract any disciplinary action;
ii. Few forms are often returned to the issuing authority;
iii. The number of completed forms is not a representative fraction to rely on for decision-making;
iv. A lot of resources are wasted in printing physical forms;
v. The storage of physical forms in folders and file cabinets expose them damage by rodents and insects;
vi. As an activity that is done every semester, much useful space is wasted storing the ever- growing completed forms;
vii For each course undertaken, the student is expected to complete and submit a questionnaire making the entire process very cumbersome;
viii. Analysis of data contained in the physical forms is time-consuming and may not be sustainable as the population of students increases

The second use case diagram is shown in figure 3 and represents the proposed system. In this scenario, the student would log onto the system, access his/her registered courses, and submit an assessment of quality of teaching questionnaire for each course that he/she has been taught. The submitted questionnaires are automatically processed and stored in the transaction database. The data in this database is periodically sent to the data warehouse through an extract-load-transform system.

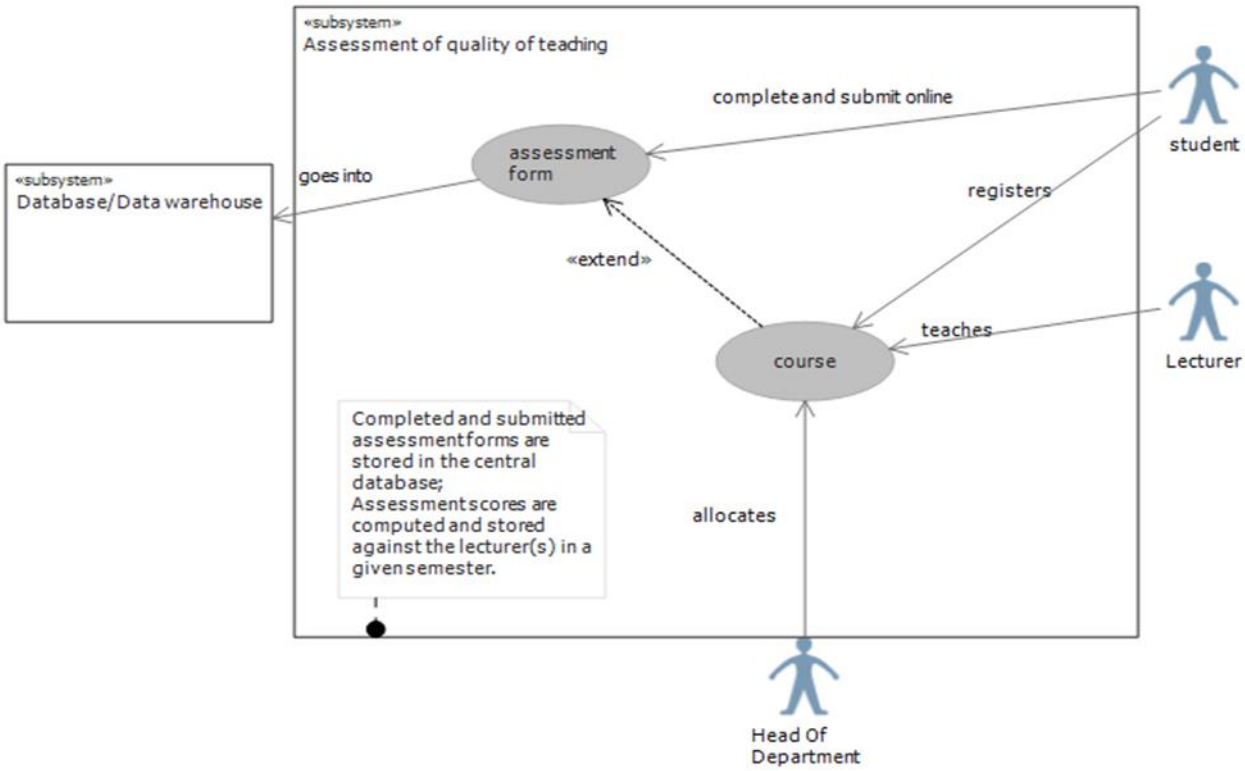

Figure 3: Use case diagram of the proposed system

2.6 Modeling the proposed system

In the light of the identified challenges, we have proposed a web-based database-driven program that could be used at the convenience of each registered student, as well as administrators. Also, we include a model data warehouse and a data mining function through which the results of assessment could be used to make predictions. As mobile smart devices with internet facility have become students' companions, we believe that students, who are frequently on the web, will find the completion of the assessment forms on the internet very easy and less time consuming.

A system could be modeled at behavior and structural levels. We have discussed the use case which often models a system at a lower level. The next phase discussed here is the structural modeling. Structural modeling could be done at two levels: higher and lower levels. At the higher level component diagrams consisting of packages are used to represent the structure of a system. At the lower levels, we use the class diagrams. The class diagrams are used here. A class diagrams represent the model of the real world system in terms of the various data requirements. In object-oriented modeling, the data requirements may be modeled at three levels: the conceptual, logical and physical models. A conceptual model consists of concepts that aid in understanding or simulating a subject the model represents. It shows the various objects and their relationships with other objects but does not provide the specifications of the attributes that make up each object. A logical data model is based on the conceptual model and has the data attributes specified as well as the primary and foreign key relationships. The most detailed is the physical data model which is a representation of the complete data design and takes into account the structure and constraints of a given database management system. It extends the logical model to provide implementation details such as table names, column names and data types.

2.6.1. Class analysis and design.

As earlier stated, the object-oriented paradigm emphasizes on objects and the relationships among the objects. In program development, an object stores both data and functions (also called methods), and is implemented using a class; whereas, for persistence, each object is implemented as a table using the relevant database system. Objects must be identified first prior to implementation. The objects identified are: Person, Student, Lecturer, Semester, Programme, Programme_Course, School,Department, Session, Course, RegisteredCourse, CourseResult, AssessmentQuestion, FeedbackOnQuestion, Feedback, FeedbackScore, StudentLevel, and Login. Table 1 presents the object dictionary. The object dictionary presents a description of each object identified in the course of system analysis.

Table 1. The object dictionary

Object class	Representation
Person	This is a superclass representing every individual person in an Institution. Other classes such as the Lecturer and student inherit from the person object
Student	This object represents all the attributes and methods shared by all students
Lecturer	represents attributes shared by all academic staff of the institution
Course	represents an academic course or subject
RegisteredCourse	represents a course that has been registered by a student
AllocatedCourse	Represents an academic course assigned to a faculty/lecturer in a semester
CourseRole	This object represents the various roles a lecturer may take on an assigned course. For instance, a lecturer may assume a role such as: adjunct lecturer, chief lecturer, etc.
CourseResult	Represents a course by course result of a student at the end of a semester
AssessmentQuestion	This object represents questions about the assessment of quality of teaching of an academic staff on a given course at the end of a semester to be answered by a student who has undertaken that course. A student who has been taught by an academic staff provides feedback based on the content of the questions
FeedbackOnQuestion	This represents the response to each question in the questionnaire
Feedback	This object represents the total responses or score from a student for each course questionnaire
FeedbackScore	This object represents the cumulative score from all completed questionnaires on a given course in a semester
Login	This object represents the access credential of the user of the system
Department	This object represents a department in a school or college
School	Represents a school or college in an institution
Programme	This object represents an academic programme offered by a department
Semester	This object represents a semester
Session	This object represents an academic session usually consisting of two semesters
StudentLevel	This object represents the academic level of the student in each academic session
Programme_Course	This object represents a course associated with a given academic programme

At this point, the logical model is of more importance. For simplicity, we split the logical model into three schemas: school, student, and assessment schemas. Each schema is a group of classes/objects within a given sub-domain. The schemas are shown in the figures 4, 5, and 6 respectively. In figure 4, the relationship between the school and department objects is a composition. The same is applicable to that between the Session object and the Semester object. Other relationships are association relationships.

In figure 5, inheritance relationships exist between the Person object and the Student and Lecturer objects respectively. That is, both the student and lecturer objects inherit from the Person object (a super object). Association relationships are common between objects. For instance, there is a one-to-one association relationship between a student and a login object. A lecturer may be associated with zero or more registered courses (RegisteredCourse). A student may be associated with zero or more course results.

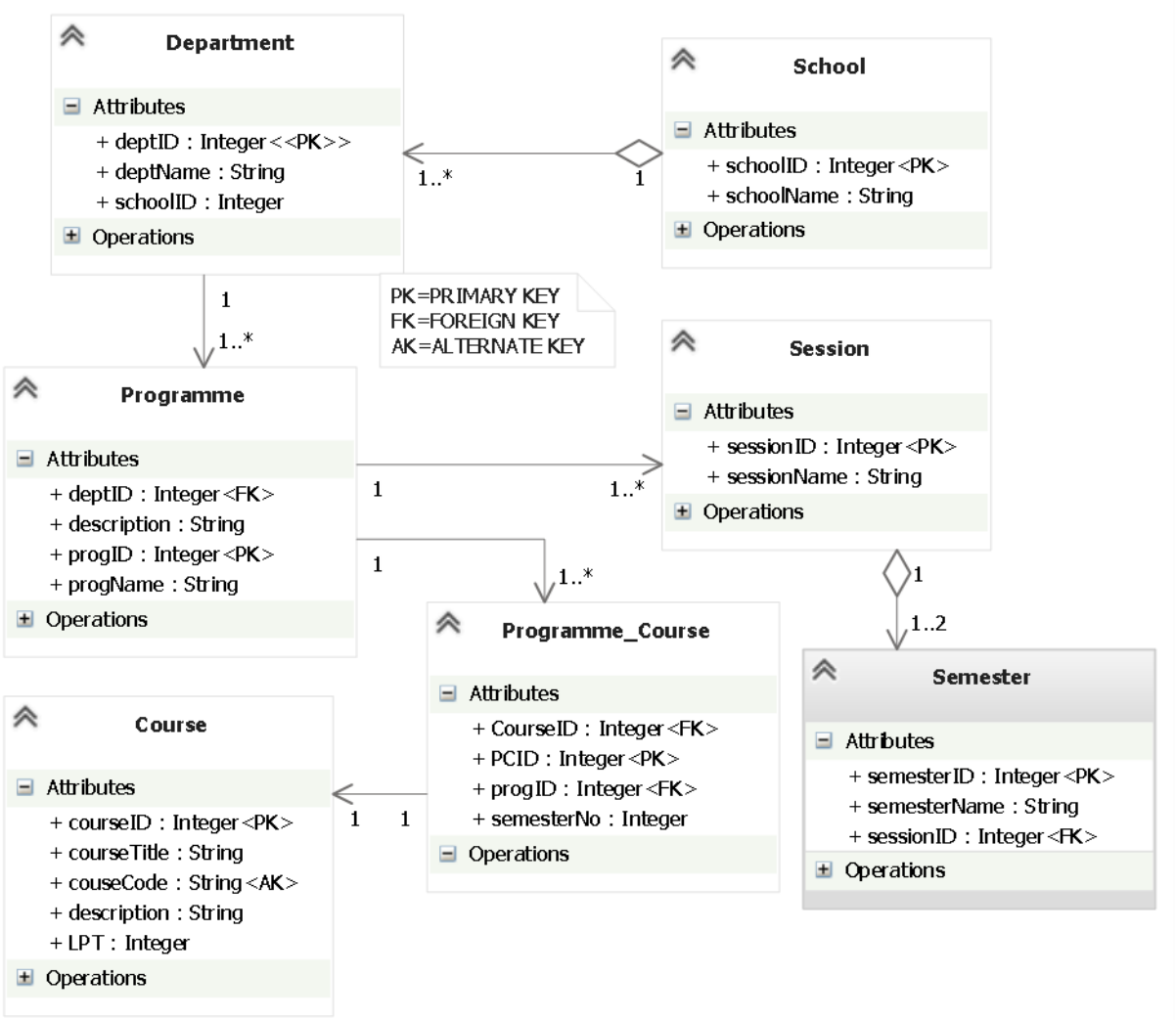

Figure 4. The School schema

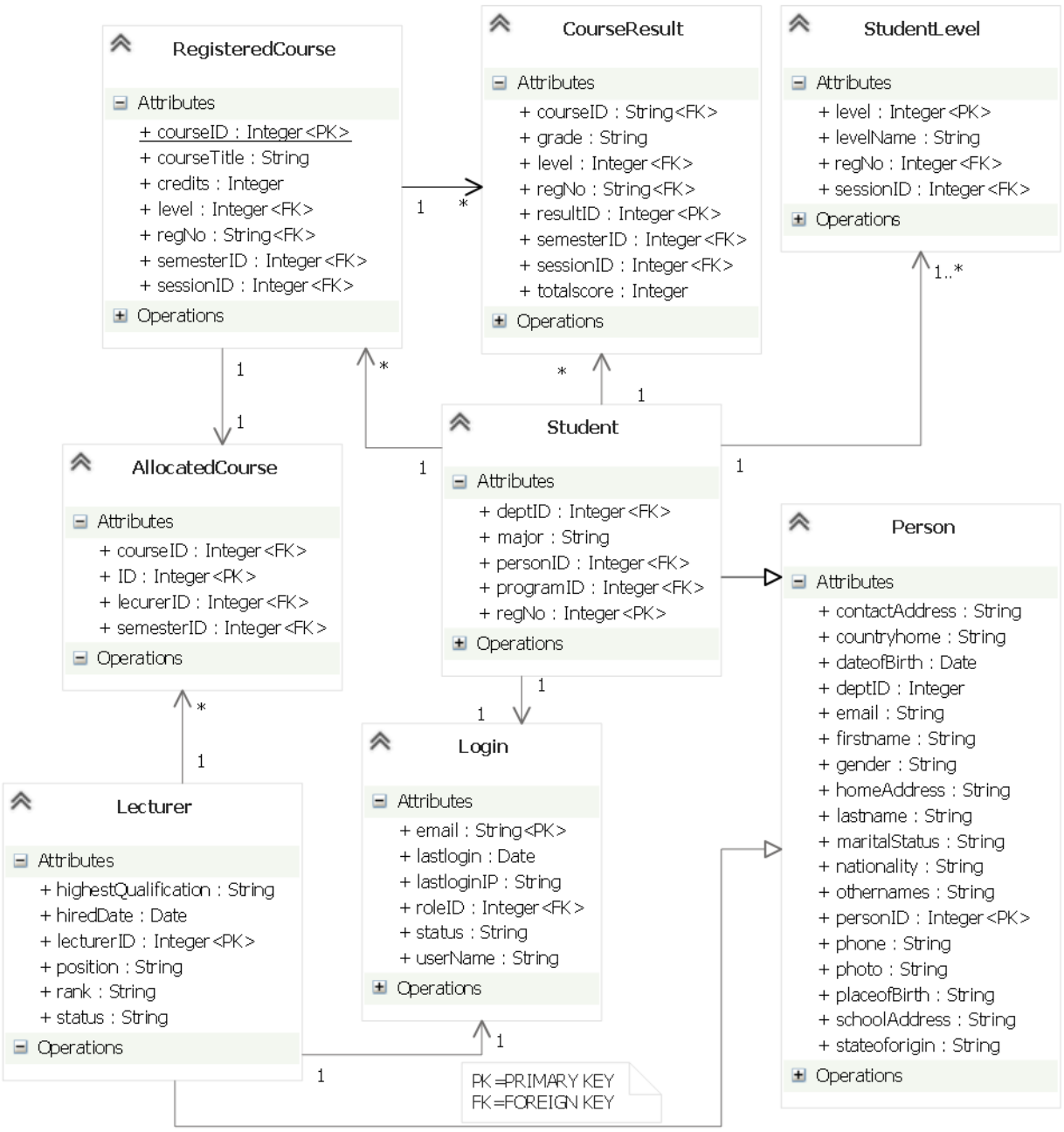

Figure 5: The student schema

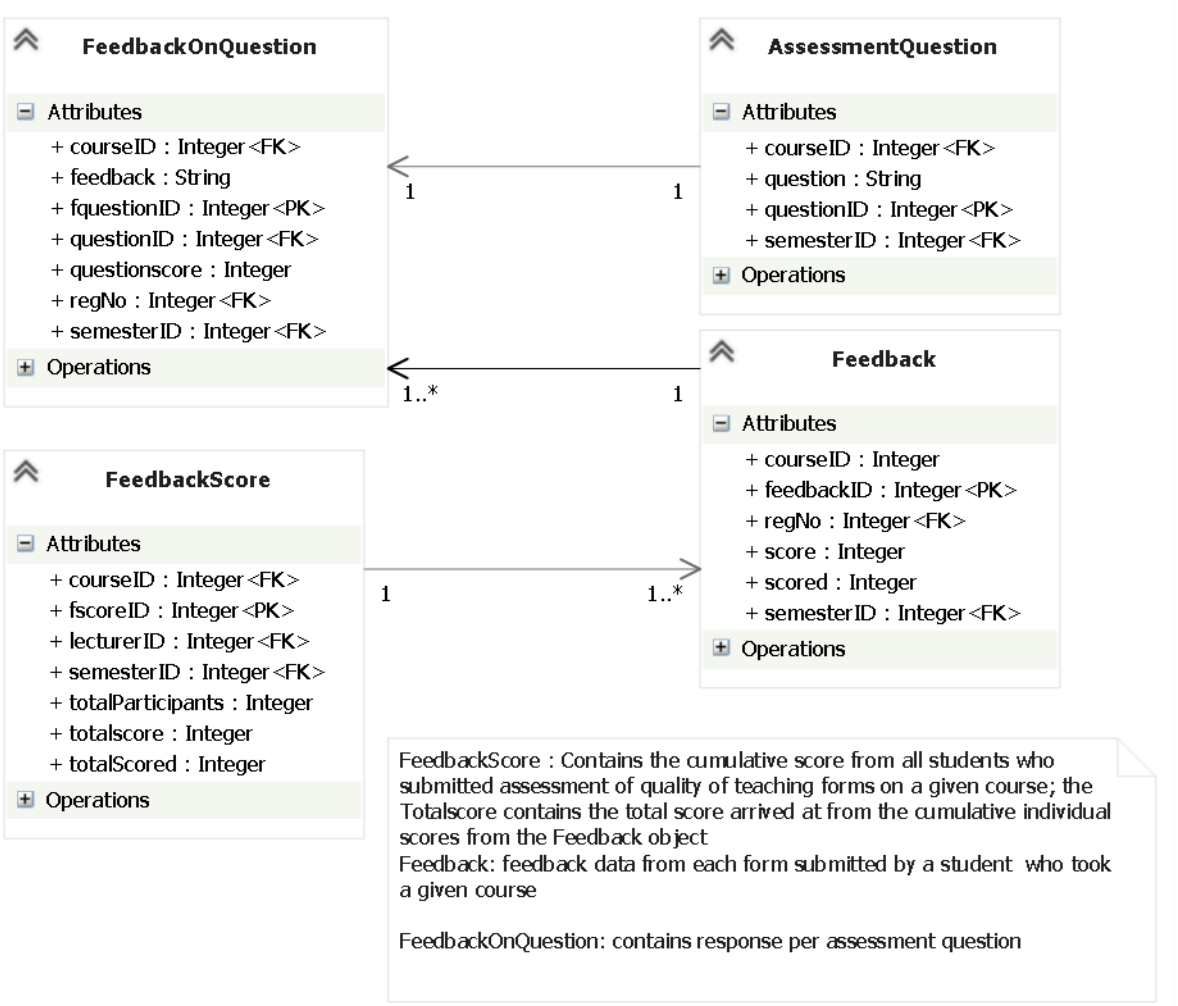

Figure 6: The assessment schema

2.6.2. Data dictionary.

It was considered useful to present the various data dictionaries on the various attributes for each object class in the schemas discussed above, as they would enable readers, system/database analysts and programmers understand what every attribute represents and how to replicate them on various database platforms. The data dictionary is an extension of the various object class dictionaries. Tables 2-19 reflect these dictionaries. Each dictionary is arranged using a table with six columns: Attributes, Description, Domain type, Null, Index, Referential integrity. Attributes are the properties of the object. The Description column defines what the attribute represents. The Domain type represents the type of data that would be stored against the attribute. The Null column is used to show whether or not the attribute could be null. The Index column shows whether or not the attribute could be used as an index field. The Referential integrity column show whether or not the attribute is a foreign key that references a primary key in another table.

Table 2.The Person object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
personID	The ID of every human member of the University whether student, lecturer or administrative staff	Numeric	NO	YES	
Firstname	The ID a course adviser assigned to a student	String	NO	NO	
Lastname	Matriculation or registration number of the student	String	NO	NO	
Othernames	Names other than first name and surname of the person	string	NO	NO	
Gender	Gender of the person	String	NO	NO	
Phone	Telephone number of the person	String	NO	NO	
Email	E-mail of the person	String	NO	NO	
deptID	ID indicating the department to which the person belongs	Numeric	NO	NO	Yes: references Department.deptID
dateOfBirth	Indicates the date of birth of the person	String	NO	NO	
homeAddress	Home address of the person	String	NO	NO	
contactAddress	Contact address of the person	String	NO	NO	
countryHome	Indicates the place of nativity of the person i.e. person's very town/village	String	NO	NO	
schoolAddress	The school address of the person	String	YES	NO	
stateOfOrigin	state of origin	String	NO	NO	
Nationality	Nationality or country of citizenship of the person	String	NO	NO	
maritalStatus	Indicates the marital status of the person	String	NO	NO	
placeOfBirth	Indicates the place of birth of the person	String	YES	NO	
Photo	Photograph or picture of the person	String	YES	NO	

Table 3. The student object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
personID	The ID of every human member of the University	Numeric	NO	YES	Yes: references Person.personID
regNo	The registration number of the student	Numeric	NO	YES	
progID	Academic programme identifier	Numeric	NO	NO	Yes: references Programme.progID
deptID	Unique department ID	Numeric	NO	NO	Yes: references Department.deptID
major	Student's area of specialization	String	NO	NO	

Table 4. The lecturer object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
lecturerID	The unique ID of an academic staff	Numeric	NO	YES	No
personID	Same as in Table 1	Numeric	NO	YES	Yes : references Person.personID
Highest Qualification	Highest qualification of the Lecturer	String	NO	NO	
Position	Position occupied by lecturer	String	NO	NO	
Rank	Lecturer's rank professional experience	String	NO	NO	
hireDate	Date of employment	Date	NO	NO	
status	Present status of lecturer(retired, active, on vacation)	String	NO	NO	

Table 5. The allocatedcourse object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
ID	Allocated course ID	Numeric	NO	YES	
lecturerID	Same as in Table 4	Numeric	NO	NO	Yes: references Lecturer.lecturerID
courseId	academic course ID	numeric	NO	YES	Yes: references Course.CourseId
semesterID	Semester ID	numeric	NO	NO	Yes: references semester.semesterID

Table 6. The course Result object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
regNo	Same as in Table 2	Numeric	NO	YES	Yes: References Student.regNo
level	Academic level of student	numeric	NO	NO	Yes : references StudentLevel.level
courseID	Same as in Table 5	numeric	NO	YES	Yes: references Course.CourseID
totalScore	Overall exam score on a course	numeric	NO	NO	
Grade	Grade of score	string	NO	NO	
semesterID	Semester ID	numeric	NO	NO	Yes: references semester.semesterID
sessionID	Session ID	numeric	NO	NO	Yes: references session.sessionID

Table 7. The registered course object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
regNo	Same as in Table 3	Numeric	NO	NO	Yes: references Student.regNo
level	Current student's level	Numeric	NO	NO	Yes : references StudentLevel.level
courseID	Same as in Table 5	Numeric	NO	YES	Yes: references Course.CourseId
Credits	Course credit units	Numeric	NO	NO	
courseTitle	Full title of course	String	NO	NO	
semesterID	Semester ID	Numeric	NO	NO	Yes: references Semester.semesterID
sessionID	Session ID	Numeric	NO	NO	Yes: references session.sessionID

Table 8: The studentLevel object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
regNo	Same as in Table 3	Numeric	NO	YES	Yes: references Student.regNo
level	Current student's level	Numeric	NO	YES	
levelName	Description of level	String	NO	NO	
sessionID	Session ID	Numeric	NO	NO	Yes: references session.sessionID

Table 9. The school object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
schoolID	Unique ID of a School/Faculty in a University	Numeric	NO	YES	
schoolName	Name of the school	String	NO	NO	

Table 10. The department object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
schoolID	ID of a School/Faculty in a University	Numeric	NO	NO	Yes : references School.schoolID
deptName	Name of the department	String	NO	NO	
deptID	Department ID	Numeric	NO	YES	

Table 11. The programme object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
deptID	Same as in Table 10	Numeric	NO	NO	Yes:references Department.deptID
progName	Name of the academic programme	String	NO	NO	
progID	Programme ID	Numeric	NO	YES	

Table 12. The session object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
sessionName	Session name	String	NO	NO	
sessionID	Session ID	Numeric	NO	YES	

Table 13. The programme_course object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
progID	Same as in Table 11	Numeric	NO	NO	Yes: references Programme.progID
PCID	ID of a Course in a Programme	Numeric	NO	YES	
CourseID	Same as in Table 5	Numeric	NO	NO	Yes : references Course.CourseID
semesterNo	The Semester in which the course is to be taken	Numeric	NO	NO	

Table 14. The course object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
CourseID	ID of a course	Numeric	NO	YES	
CourseTitle	Title of a course	String	NO	NO	
CourseCode	The code given to a course	String	NO	NO	
Description	Brief description of the course	String	NO	NO	
LPT	A three digit code representing lab/practicals and classroom tutorials	String	NO	NO	

Table 15. The semester object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
SessionID	Academic session ID	Numeric	NO	YES	Yes:references Session.SessionID
SemesterID	Semester ID	Numeric	NO	YES	
SemesterName	Name of semester	String	NO	NO	

Table 16. The feedbackonquestion object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
feedback	Student's response to an assessment question	String	NO	NO	
fquestionID	Serial number of the responses	Numeric	NO	YES	
courseID	Same as in Table 5	Numeric	NO	YES	Yes: references Course.CourseId
questionID	Assessment question ID	Numeric	NO	YES	Yes :references AssessmentQuestion.questionID
questionscore	Graded score for the chosen response to an assessment question	Numeric	NO	NO	
semesterID	Semester ID	Numeric	NO	NO	Yes: references Semester.semesterID
regNO	Same as in Table 3	Numeric	NO	NO	Yes: references Student.regNO

Table 17. The assessmentquestion object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
questionID	Assessment question ID	Numeric	NO	YES	
courseID	Same as in Table 5	Numeric	NO	YES	Yes: references Course.CourseId
semesterID	Semester ID	Numeric	NO	NO	Yes: references Semester.semesterID
question	Content of the assessment question	String	NO	NO	

Table 18. The feedback object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
regNo	Same as in Table 3	Numeric	NO	YES	Yes: references Student.regNo
feedbackID	Unique ID of each complete feedback on a course	Numeric	NO	YES	
courseID	Same as in Table 5	Numeric	NO	NO	Yes: references Course.CourseId
score	Graded score for each complete feedback on a course	Numeric	NO	NO	
scored	Graded score obtained on submitting a complete feedback on an assessment form	Numeric	NO	NO	
semesterID	Semester ID	Numeric	NO	NO	Yes: references Semester.semesterID

Table 19. The feedbackscore object dictionary

Attributes	Description	Domain type	Null	Index	Referential integrity
fscoreID	FeedbackScore ID	Numeric	NO	YES	
lecturerID	Same as in Table 4	Numeric	NO	YES	Yes : references Lecturer.lecturerID
courseID	Same as in Table 5	Numeric	NO	YES	Yes: references Course.CourseId
totalParticipants	Number of students that submitted the assessment form on a given course	Numeric	NO	NO	
totalScore	The maximum assessment score attainable per course	Numeric	NO	NO	
totalScored	The total assessment score obtained on a	Numeric			

	course from all students that registered and took the course in a given semester				
semesterID	Semester ID	Numeric	NO	YES	Yes: references Semester.semesterID

2.6.3. How the proposed system works.

The proposed system is web-based and database-driven. The object classes developed above are individually mapped to relational tables and could be implemented using a relational database management system such as Oracle, MySQL or ProgressSQL. In addition to the functionality, the application is designed with emphasis on usability and simplicity. It uses moderate graphics user interface, and navigation is made easier using less multimedia graphics and hyperlinks. The model of the new system is shown in figure 7. In order to submit an assessment form, a student must gain access to the system using requisite credentials such as username/email/registration number and password, and must have registered for the course for which an assessment form is to be submitted. On submission of the form, computations are made at the background, and the computed scores are stored in the database.

Administrators can view the various statistics against a lecturer on a course over a given period. To get the assessment statistics, the program computes the percentage assessment scores for each lecturer in a given semester considering the number of participants (students who registered and took the course).These statistics would be used for analysis of performance of the academic staff particularly when linked to the course by course performance of students over the same period. The stored data can also be used to generate reports.

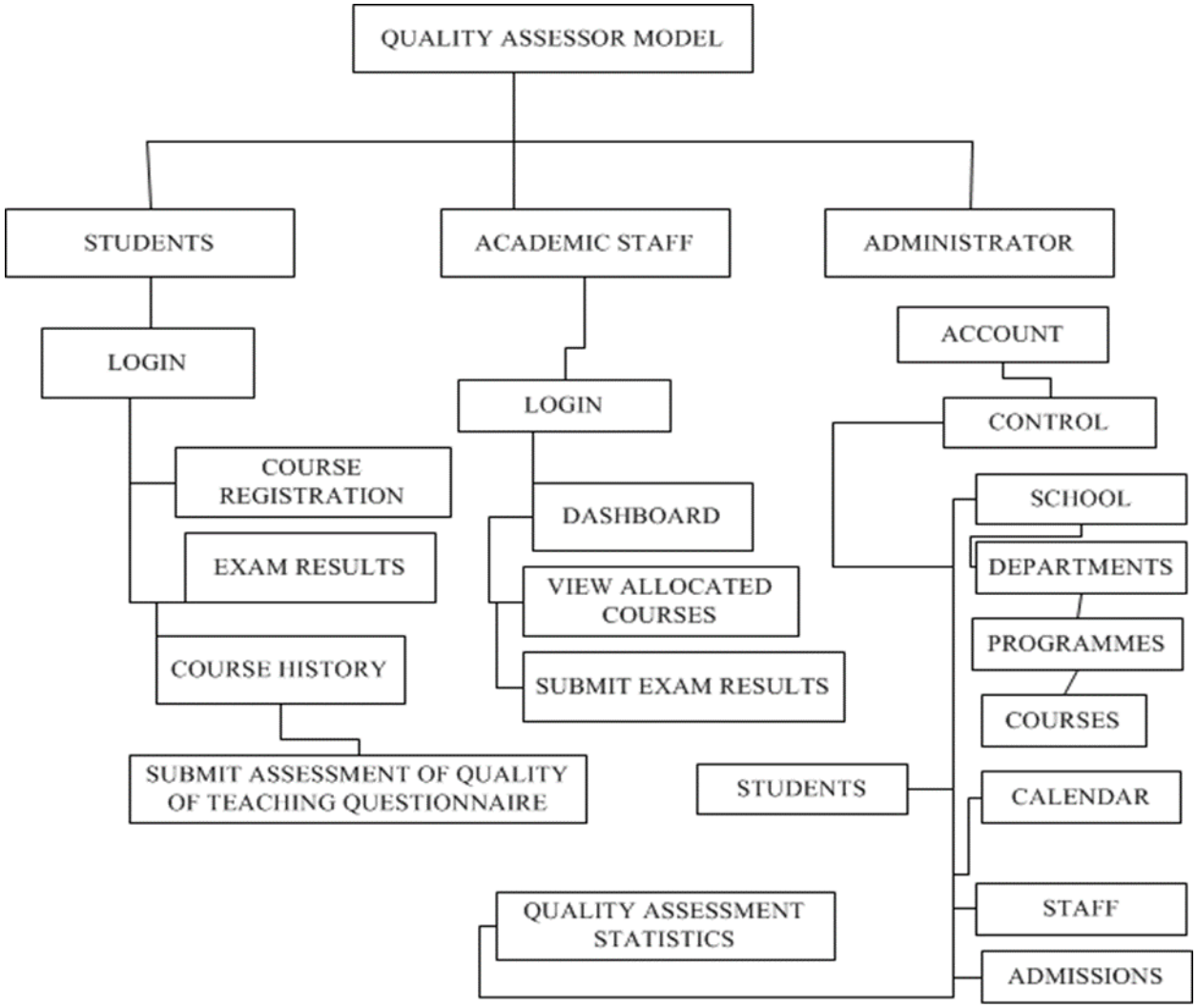

Figure 7. The model of the new system (Quality assessor)

Figure 8 shows a sample assessment of quality of teaching statistics presented as a bar chart which represents the various total scores on sample courses(depicted by the course codes) in a tentative semester with a semester ID of 100. The chart is accessible through the 'quality assessment statistics' menu in the model in figure 7.

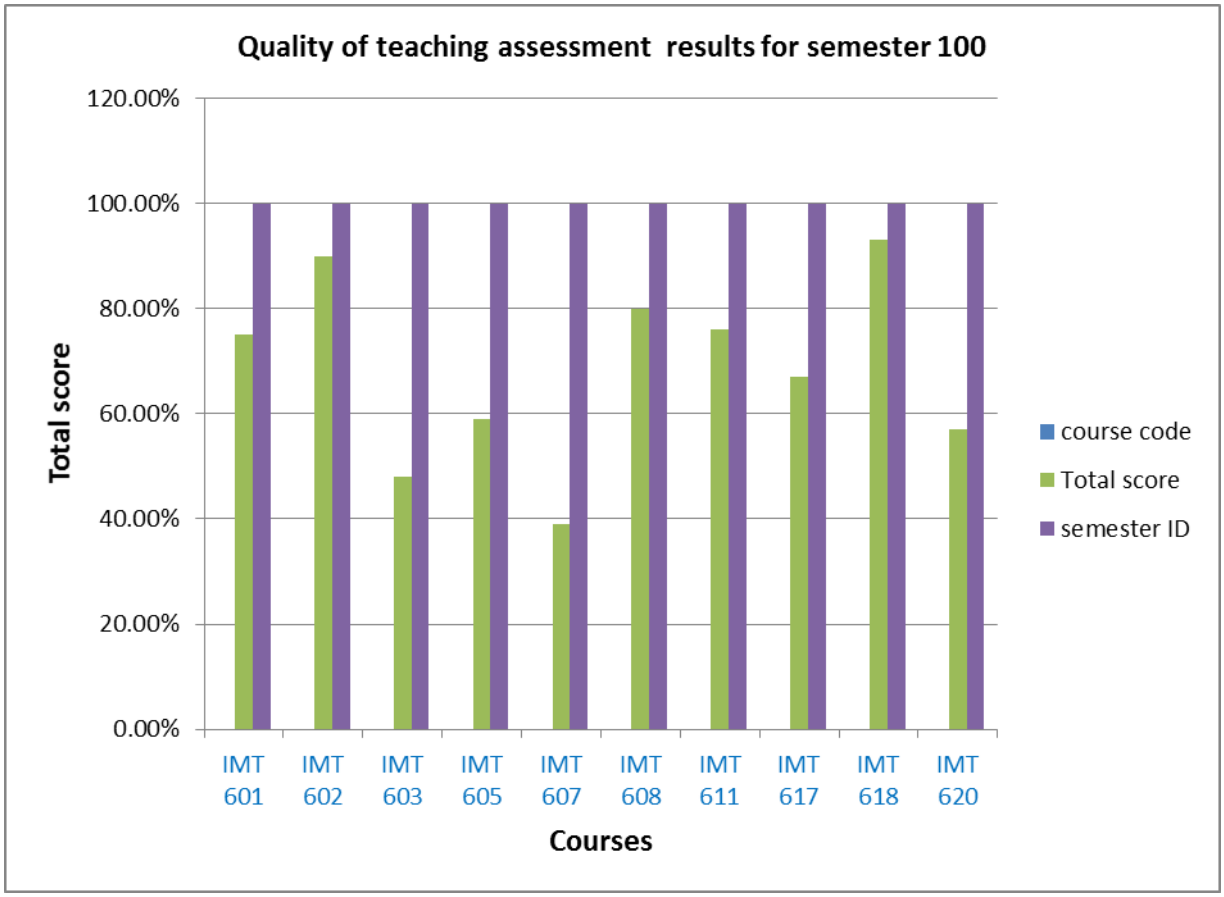

Figure 8. Sample bar chart using the assessment of quality of teaching scores

2.7. Conclusion

In this paper we have demonstrated how an application program could be developed to simplify the assessment of quality of teaching process. In the University where this study was conducted, assessing the performance of academic staff through the data gathered from students through the assessment of quality of teaching questionnaires is a serious task but is confronted and limited by the means and procedures employed to realize it. We commenced the study by investigating and documenting the existing system. Requirements analysis was done and the problems were identified.

A new model was proposed and designed. The new model is code-named the "QUALITY ASSESSOR". The functionality, limitless data volume capacity, usability and maintainability were factored into the proposed application thus making it a better and more cost-effective option for handling assessment of quality of teaching functions right from data capture to statistical reporting.

As a web-based application program, location is not a barrier as it can be hosted on the University portal over the internet. The modest user interfaces would make it very easy to use by any user who has a little knowledge of web browsing.

It is expected that the full implementation of this system in the University or any higher learning institution in Nigeria would effectively support academic staff performance assessment as well as supporting the integration of more functionalities such as data mining for advanced decision making.

3. References

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