

An Integrated E-Learning Examination Model Using Combined MCQ and Essay Based Full Blind Marking Assessment Technique

Akanbi C. Olufisoye

Dept. of ICT, Osogbo, Osun State University, Osun State, Nigeria.
Information Management and Technology Centre, Osun State University, Osogbo, Osun State, Nigeria
akanbico@uniosun.edu.ng

Akinfenwa T. Ola

Information Management and Technology Centre, Osun State University, Osogbo, Osun State, Nigeria
akin.akinfenwa@uniosun.edu.ng

Abstract—Web-based testing and assessment systems offer greater flexibility than the traditional approach because test could be offered at different times by students and in different locations. Though Multiple-Choice Question (MCQ) is known to offer easier and faster methods in examination scoring and assessment, it has major disadvantage of fixed responses which tend to emphasize recall and encourage guessing. Assessment systems normally should generate responses that have the potential to show originality and a greater depth of understanding of the learning contents. This paper presents integrated online assessment systems as a remedy to MCQ limitations. The Online Examination architecture developed and the model formulated combined MCQ with other assessment systems such as Long answer(essay) questions, Short answer (fill in the gap) questions, True/ false questions, Graphical (diagram –based) questions The discursive examination component-essay type uses double blind marking technique to assess the performances in examination and the system model was implemented using Apache Server, PHP Programming Language , HTML, Ajax, jQuery, Javascript and MySQL Database.

Index Terms—E-learning, E-assesment, MCQ, essay-based examination, Double blind marking

I. INTRODUCTION

The advent of web applications into the computing technology has brought about a significant revolution in our social life including the traditional system of education and examination. Many institutions are replacing their traditional methods of conducting examination with online testing and assessment systems. Web-based testing and assessment systems offer greater flexibility than the traditional approach because test could be offered at different times by students and in different locations [1]. As online teaching and learning

become widespread, there is a growing need for educators to consider modes of assessment [2], [3].

According to [4], the benefits of online assessment include student motivation, immediate feedback, assess to larger classes effectively [2]. Majority of online real-time test centers are limited only to atomic, closed form assessment units, such as Multiple Choice Questions(MCQ).

Though MCQ tests offer greater efficiency in short period and ease of assessment, however, have constraints in terms of quality, validity, reliability and fairness. Major disadvantage of a multiple-choice item is that the fixed responses tend to emphasize recall and encourage guessing. This is not effective for testing true cognitive knowledge of students because, students with poor knowledge of course concept can even pass the examination.

In addition to MCQ, Assessment systems also should require students showing full spectrum of competencies by reading the answer carefully and looking for specific features, such as clarity, logic, and key points among others. This allows students to generate responses that have the potential to show originality and a greater depth of understanding of the topic [5].

This paper presents an integrated online assessment system as a remedy to MCQ limitations. The Online Examination architecture developed and the model formulated combined MCQ system with other assessment systems such as

- Long answer(essay) questions
- Short answer (fill in the gap) questions
- True/ false questions
- Graphical (diagram – based) questions

The discursive examination component- essay type uses double blind marking technique to assess the performances in examination and the model was implemented using Apache Server, PHP Programming Language, HTML, Ajax, jQuery, Javascript and MySQL Database.

II. LITERATURE REVIEW

Ref. [6] describes the rapid growth of computer technology use in workplaces and education as inexorable. This technology offers the potential to broaden educational assessment beyond what traditional methods allow. Ref. [7] found that valid and reliable data can be gained through online ability assessment when comparing online and paper-based intelligence tests. According to [8] context of assessing essays on screen demand an enquiry into construct validity; explore whether the same constructs or qualitative features of essay performance are being attended to by assessors in different modes.

Ref. [9] presents an excellent argument for having online courses. Their research-based findings support the argument for having online courses as well as a detailed analysis of the characteristics of online learners.

According to [10], assessment plays different roles in teaching and learning process. It provides teachers with a means of evaluating the quality of their instructions. Students also use it to drive and direct their learning. Online assessments can be offered at different time, location or even different test or different students. In many cases, online assessments are carried out using an institutional Learning Management System (LMS) such as BlackBoard, WebCT, or an in house product via quizzes, forums and digital assignments [11].

E-assessment can be justified in a number of ways. It can help avoid the meltdown of current paper-based systems; it can assess valuable life skills; it can be better for users – for example by providing on-demand tests with immediate feedback, and perhaps diagnostic feedback, and more accurate results via adaptive testing; it can help improve the technical quality of tests by improving the reliability of scoring.

The earliest online assessment makes use of Multiple Choice Question Techniques (MCQ). In the view of [11], MCQ exams can be used not just for testing lower level cognitive skills, but can be implemented to measure deeper understanding if questions are imaginatively constructed.

Double blind marking ensure that all the assessments have been considered thoroughly, conscientiously and objectively, There are three types of double blind marking according to [2], [12] and [13].

1) *Sampled double marking*: In this process, all scripts are 1st marked (in small numbers usually by the course leader’ or chief examiner and then a percentage is double marked by a moderator for the purpose of verification. In best practice the first marker has put the marks and comments on the assessed work or the provided proforma

2) *Full “seen” or “open” double marking*: in this process, all scripts are marked by two markers but the second examiner marks with knowledge of the first marker’s marks and comments. The second examiner is expected to exercise independent judgment and the final marks are awarded by computing the average.

3) *Full double blind marking*: in this process, all scripts are marked by two examiners and the second examiner marks with no knowledge of the marks or comments of the first examiner. This method maximizes independence in marking. Marks may be agreed by simply averaging the scores from the two independent markers.

For both open and full blind double marking, when examiners cannot agree a third party moderator is required. In the past, this role was often given to the ‘external examiner’. In this paper, full double blind marking techniques was employed in the essay based examination assessment component.

III. SYSTEM ARCHITECTURE

The System Architecture is shown in Fig. 1 consisting of seven modules: System Administrator Module, Instructor Module, Student Module, Inference Engine and Knowledge Base MCQ and Blind Marking Module. The student login page is shown in Fig. 2.

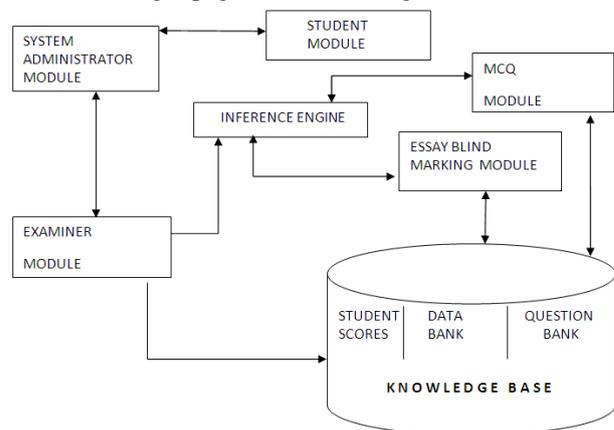


Figure 1. Integrated e-examination system architecture

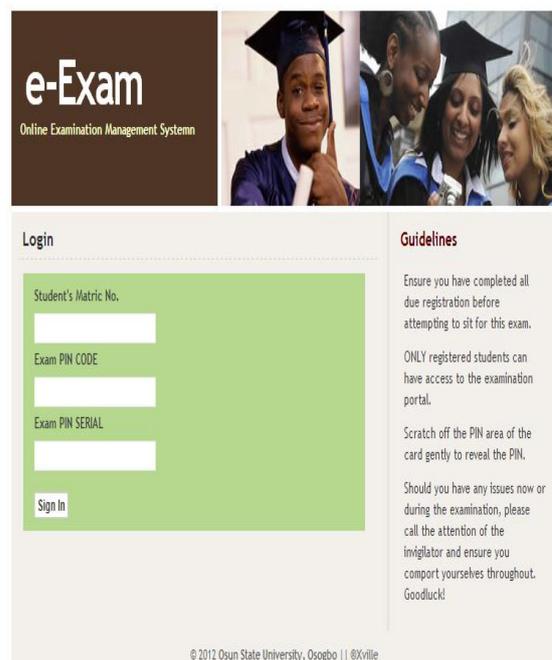


Figure 2. Students module login page

A. System Administrator Module

This module of the solution controls the entire operation of the system. With this Administrator module, the administrator can add lecturers, instructors and students. This module defines the registration process. The system administrator can determine which kind of questions should be available when setting up a test, period of the exam and other site administrative issues.

B. Examiner Module

The examiner module handles the setting up of exams. It is only accessible to users with the examiners rights and privileges. This module allows the examiner to create new exams and set up the exam with the required configuration that fits the exam the user is administering. Examiner can later re-edit the examination setting to fit into the maybe a new session or curriculum. After setting up the examination, the user can then add questions of different types to the examination using randomization facility. Also, setting the score profile of each question to be assessed manually by the examiner. The examiner module allows setting up a number of examiners to mark the essay type questions. Others include registration of exam candidates, create/edit/delete candidate groups.

The examiner can also access candidates who have taken a test, the time spent on the test and also their respective scores. The score statistics like average score pass rate and cumulative score can also be viewed by the examiner, setting time limit of the exam and randomizing the questions. When markers log into Exam Online, they are presented with a list of questions / papers to be marked. Clicking on a question brings them to the main marking interface that is shown in Fig. 3.

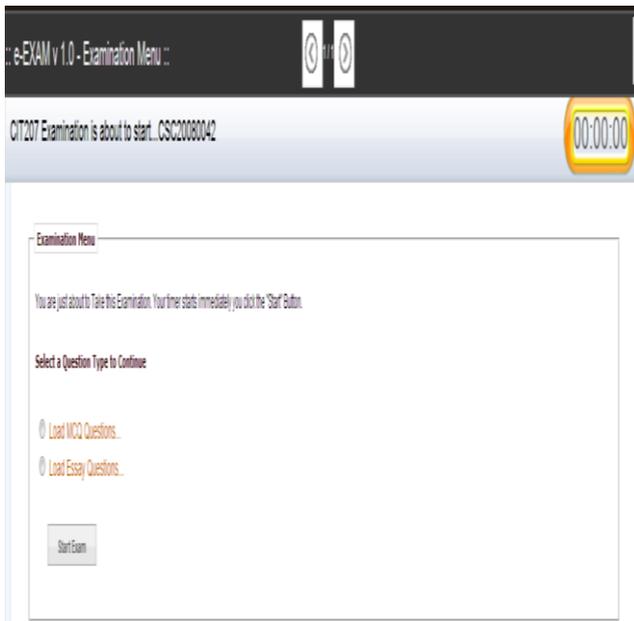


Figure 3. Exam module showing the mcq and essay question type

C. Student Module

This module is the aspect that is visible to the 'exam-takers'. If the exam is free-for-all, then any visitor to the web application can partake in the exam. But restricted

exam will require pre-registration. Examinations to be taken are visible only to candidates who have the privilege to take a particular exam. So candidate may be privileged to take several tests while another may not have any pending test based on their curriculum and department. Exams are available only for a period of time set by the examiner, and the duration of the examination can also be pre-configured by the examiner. Categories of questions available are:

- Multiple Choice Questions
- True/ false questions
- Short answer (fill in the gap) questions
- Long answer (essay) questions
- Graphical (diagram – based) questions

D. Knowledge Base.

This is the knowledge repository for this application system. It consists of three categories of repositories as shown in Fig. 1 which are:

- 1) Data Bank
- 2) Question Bank
- 3) Student Scores

E. Inference Engine

This is the intelligent (reasoning) component of the architecture. The roles could be broadly categorized as coordination of all module components as well as computation roles. This is achieved through the intelligence embedded using integrated rule and case based reasoning scheme.

IV. E-EXAMINATION ASSESSMENT MODEL

E-essay examination model in this study consist of (i) Multiple Choice Questions (MCQ) (ii) Essay / extended response / short answer questions (and possibly a mixture of all three). Also some questions that require drawings and calculations are also taken care of in this system design.

A Full Double Blind Marking Technique (FDBMT) is adopted as the essay assessment model in this paper. Assessments of the MCQ are marked automatically by this exam software and the score is sent to the score database. Also, essay based examinations using FDBMT require human marking by posting the answers by a student to two independent markers and the average of the scores are forwarded to the score database. The following simple model is adopted for the generation of the marks for the students.

During a typical e-examination, essay component is marked by marker j and the mark X_{ij} obtained is computed as the average of the marks returned by all the markers j .

The mathematical equation is

$$Essay_score = \frac{\sum_{j=1}^n X_{ij}}{\sum n} \quad (1)$$

For double blind marking where two markers are involved, Marker $J = 2$ so we have

$$Tot_score = \sum_{j=1}^2 \frac{X_{ji}}{2} \quad (2)$$

Let M be the score obtained in MCQ by the same student X_{ij}

$$Tot_score = M + \sum_{j=1}^2 \frac{X_{ji}}{2} \quad (3)$$

Let the score obtained by the same student X_{ij} in extended response / short answer be P_i

The total score obtained by the student X_{ij} is

$$Tot_score = M + \sum_{i=1}^2 \frac{X_{ji}}{2} + P_i \quad (4)$$

if student has taken continuous assessment m and score is supplied, the total test score(tts) is

$$tts = \sum_{i=1}^m \frac{T_{ji}}{m} \quad (5)$$

The total score obtained by the student X_{ij} is

$$Tot_score = M + \sum_{i=1}^2 \frac{X_{ji}}{2} + P_i + \sum_{i=1}^m \frac{T_{ij}}{m} \quad (6)$$

V. CHOICE OF DEVELOPMENT SOFTWARE

PHP and MySQL are opensource software chosen because of its flexibility which makes the coding with other enhanced web programming languages such as HTML, Ajax, Javascript and jQuery. It helps in creating customizable Graphical User Interface (GUI) feature which makes communication with other users possible by displaying pictures and other standard objects. MySQL database can store large volume of data and has been optimized to provide a secured environment with full data integrity. It can easily be connected with PHP programming language through the use of SQL queries. There are other enhanced features which make PHP and MySQL an ideal choice for coding program on the web. Some of the features include ability to run on the web and a managed runtime environment.

VI. IMPLEMENTATION

The System Model in equation (6) was implemented in this study by storing student data, questions and answers among other relevant data, in the MySQL database running on an Apache server. The students, administrator, examiner interfaces were designed using HTML, javascript and other appropriate programming languages; PHP connects the data in the database with the user interface. The application was installed on the university server in the ICT laboratory housing about 100 systems connected to the university intranet. Fig. 4 shows the sample MCQ question while Fig. 5 displays sample essay

question with answer provided. Also Fig. 6 shows answer for review by the examiner while Fig. 7 shows the essay script displayed to the examiner.

A sample questions inform of MCQ and essay-based questions were drawn from a course in CIT 207 as test case for the implementation. For each MCQ option selected by the student, it is compared with the answer already stored in the database by the inference engine and determines whether or not the chosen option was correct. The student is also provided with a Review Mode where already answered questions can be reviewed and updated, provided the student is still within the Examination time. A defined score is allocated by the examiner for each correct answer and no score (zero) for an incorrect answer. The total MCQ scores of each student are stored in the database awaiting the computation of essay scores by the examiners.

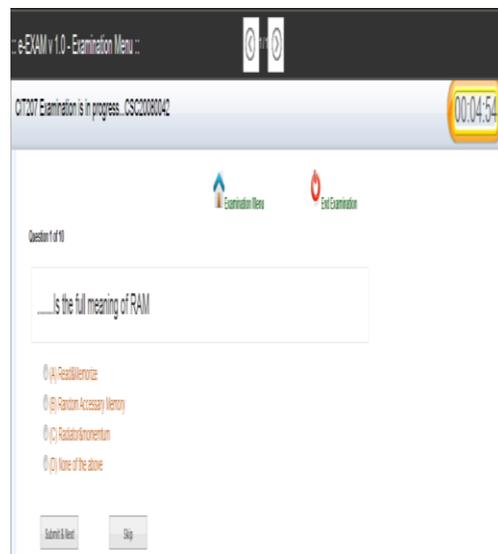


Figure 4. Display of a sample MCQ Question



Figure 5. Display of a sample Essay Question with answer provided

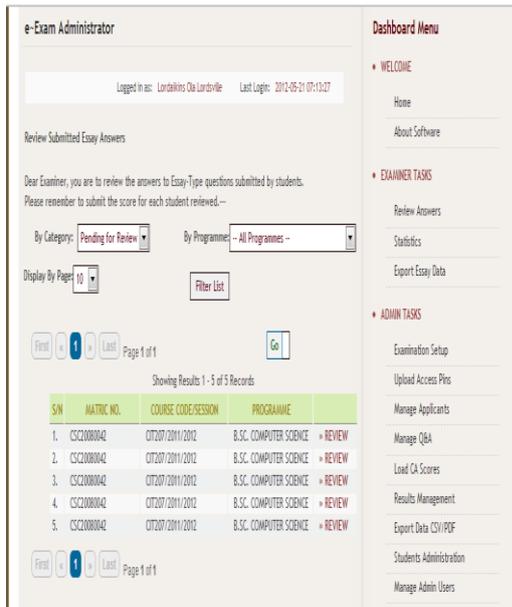


Figure 6. Submitted Answers for Review by the Examiner

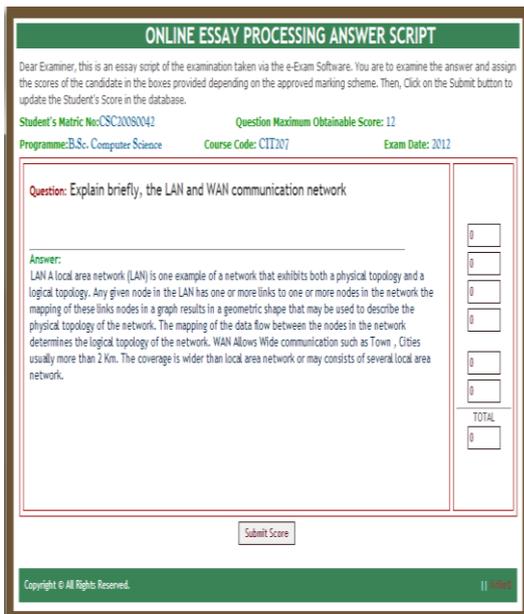


Figure 7. Online Essay Answer Script displayed to the Examiner

As each student complete a particular essay type question, this question is sent to two blind markers and the average of the marks scores returned by the two markers are stored in the knowledge base by the inference engine for the final computation along side with the MCQ result. The overall result is then made available to the student via the Student module.

VII. CONCLUSION

In this paper, a model of assessment combining MCQ and essay-based question was formulated and, online essay examination and assessment was proposed as a

remedy. The software design was conceptualized; the system was implemented using PHP, HTML, Ajax, Javascript, jQuery and MySQL. A sample MCQ and essay- based type were used as a test case (CIT 207) for the implementation. As each student completes a particular question, this question is sent to two blind markers and the average of the marks scores returned by the two markers are stored in the knowledge base by the inference engine for the final computation. The software was implemented on Osun state University Intranet The response from sample users shows that the assessment is better than MCQ assessment alone..

REFERENCES

- [1] A. Fluck, D. Pullen, and C. Harper, "Case study of a computer based examination system Australasian," *Journal of Educational Technology*, vol. 25, no. 4, pp. 509-523, 2009.
- [2] J. Wales and R. Baraniuk, "Technology opens the doors to global classrooms," *The Australian*, 2-3 February, 2008, pp. 27.
- [3] J. Bull and C. McKenna, *Blueprint for computer-Assisted Assessment*, London: RoutledgeFalmer, 2004.
- [4] K. J. Rowe, "In good hands? The importance of teacher quality," *Educare News*, vol. 149, pp. 4-14, 2004.
- [5] R. E. Bennett, "Inexorable and inevitable: the continuing story of technology and assessment," *The Journal of Technology, Learning, and Assessment*, vol. 1, no. 1, pp. 1-24, 2002.
- [6] F. Preckel and H. Thiemann. (2003). [Online]. "Pencil of a High Potential Intelligence Test Saves," *Journal of Psychology*, vol. 62, no. 4, 2003.
- [7] P. Paek, "Recent Trends in Comparability Studies," Pearson Educational Measurement Research Report 05-05, 2005.
- [8] I. E. Allen and J. Seaman. (2003). "Sizing the opportunity: The quality and extent of online education in the United States, 2002 and 2003." Needham, Massachusetts: The Sloan Consortium. [Online]. Available: <http://www.sloan-c.org>
- [9] J. Harvey J and N. Moge, "Pragmatic issues when integrating technology into the sessment of students," *Computer -Assisted Assessment in Higher Education*, S. Brown, P. Race, and J. Bull, Ed, London: Kogan, pp. 1999.
- [10] A. Ricket, D. Pullen, and C. Harpers, "Case study of a computer based examination system," *Austalian Journal of Educational Technology*, vol. 25, no. 4, pp. 509-523, 2009.
- [11] J. Engelbrecht and A. Harding, "Combining online and paper assessment in a web-based course in undergraduate mathematics," *Journal of Computers in Mathematics and Science Teaching*, vol. 23, no. 3, pp. 217-231, 2003.
- [12] D. Pullen and B. Cusack, "Content Management systems; the potential for open education Fact Sheet," FS01, Australian College of Educators, Canberra 2008.
- [13] J. Christie, "Automated essay marking for content—does it work?" in *Proc. 7th International CAA Conference*, Loughborough, July 2003, pp. 8–9.

Caleb.O. Akanbi is a Lecturer in the Department of Information and Communication Technology, Osun State University, Osogbo, Nigeria. He holds a PhD degree in Computer Science from Obafemi Awolowo University, Ile Ife. He is a member of Computer Professional Registration Council of Nigeria (CPN) .His research interest are e-learning., Agent based System, Mobile Computing. (E-mail: akanbico@uniosun.edu.ng, +2348033920834)

Akinfenwa T. Ola is a Programmer I in the Information Management and Technology Centre, OsunState University, Osogbo. (E-mail: akin.akinfenwa@uniosun.edu.ng, +2348032070442)