Original Research Article

COMPUTER BASED TESTING (CBT) SYSTEM FOR GST EXAMS IN ADAMAWA STATE UNIVERSITY, MUBI

ABSTRACT

Examination is one of the most broadly used strategies for assessing learning and capacity of a student. ~~The GST unit~~ in Adamawa State University is engulfed in a lot of irregularities during examination and also delays of results after the examination. These and other manual method of processing results gives room for errors during results compilation. The utilization of Information and Communication Technology in directing examinations can enhance proficiency and decrease delay of student's result after examination. A Computer Based Testing System (CBT) was designed and implemented to diminish the delay of student's examination result. The CBTS was designed using the Agile model of the Software Development Life Cycle (SDLC). Implementation was done utilizing the open source technologies, like XAMPP server, MySQL, PhP, JavaScript, Cascading Style Sheet and Hypertext Markup Language. The CBT presents notice of student's outcome quickly in the wake of taking the examination, enable the student to retake exam (where necessary), and furthermore give diverse kinds of questions. The utilization of CBT system can enhance the productivity and gainfulness of scholarly establishments as it diminishes the cost of stationeries and work associated with conducting examination manually. This by implication can reduce the cost of buying examination materials (papers, printers, turners etc) and students can have their results immediately after the examination. This work can be enhanced by adding other forms of questions like diagrammatic question to make the test addresses more diverse areas.

Comment [r1]: Expand the term GST as General Studies

Comment [r2]: After this, add the following sentence for future research ; As the future research the validity of new system and the satisfaction of the students and the staff based on newly developed system.

Keywords: [Examination, CBT, Online Exam, Student, General Studies, malpractice, delays]

1. INTRODUCTION

General Studies usually coded as GST is a university based core course that equip students with education-oriented skills that cover a broad range of topics, thus prepare them for endless career paths. General Studies is a common nomenclature in most institutions of higher learning. By status, GST is compulsory for all registered students irrespective of course of study or programme of study in the university. In other words, all General Studies courses must be offered and passed by students to meet graduation requirement of the University.

As the name implies, general studies is “general” because it encompasses studies from a wide range of contents from various spheres of human endeavors. The course is tagged with various names in other institutions but it is generally refers to as GST in Adamawa State University, Mubi.

GST gives student basic preparation for many future careers. Graduates who acquired fundamental knowledge of GST can use the same experience to perform basic functions in various professional fields, including education, law, government, health care, social service, and private industry. Due to the ever increasing number of students offering GST courses and some observed examination irregularities like delays in processing results, there is a need to employ a method of assessment that can be used to conveniently examine large number of students at a time. Computer Based Test is a modern approach to testing and assessment. It is one of the modern breakthroughs of technology. Technology has significantly reshaped the method of evaluating students. For instance, Computer as tool for technology is used in multi-dimensional ways, though only very few organizations in Nigeria, including tertiary institutions have gone beyond word processing and other routine tasks (Olumorin & Sofoluwe, 2013)[1]. In many educational sectors, educational evaluation has moved towards the use of computer-based testing (CBT), which is known as tests or assessments that are administered by use of computer through technological devices linked to the intranet and in certain cases, internet.

Computer based Test simply refers to tests and assessments conducted through the use of the organized systems on computers. Computer Based tests have the ability to automate a very time consuming task, marking and monitoring progress. Chalmers (2011)[2] sees Computer Based test as a

test that can be used in a supervised or non-supervised environment, and can allow students to check their own progress through self-assessment. It can also be used for testing lower-order skills (such as knowledge, understanding and application); it can also be used for testing higher-order skills to improve the students' analysis, synthesis and evaluation skills with more complex application software.

1.1 Overview of CBT System.

During the last few decades and especially from 1990 onwards computer-based testing (CBT) has become one of the most conspicuous ways of organizing and delivering the tests. The reason behind this prominence of CBT over the paper-and-pencil based testing is its ease of administration, immediate display of results, improved item development, enhanced identification and authentication, and so forth. However, most of the organizations and institutions are still relying on the examinations where the examinees have face to face exams in an identified place under an administered situation. This may help the organizations to check the authenticity of the examinee by checking his identity using ID card and also ensuring that no cheating is going on during the exam. But due to the enormous advantages of computer-based testing over the traditional paper-and-pencil based testing, most of the organizations are now moving towards CBT, Saleh et al (2014)[3].

Kuyoro et al (2016)[4]. View CBT as an assessment platform in which a computer is an integral part of question papers' conveyance, response, marking of response or report of results from a test. The main goal of a compute based testing system is to provide all features that examination system must have, with a user friendly interfaces that don't terrify its clients. Taylor (2015)[5], a Computer-Based Testing system could be conveyed on a remain solitary PC, inside a disengaged Local Area Network (LAN) or online using technologies such as the web, for example, web pages over the Internet. The two sorts of CBT system are:

1. Linear Test
2. Adaptive Test

1.2 CBT SYSTEM IN NIGERIAN INSTITUIONS

Computer based testing system can be used as an assessment tool in a long distance education or online education systems with a quite number of students . Successful execution of an examination targeted at assessment and evaluation is very critical because of the problems arising from human errors and other technical difficulties which may lead to questioning of the examination and thus reliability and efficiency of the online and distance education systems. Tasci et al (2004)[6].
National Open University of Nigeria (NOUN) is a distance learning institution in Nigeria which has many schools and academic centers within the country employs the use of online examination as their method of evaluating and assessing their students.

A research conducted by Osang (2012)[7] on 105 academic staff, revealed that 84 respondent recommended the use of CBT for conducting their examination in the university (NOUN) based on the fact that it is easy to use and administer by the users. Most importantly is the fact that the examination result can be viewed immediately after the examination.
Many tertiary institutions are now using the CBT system for conducting Post-UTME examination for screening students into universities. So many universities in Nigeria are fully or partially implementing the use of CBT system for evaluating their students. Kuyoro et al (2016)[4]. However, some institutions like the National Open University of Nigeria (NOUN), has fully implemented the use of CBT system for assessing their students and it was employed through the internet, while other institutions employ through the intranet. Since 2015, the Joint Admission and Matriculation Board (JAMB) has been using the CBT system fully to conduct exams for admission into the tertiary institutions in Nigeria. Kuyoro et al (2016)[4]. The use of ICT services can only be appreciated when compared with the manual method where students wait so long before getting their result.

2. LITERATURE REVIEW

A novel online examination system in light of a Browser/Server structure was designed by Zhenming et al (2003)[8] to test the ability of students on basic computer skills using the Multi-Choice-Question (MCQ) type of question. The courses includes Visual Basic programming, Operating system, Word, MS Office Packages, Internet and Email services. The system was a distributed communitarian

system which depends on Distributed Component Object Model (DCOM) innovation. Web Information Server 4.0 (IIS) was utilized as the Web Server, Microsoft SQL Server 7.0 as Database Server and a browser as user interface. Cryptography, real-time monitoring system and data transmission encryption were utilized to ensure security of the system. The system can be enhanced through an arbitrary organization of questions to decrease the level of examination malpractice.

Yuan-Lung et al (2005)[9] developed an online examination system that isn't restricted by time and place which allows students to schedule time for examination based on their level of study. The system generates test questions randomly for each student, which reduces exam malpractice. The questions could likewise be in form of diagrams and animation other than MCQ questions, subsequently making the test addresses more different aspects that needs to be examined. The system was categorized into three unit: the student unit, the instructor unit and the admin. Implementation was done using ASP.NET, internet information server (IIS) and Microsoft access as the database. The database was accessed using ODBC. Students can schedule their examination time based on their study progress. Test takers can check the test result instantly after the test. With the ascent in cybercrimes, the security improvement of the online examination system ought to be looked into so as to guarantee that the exam questions are not altered or leaked preceding formal examination date.

Rashad et al (2010)[10]. Built up an online examination administration system that is equipped for supporting a faculty in an institution, students and administration roles in the examination procedure. The system uses various types of questions, for example, yes/no question, multi choice question single answer, multi choice/multiple answer questions, fill-in the black question with a string. The system mark and give out Examination result immediately. The system can be deployed through the Internet which is suitable for both local and remote examinations. The system could help, lecturers and instructors who will make new examinations or alter existing ones and the students that will participate in the examination. The system was designed using open source technologies like; AJAX, PHP, HTML and MYSQL as the database. Since the system will be used over the internet it will require a reliable security.

An online examination system that allow students to haphazardly choose a test paper or utilize a test question assigned by the instructor to test them keeping in mind the end goal to comprehend their learning level and change their learning progress was designed by Qiao-fang (2012)[11]. The system enables the lecturers to manage questions through questioning, including, erasing and altering the questions. It likewise guarantees that test questions are haphazardly generated based on a specific requirements. A student can likewise haphazardly select a paper for individual test. Implementation was done using client/Server model as its network application development model. Java Web technologies using the JSP Model 1 and JavaBean were utilized together with Tomcat as the JSP Engine and Web Server. JavaScript was used on the client-side scripting language while JSP was used as the server-side scripting language. The system enables the students to test their knowledge anytime they want to assess their level of understanding in a particular course. However, this work does not show us whether the system had a flexible timing features that can logs off the student from the system when his time elapse; this will help with evaluating how well the student has mastered a course.

A web based online examination system designed by Adewale et al (2011)[12], which gives out students' scores immediately upon submission of the examination. The Admin of the system has the privilege of adding, editing and deleting test questions. A client can enroll and login with his/her particular id. The system has two users (the admin area and the Student area). The system was design using ASP.NET and VB.NET having DB2 as back end (database). Windows 2000 Enterprise was used as the server interface while both of Windows 95/98/2000/NT could be used as the student interface. The system can generate report (Exam result) showing who passed and those that failed the examination. The challenges of this system is that the lecturer can't enter the questions directly into the system and the questions are not randomized, Adewale et al (2011)[12].

The CBT system developed by Fagbola et al (2012)[13] was an online examination system that assesses students using multiple choice questions set by the lecturers and is capable of grading students accordingly. The system is expected to provide an effective solution for mass student evaluation and provides functionalities such as auto-submission of examination on expiration of set time, auto-grading of students and examination result report generation. The Waterfall Model of

software development Life cycle was adopted and the conceptual design (activity diagram, the use cases, the data flow diagram and the entity-relationship diagram) were presented. Macromedia Dreamweaver 8.0, Microsoft Visual Studio 2012 and Microsoft SQL Server 2008 were the tools used for the development of the CBT system. The system was implemented using C# (C Sharp) and SQL server. The CBT system was composed of six different functional pages which are the student login page, the admin login page, the result summary page, the question page, question upload and configuration page and the student result page. It was expected that the system would proffer solutions to challenges such as examination malpractices, low capacity examination venues, inadequate invigilators and inadequate examination materials. Performance assessment of the CBT system was carried out using 250 students and the statistics proved the system as highly flexible. This CBT system can be improved on through the implementation of essay-based questions. Integration of students' continuous assessment should also be included for it to be effective in a tertiary institution.

Taşci et al (2014)[6] developed an online examination system which manages the entire examination process, i.e add, delete, update and refresh, execution and assessment, management of feedback from students, alongside guaranteeing utilization of analysis reports identified with the questions and examination created by an intelligent agent in the decision-making process. The system design incorporates Administration, Implementation, Finalization and Support layer. A Monitoring Agent was intended to help students through making reports. Analysis on this system at Sakarya University Turkey, demonstrated that the proposed intelligent agent support online examination system, it can detects problems that may emerge and enable the teachers to easily make decisions more effortlessly on such issues in a shorter time. The system utilizes the IF THEN construct, the system should incorporate more intelligent features with the aim of solving more diverse issues.

Oluwatosin and Samson examined some of the challenges of the existing computer-based testing systems and came up with a new system that could be deployed on either internet or intranet. The proposed scheme was designed by unified process using UML. Security and result integrity features were integrated in the system. The examiner should answer some questions on the first login and should update his authentication details. All authentications are logged automatically by the system in order to determine any illegal access. Also an examinee could not have more than one active session running simultaneously.

3. MATERIAL AND METHODS

The CBTS developed in this work is based on the existing implementation infrastructures with an improvement in the systems adaptability to meet with the Nigerian structure of higher institutional examination systems. The Software Development Life Cycle (SDLC) for this system is the Agile Model. The CBTS design was presented using; use case diagrams, entity-relationship diagram and data flow diagram. The design was based on the users and system requirements of the CBTS.

3.1 RESEARCH METHODOLOGY

Data was collected using a stratified random sampling. Interview and questionnaire were administered to students and staff at all levels in the University as seen in table 1& 2 below. Thirteen departments were selected for this study in ADSU; where eighteen (18) students (10 males, 8 females) were selected from each department for the interview and questionnaire purpose. Also six (6) lecturers were selected from each department for interview on their students' performance in the GST courses.

The departments were selected randomly which includes; Computer science, Mathematics, Chemistry, Physics, Public Admin, Business Admin, Political Science, Agric Econs & Ext.. Animal Production, Biochemistry, Geography, Mass Communication and Accounting.

Table 1: Students Response

STUDENTS				
S/N	**Department**	**Good/Accept (18)**	**Fair/Reject (18)**	**Indifference (18)**

1	Mathematics	8	10	-
2	Computer Sci.	5	13	-
3	Biochemistry	9	9	-
4	Political Sci.	3	14	1
5	Business Admin	7	11	-
6	Public Admin	4	12	2
7	Agric Extension	4	14	-
8	Accounting	4	11	3
9	Mass Comm.	8	10	-
10	Chemistry	7	10	1
11	Geography	2	16	-
12	Physics	6	12	-
13	Animal Production	6	11	1
	TOTAL	73	153	8

Table 2: Lecturers responses

LECTURERS				
S/N	**Department**	**Good/Accept (6)**	**Fair/Reject (6)**	**Indifference (6)**
1	Mathematics	1	5	0
2	Computer Sci.	2	4	0
3	Biochemistry	1	4	1
4	Political Sci.	2	3	1
5	Business Admin	2	4	0
6	Public Admin	1	5	0
7	Agric Extension	3	3	0
8	Accounting	1	4	1

9	Mass Comm.	2	4	0
10	Chemistry	2	3	1
11	Geography	1	5	0
12	Physics	0	6	0
13	Animal Production	0	5	1
	TOTAL	18	55	5

3.1.1 Analysis of the Interview Result

From the above tables, it was discovered that out of the 234 students interviewed, 73 students accepted that the manual method of examination (PPT) for GST courses is good enough. 153 students rejected the use of the manual method of conducting examination, thus prefer the use of CBT system for the conduct of GST exams, while only 8 students show indifference to the interview. Also, from table 2, 76 lecturers were interviewed, 18 prefer to continue using the existing manual method (PPT) while 55 saw the need for CBT system. Only five 5 lecturers did not respond to the questions.

It can therefore be concluded from table 1and 2 above that most of the students and staff prefer the CBT system to the manual PPT or paper based methods of conducting GST examination in the University.

3.2 PROBLEM OF THE EXISTING SYSTEM

The manual method of conducting examination in Adamawa State University, Mubi is faced with challenges due to the ever increasing number of students taking exams which include but not limited to exam malpractice, inaccuracy in marking, delay in marking results and omission of student's results.

However, many CBT system has been designed to curb with the above mentioned problems but with certain limitations which includes:

a. Some of the systems are standalone which makes it difficult to use over the internet or intranet.
b. While some of the systems support only Multi-Choice-Questions (MCQ).
c. And most importantly, the security of the system.

Hence, this research to design and implement a robust CBT system that can curb the existing problem and optimally meets the standard requirements in terms of speed, security, questions randomisation and cost.

3.2.1 RESEARCH QUESTIONS

Can the manual method (pen -on - paper) of GST examination be automated in Adamawa State University?

3.3 THE DEVELOPED SYSTEM

The CBT system developed in this paper is an online examination system which can be use over the internet or intranet. The system support MCQ and fill in the blank spaces type of question, it allow the students to retake examination (where necessary), view their result immediately upon submission with a flexible timing function and presents the overall result statistically using pie chart.

3.3.1 SECURITY OF THE SYSTEM

1. The system allow students to login only when it is time for exam (the admin sets the time).
2. Login details of users is well encrypted using MD5 encryption method
3. Data access is limited to each user except the admin who oversees the entire system.
4. To avoid leaking of exam questions, only the course lecturer is allowed to upload exam questions.
5. To help curb exam malpractice, the exam questions are randomized

3.4 SYSTEM DEVELOPMENT

The CBT system was designed based on the requirements specifications. The conceptual design was carried out using; the data flow diagram together with the Entity-Relationship Diagram, system flow chart and the use case diagrams. However, Figures 1 is the flowchart diagram of the CBT system.

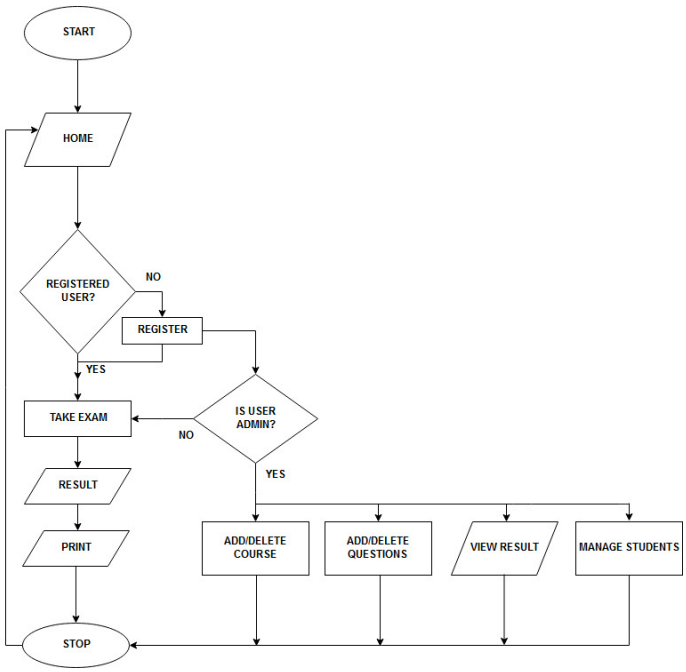

Figure (1): Flowchart Diagram

3.5 DEVELOPMENT TOOLS

The CBT System was developed using WAMP Server, Hypertext Markup Language (HTML), JavaScript and Cascading Style Sheet (CSS), PHP and MySQL.

4. RESULTS AND DISCUSSION

The CBT system is composed of six (6) different functional pages including the student login page, the admin login page, the question page, the result summary page, question upload and configuration page as well as the student result page.

4.1 IMPLEMENTATION

The implementation was done on xampp server locally hosted on a computer and tested for consistency and correctness. The screen shots in the figures below shows few interfaces from the system.

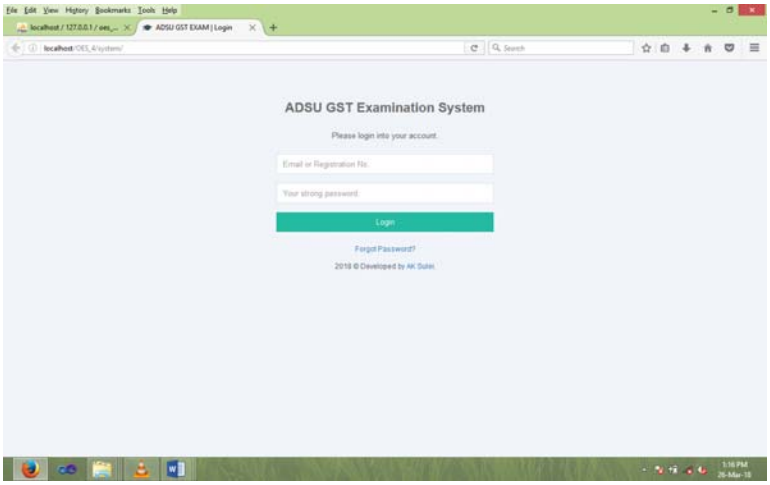

Figure (2): Login page

This page (Fig. 2 above) is used by the users of the system to login into the system with their login details in other to perform task on the system it is also the homepage.

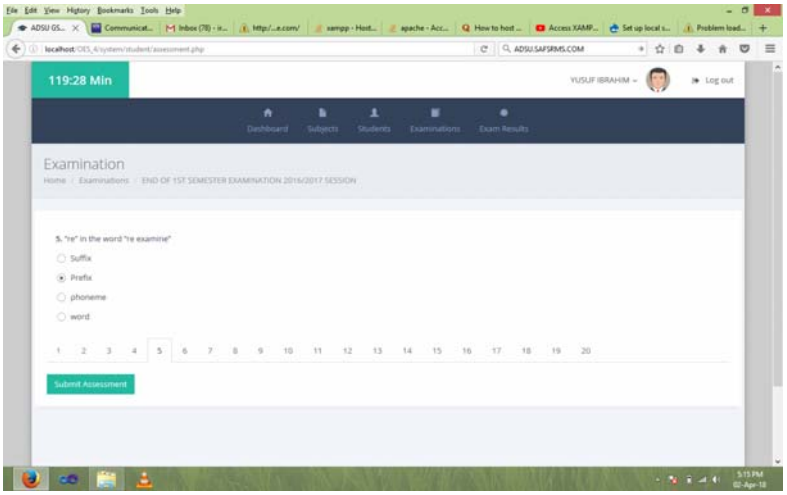

Figure (3): Examination page

Figure 3 Above shows the examination process. Students use this section to take their examination, the page allow students to navigate through question number and finally submit by clicking on the submit button. However, the system submit automatically when the exam time elapse.

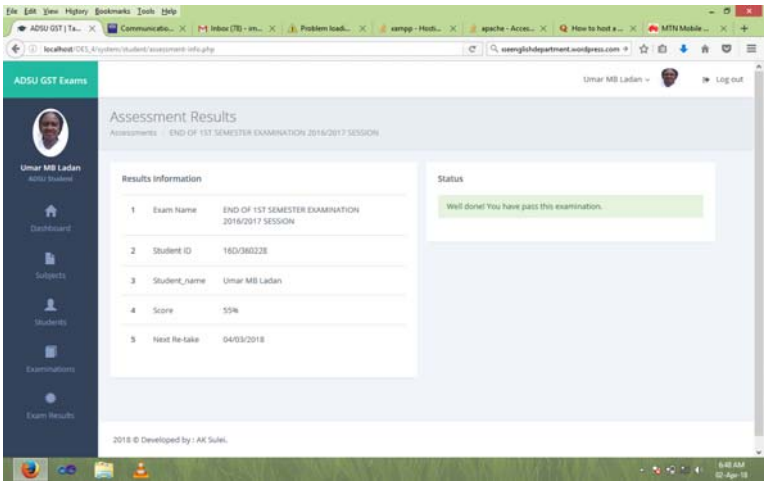

Figure (4): students' result page

The students' result page is displayed immediately upon submission of the examination showing the score in percentage and remark. However, students can login to their dashboard later to view the result.

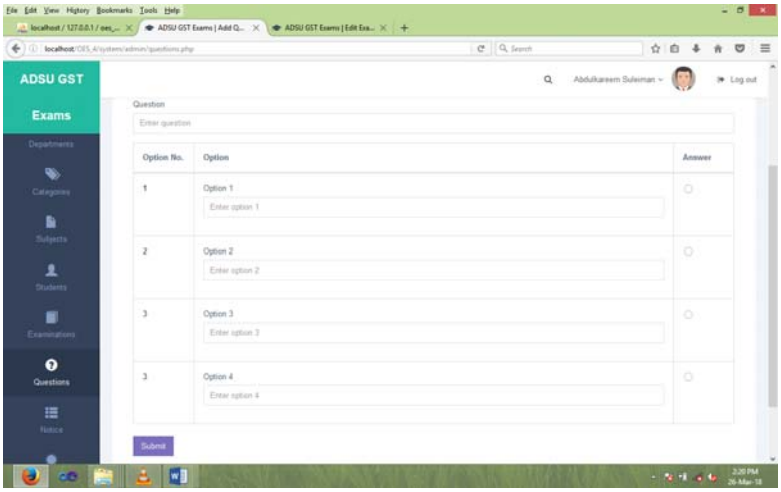

Figure (5): Question upload page

The course lecturers uses this section to upload or set examination question by choosing the question type such as MCQ or fill in the blank space e.t.c, and thus specify the correct answer and pass mark.

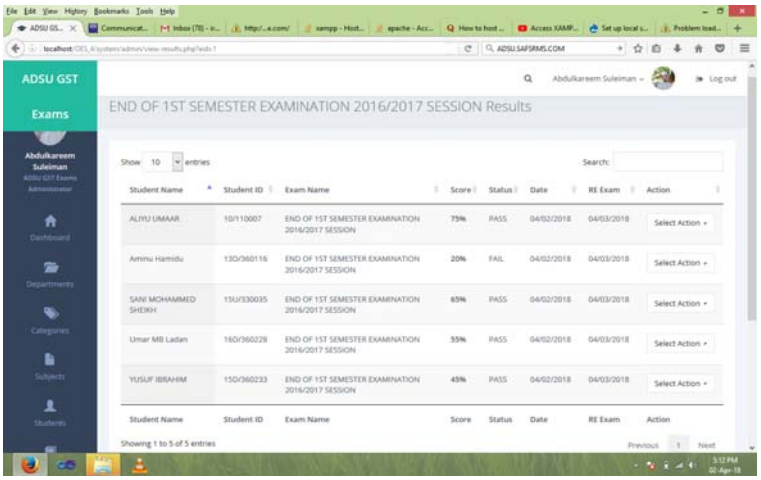

Figure (6): Result Summary page

4. CONCLUSION

However, in conclusion, Findings shows that the CBT system has the possibility to do away with some of the problems that are linked with the manual methods of conducting examination such as omission of students result, delay in marking result, inadequate examination materials, human error (s) during the marking process, and eliminate some forms of examination malpractices. By adopting *CBT* system, the cost implication of conducting General Studies (GST) examination in the university will be cut down drastically and significantly reduced as there will be no need to any longer print questions papers and answer booklets.

RECOMMENDATION

The researchers recommend that the system be adopted in Adamawa State University. The system is secured, many security features has been integrated. Staff can upload their questions during examination and students can see their results immediately after the examination.

FURTHER STUDIES

However, future research work should accommodate:

1. Other forms of question types such as diagrammatic questions to make the test questions more diverse.
2. Automatic delivering of the students' login details to their mobile phones or email address.

Comment [r3]: Without using numbers write it as a paragraph.
After using the new system (as trials), you have to validate the system with some student and staff sample.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

CBT: Computer-Based-Testing
GST: General Studies
ADSU: Adamawa State University - Mubi