

DEPARTMENT OF COMPUTER SCIENCE

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**AUTOMATED EXAM BANK IN HIGHER LEARNING INSTITUTIONS: CASE OF
BINDURA UNIVERSITY**

BY

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APPROVAL FORM

The undersigned certify that they have supervised the student MUSONZA CAROLINE (B1128364) dissertation entitled, “Automated exam bank in higher learning institutions: Case of bandura University.” submitted in Partial fulfilment of the requirements for the Bachelor of Computer Science Honours Degree of Bindura University of Science Education.

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DEDICATION

“For God who began a good thing in us is capable to bring it unto accomplishment until the day of Jesus Christ”. I dedicate this research project to my parents (Norman and Emma), my siblings (Natasha and Clive) my husband Themba and my daughter Ashley Makanaka.

ABSTRACT

The methods at which assessment is carried out are diverse and differ from state to state around the world. Automation of the exam assessment process has been adopted by many developed countries over the past decade. They have managed to automate some courses and not the whole examination process. The few courses that were automated seemed to be successful hence this is what prompted the researcher to carry out this research. The developing countries seemed to have adopted the idea but mainly for multiple choice questions which do not require too much human effort.

The proposed method will not skip the examination rules, regulations and procedures that have to be followed. The system will be used after all the normal procedures have been followed. The normal procedure is that lecturers set exams and a board meeting where the set exams are discussed is carried out. It is during this board meeting where the chairperson of the department will be taking note of the mistakes. The proposed system will be used after the board meeting. This is when the lecturer will enter their questions into the exam database. In the system the lecturers can only edit topics and questions. The chairperson's role is to verify the questions set by the lecturer and also to create and delete the users. Finally the exams officer can only generate an exam from the set questions and print it.

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CHAPTER ONE: PROBLEM IDENTIFICATION

1.0 Introduction

The on-going reform in the Education Sector puts premium on university examinations as the yardstick for determining standards and quality of education delivery in the universities. The study sought to provide a more convenient way to store and randomly select exam questions (Godswill Obioma et al, 2010). There is a general conviction among policy makers that feedback from the performance of candidates in examinations provide information about the educational progress of learners in a systematic way, and it is also indicative of the quality of teaching and learning that takes place. Thus the Bindura University of Science Education (BUSE) through its faculties is making concerted efforts to improve the reliability of their examinations systems in the assessment of candidates' academic performance. The automation of the assessment practices seems to be a solution to the current data traffic management problems that are being faced at Higher Learning Institutions.

Automation refers to the use of inanimate electronic or mechanical devices such as computers or other machines for the execution of tasks. It is the process of having a machine or machines accomplish tasks which were performed wholly or partly by humans. In other words, automation is the replacement of manual operations with computer procedures and other machinery. As a technology, automation can be applied to almost any human endeavour, be it manufacturing, office, teaching - learning, administrative or assessment tasks and operations. Automation of educational assessments, be it school-based assessment or university examinations, can be described as the application of technology for the assessment of learning outcomes. It involves the use of machines to perform those operations which was performed wholly or partly by teachers or employees of examination bodies. In a generic sense, automation of assessment is synonymous with 'technology enhanced assessment'. Technology-enhanced assessment refers to a wide range of ways in which information communication technologies (ICT) can be used to support assessment, feedback and other related activities (Godswill Obioma et al, 2010).

Examination is a medium of knowing the intelligent quotient (IQ) of a person and how far is the understanding of certain subjects. Normally, the questions are prepared by lecturers in sets and become a burden if the subject is new to them as they need to prepare it in a given time (Han, 2014). He proposed a system of auto generating a new set of final exam questions. The objectives of the system are: to optimize selection of final examination question based on

the Cognitive Level of Blooms Taxonomy; to design and develop a prototype of auto-generator examination question using Genetic Algorithm and to evaluate performance of this tool. There are many types of questions in an examination; but this system chooses to analyse the structured question only. This technique can be upgraded and be used by other type of question too.

Bloom's Taxonomy is a hierarchical model for organizing thinking skills to write clear learning objectives that move from the most basic to the most complex kinds of thinking. The categories build in complexity with these six categories: remember, understand, apply, analyse, evaluate, and create. The original taxonomy was developed in the 1950's by Benjamin Bloom and was revised in the 1990's by Lorin Anderson, a former student of Bloom. This tool is based on the revised taxonomy, which has become a gold standard for writing learning objectives (Jeanne & Adam, 2015). Verb lists of measurable objectives are available for all six levels of the taxonomy. The verb helps lectures when they will be structuring their examination questions. For each and every question that is set it has to least comply with the three levels of the Bloom's Taxonomy

1.1 Background of the Problem

Bindura University of Science Education introduced the manual exam bank system in August 2013. Up to date the exam banks have not been automated and this is resulting in many data management problems. The Exam Bank was introduced as a measure to reduce exam leakages since they were a lot of people involved with the exam up until it's written and also there was one paper set hence it was easy to predict the exam that was going to be written. The manual exam bank came as way to curb all the problems that were currently being faced by the traditional way of setting exams.

The examination assessment in today's context is behind its time in respect of the usage modern ICT as seen by experience. The Bindura University of Science Education provides a manual way of storing and selecting exams to be written. Since the process is wholly manual some question papers can be misplaced resulting in lecturers required to set some more exams. Also the manual selection process seems to be unfair as some exams stay in the exam bank for a long time resulting in them being written whilst they are outdated. The exam bank problem is traditional combinatorial optimization problem. Manually managed exam bank systems are not only inconvenient but they also prove to be costly in terms of time and money. A lot of money is being spent on making hard copies. This manual method is similar

to the traditional file system and they are a lot of disadvantages associated with it. The disadvantages include: data inconsistency, data redundancy, and lack of data integration, limited data sharing and the problem of security. Inconsistency is one of the major problems at the BUSE exam bank system. This is because when examinations are being set the exams officer has to update each and every department telling them how many examination papers that is required for each course. There is data redundancy because with the current method questions can be repeated and there is no way to check for that since a lot of hard copies are involved. The problems increase due to the increase in number of students and number of courses offered.

1.2 Problem statement

The exam bank system has not been automated since 2013 when it started hence there are a lot of problems which are arising due to the existing manual system. Firstly since the data involved are hard copies the data management process becomes very difficult.

With the current manual picking method the exam might be selected after it is out dated resulting in students writing out dated exams. Exams are manually submitted and this involves a lot of paper work which in turn makes the exam data management process very difficult. Also since hard copies are involved they can be misplaced hence there is need to automate the process in order to reduce the time and money lost and to increase the accountability of the exam assessment process

1.3 Research Objectives

1. To develop an automated exam bank system that stores examination questions on topics from course outline
2. The system will randomly select the questions from the exam bank by picking and arranging questions from lower order to higher order.
3. To balance marks and content of examination questions being picked
4. To remove outdated questions and written examinations from the Exam Bank

1.4 Research Questions

- ✓ How will the generated examination address the issue of balancing marks and content of examination questions
- ✓ How can the exam bank automation improve the data traffic management problems that are currently being faced at Bindura University of Science Education
- ✓ How are the generated examination questions arranged

1.5 Research propositions/Hypothesis

The research postulates that exam bank automation is more effective in the exam assessment than the manual method

A hypothesis:

H0: the use of the automated exam bank is not an effective method to ease data traffic management problems compared to the manual method

H1: the use of the automated exam bank is an effective method to ease data traffic management problems than the manual method

1.6 Justification

Developing an automated exam bank system seems to be solutions considering the problems highlighted that are being faced by the Exam Officer, Chairpersons and lecturers in trying to manage the exam process. The automated exam bank has the potential to be more usable than the manual method especially on ensuring that out-dated examinations are removed from the exam bank. The research will try to assess the benefits and limitations of an automated exam bank system at the same time making sure that the process is very secure. The results of this research will seek to illustrate and explain the effectiveness of the automated exam bank system. Exams play a vital role in the assessment of students' progress. As such the efficiency, reliability, and security of the technologies involved are critical. The aspect that Information Technology is seen as another great supporter of the environment friendly development, the automation process gets rid of the manual paper work and complies with Green IT regulations of ISO Standards which requires a step change in current practices: reducing unnecessary IT use whilst optimizing technology's ability to offset emissions from other parts of the business. This would ensure that fewer trees are cut down to produce paper since we are dealing with the reduction of the usage of paper.

1.7 Assumptions

The researcher assumes that

- People responsible for the exam bank have the basic level of computer literacy
- Exam officers have to be motivated to use the exam bank
- The exam questions will be pre-sorted before being uploaded in the exam bank database
- The exam questions must constitute more than 70% of the course outline

1.8 Scope of the study

The research will be carried out at Bindura University of Science Education (BUSE), Faculty of Science and Department of Computer Science.

1.9 Research limitations

The major limitation of this project would be to get the information on problems and challenges that are being faced by the exams officer. This is because the exams officers are not allowed to disclose too much information concerning the exams and how they are conducted in order to give a live implementation. As a result this research and conclusions will be carried out on the available information. Time and money are the other limiting resources because in order to be able to develop a very big system more time and money is needed.

1.10 Definition of terms

1. **Exam bank** is a database consisting of all the examination questions for courses offered at Bindura University of Science Education.
2. **Exam bank list** is a list consisting of all the examinations in the exam bank
3. **Automation** it is the process the process of moving from the manual method to the modern method which involves the use of IT

CHAPTER TWO: LITERATURE REVIEW

2.0

INTRODUCTION

The traditional examination method faces replacement, and automated exam bank is a very important direction. Producing a quality graduate is one of the main objectives in any educational institution. The higher acceptance of their graduates in work market indicates the quality of the institutions. The quality of graduates produced by any institutions is determined by many factors for example the quality of the evaluation system.

In order to fully understand what the exam bank is all about, it is worthwhile to understand some sources of the development of previous exam bank systems that were designed in other places of the world. Therefore this chapter seeks to discuss in depth previous exam bank systems that have been developed so far, how they impacted in their area of study, what benefit they brought to the community at large and whether they managed to fulfil their individual set objectives and the general I.T objectives that they were intended for.

The traditional exam bank is designed and built by one traditional/unconstructive way, which means every kind of exam question has its unique scheme to store and handle. This way is easy to design, but hard to handle when more and more different kinds of exam questions are put into the bank. So we can use document as a kind of container to store exam question, which changes the basic storage structure of exam question item. If we put exam questions into document container, we can get a common interface at system level to access those questions without considering the detailed structures of different kinds of questions (Tao,et al., 2012). The document container seemed to accommodate most courses or subjects but failed to accommodate practical questions since they have to be assessed in different environments. The proposed system seemed to provide a solution since it could cater for most exams but the major problem was it could only accommodate unstructured questions ignoring multiple choice and structured questions.

Many authors have proposed the development of different systems as solutions to the current problems that are being faced with the manual method of selecting and managing exam bank. Bardesi,et al 2011 proposed the development of the e-exam management system (KAU-eExam). The KAU-eExam allows instructors to build questions bank for different courses, generate, and delivery examinations for undergraduate students. The technique of building the exam is to cover all intended learning outcomes of the course such as, knowledge, cognitive, interpersonal and responsibility, communication, and information

technology skills. These questions are built based on three levels of difficulties the levels are namely high, middle and low level. A higher level question usually constitutes more marks and also they ask about application of the concept. A middle level question usually has fewer marks compared to the higher order question and asks about knowledge of the concept. A lower order questions has the least number of marks of the three levels and it mainly asks about defining or stating a concept.

2.1 Different views for automated exam bank

Different automated exam bank systems may give different results, particularly in different subjects or courses. Academicians in Learning Institutions are usually in dilemma when it comes to creating quality questions that could measure the students' skills and knowledge. Moreover, most academic institutions are not yet equipped with organized knowledge bank repository that can assist the teachers/lecturers in assessing previous questions in helping the lecturers to create new sets of questions. ExGenoba was developed to help teachers/lecturers to automatically identify the level of questions based on Bloom's Taxonomy using Intelligent Question Checker (IQC). The questions will be stored in an organized repository known as Knowledge Questions Bank (KQB). In addition, a component known as Automatic Exam Generator (AEG) could automatically create examination questions from the KQB. (Abdul & Aziz, 2014). The Bloom's Taxonomy is a way of distinguishing the fundamental questions within the education system in order to promote higher forms of thinking in education, such as analysing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts (rote learning). It is named after Benjamin Bloom, who chaired the committee of educators that devised the taxonomy. The Bloom's Taxonomy has six levels and it is difficult to cater for all these six levels on all questions hence there is need to develop a more realistic system with guidelines that can be met.

The examination bank is a software tool developed to manage the assessment process for high stakes and formative examinations from item and examination creation. Exam Bank tracks the assessment lifecycle from creation of draft items through peer review and approval to performance in multiple examinations over time. Questions can be meta-tagged with key curriculum information (e.g. learning objective, subject area, unit of study, year). Statistical performance indicators for each question can be stored in the database and used to audit assessments. The implementation of Exam Bank using this method was successfully implemented and tested in two faculties at a University in Australia (Deborah et al, 2014).

The meta-tagging of exam questions seems to make this method unfair and unsuitable for our problem because it is a semi automatic method as the database will be pre-sorted.

Preparing examination questions is challenging and tedious and time consuming for the instructors. This resulted in the development of analysed item bank of the exam system from the aspects of reliability and validity of questions, database structure and database maintenance. The paper presents the following points: the validity should be emphasized; the technical indicators in the database structure should be diverse to fully reflect the knowledge points; the system should provide a more extensive database maintenance method for the convenience of the administrator to operate (Li Guohong, 2009). The proposed database could only store the questions and not generate an examination. It was mainly for storage purposes hence suitable for archiving purposes so that the examination questions can be used for revision by students and they can also be used by lecturers as a guideline when setting examinations. The proposed system is unsuitable for our problem at hand because it was mainly designed for revision purposes as it could only store examination questions without being able to generate an examination after storing the questions.

2.2 The argument for the exam bank

Modern technologies have generally been accepted in almost every facet of society, which in turn have made people's lives much easier and enjoyable to live. Nobody would dare think of any meaningful life on this planet without computers, mobile phones, the Internet, Compact Disks and satellite televisions as instant sources of information and entertaining. Mathematicians world-wide likewise stress the need to adapt an ever-changing technological society (Brumbaugh & Rock, 2001) so as to keep abreast with the changing technological times. Keeping up with the changes in the technological advances will help an institution to increase its credibility, improve the reliability, consistency, fairness, utility and credibility of assessment?

Computer will continue to make processes simpler, less cumbersome and make time bound operations more attainable than ever before. There is more to be done in the computerization of the assessment process, most especially Item generation and banking. Using manual method exposes these important documents to hazards like paper leakage, poor selection of items, restricted item generation, unavailability of trial testing, and inadequate records for test parameters such as difficulty and discrimination indices. All these make for a good test

development, which are lacking in most examination processing bodies in Africa (Borokinni& Joseph, 2009). A survey carried out at Bindura University of Science Education showed that some examinations in the exam bank are staying longer because of the manual picking method and also some papers can be found missing because it is very difficult to manage the manual method that is being currently used.

Vector space model (VSM) is a common method for measuring test questions similarity in large-scale item bank system. VSM is limited in accurately representing the knowledge relationship and the potential semantic relations of different characteristic words; hence the proposal of a method to test questions similarity called OVSM-TQSM which combines domain ontology and VSM. OVSM-TQSM can reveal the intrinsic relationship among words by using the constructed domain ontology which integrates with the tree structure and the graphics structure. Incorporated with eigenvectors and the weight of words in VSM, OVSM-TQSM calculates the similarity of test questions. A large number of experimental results demonstrate that the novel approach is feasible and effective. Comparing with the traditional method based on VSM, OVSM-TQSM has the advantages of higher accuracy and little unnecessary laborious pre-processing (Jing et al.,2014). The system was implemented and the results showed that it was effective most of the times but however it faced challenges especially on questions that are differentiated by a word. This forced the examiners to rephrase their questions hence losing its original meaning or to totally avoid such questions. This means that the created exam bank excluded some questions due to that fact.

2.3 Benefits of automated exam bank compared to manual method of selecting examinations

There is a brief and largely successful history involving applications of information communication technologies (ICTs) and computer technology to assist in data capturing and releasing of results. While several critical issues have been identified, none has been so significant that an end-game strategy should be invoked than continued innovation. Providing detailed, constructive and helpful feedback is an important contribution to effective student learning. Quality assurance is also required to ensure consistency across all students and reduce error rates. However with the manual method a lot of errors can occur and also data traffic management is difficult hence there is need to automate the process in order to reduce the time taken to complete the tasks and the error rates. The aim is to provide a more effective method with fewer errors than alternative manual approach at the same time demonstrating that it offers quality control, efficiency and effectiveness benefits whilst generating consistent feedback compared to the manual method (Debusse et al)

The benefits of an examination bank evaluation, are related to the possibilities of generating a large number of different tests (practically a different test for every group) with the same structure (using the same template) with the same level of difficulty, making inspiration between participants almost impossible, but keeping the objectiveness of the evaluation. It also decreases very much the infrastructure required for examination generation (the move towards a paperless exam environment will be possible) and discourages exam leakages as few people will be involved with the examination handling. The system will be generating the examination using the same template hence the generated examinations will be consistent in terms of content, marks and the level of difficulty(Nicolae M,2010)

Schramm (2011) believes that the system proposed by Nicolae is reliable because tests perform precisely the same operations each time they are run, thereby eliminating human error and it also gives the same characteristic examination for the same template compared to the human tutors who change the way they set their examinations according to mood and also different tutor means different examinations with different levels of difficulty. If two human tutors are required to produce each an examination, they will produce two different examinations unlike the system which sets according to the same template. You can test how the software reacts under repeated execution of the same operations. Reusable that is you can reuse tests on different versions of an application, even if the exam regulations changes. This means that it can easily be edited to suit the new arising needs. Fast: Automated Tools run tests significantly faster than human users. The same job that can be done in hours by the system require more time when it is done by humans. Cost reduction the numbers of resources for regression test are reduced. The benefit of cost reduction is not felt at first since they are cost of buying the software but as time goes on the benefit will be enjoyed. Choosing the right tools for the job and targeting the right areas of the organization to deploy them can only realize these benefits. The right areas where the automation fit must be chosen.

Examination question preparation is challenging, tedious and time consuming for the instructors. Usually the instructors end up keeping their own test bank in some form to help them prepare future exams. Current technologies help the instructors to store the questions in computer databases. The major challenge is how the current technologies would also help the instructors to automatically generate the different sets of questions from time to time without concern about repetition and duplication from the pass exam while the exam bank growing from time to time. Lecturers can generate question based on the learning outcomes elements. Shuffling Algorithms helps randomization process in selecting questions in the database thus

preventing duplication and repetition. The question can be added to the bank at any time. Different sets of questions could be generated without any limitation. Implementing learning outcomes could classify the question and possible way to evaluate the level of achievement of each course. ((Nor Shahida et al,2013)

Other benefits to the education sector of the examination bank according to (Obioma et al,2012) include lower long-term costs in the sense that , extensive and efficient use of existing item banks, precision measurement through the adaptation of test content to individual students competency creation of digital records and development which can easily be passed along from grade to grade ,greater flexibility with respect to location and timing of examinations improved reliability (machine examination generation is much more reliable than human examination generation) improved impartiality (computerised generation does not make allowances for minor errors) greater storage efficiency - tens of thousands of questions can be stored on a server compared to the physical space required for examination papers, enhanced question styles which incorporate interactivity and multimedia increased productivity and low operational variability accommodation of candidates with special needs.

Steffen et al,2011 in their paper named more than paperless postulates that the benefits of an exam bank include the lecturers will have to spend less time and effort on preparing the examination but rather spend more time teaching the students. Save 75% of the resources used in managing examinations that is it removes the need for paper, printing, posting and physical archiving. A lot of hard copies had to be printed and at the end of the day it resulted in high cost of printing. Physical archiving has a lot of problems which include some exam papers could be lost in the process and also the process is very tiresome and difficulty to manage. It is very difficult to put the house in order in physical archiving and the process to human errors hence the need to automate all processes regarding examinations. The manual method of selection is poor and biased hence there is need to automate the process in order to reduce the biases.

2.4 Exam Management in other institutions

An examination is an important component of any institution that educates people. It is a form of assessment used to measure the students' understanding of the concepts and principles they would have learnt. Zimbabwe Open University, an Open and Distance Learning institution has been setting its own examinations for the academic programmes offered. Through examinations, ZOU students are encouraged to take an active role in analysing and questioning the things they would have learnt. Examinations management at

ZOU involves the setting, administering, marking right up to the publication of results. The investigation adopted the qualitative methodology and a case study design to generate data to address the questions which guided the study. The sample consisted of manager - examinations, manager- quality control, chairpersons of departments from different faculties, programme leaders, programme coordinators, regional quality coordinators, regional administrators, and students who were in their second year of study. Face-to-face interviews were used to generate data from manager -examinations, manager- quality control, regional quality coordinators and regional administrators (Onias et al.,2012)

Data from chairpersons of departments from different faculties, programme leaders, programme coordinators, second year students were generated through focus group discussions. Major findings were the management of examinations at ZOU enhances quality assurance, cited activities which contributed to quality assurance included setting of examination items for the item banks, tight security in the transporting of examination items to and from the regions, residential marking, active invigilation. Participants were aware of activities that compromised quality assurance such as uncommitted invigilators, incomplete examination, lack of clarity on instructions, lack of security and non-confidentiality of examination items, timetable alterations. Some of the challenges that were mentioned by participants were unrealistic deadlines set by academic registry regarding marking, delays in dispatching of Personal Identification Numbers to newly admitted students, welfare of invigilators during invigilation, and the need for communication between invigilators and other relevant authorities if the need arise when the examination is in progress (Onias et al.,2012).

Some of the recommendations arrived at were that faculties should hold periodic workshops on examination management, induction of new staff members who deal with examination management, adopting ICT in the dispatch of examinations to regional centres and networking of the National Centre and the regional centres to facilitate communication and generation of student Personal Identification Numbers(Onias et al.,2012).

Assessment is one of the most important aspects in the learning process of every programme. It entails the critical tools that lecturers employ to evaluate the degree of effective learning within the student. It makes the learner stay focussed throughout the learning period at the same time assisting the lecturer with the much needed feedback and direction. An examination is a major part of every academic learning process as success and failure of

learners is judged by one's performance in it. This places the assessment tool at the centre of the whole learning process as both lecturers and students perform their duties throughout the academic year with the ultimate examination in mind. Challenges include the unavailability of the necessary resources. (Isaac et al., 2013).

2.5 Gaps in literature

Good systems, if well implemented, can take the examination bank to the next level. The examination bank demands the integrity and authenticity of those in charge and the efficiency of the system. The system that is being proposed will fill in the gap by providing automatic generation of the full examination taking note of the content of the examination questions that is the content must be balanced in marks and course outline. More and more countries are contemplating using the automated examination bank system in the examination process considering the increasing numbers of programmes and courses that they are offering. The adoption of exam bank seems to be a solution considering the tedious process that the examiners have to go through using the manual method. Universities and colleges would eventually depart from having manual method of data gathering processes to having the automated method. There is a great need to standardise the exam bank throughout a nation in national examinations and worldwide in examinations that need international recognition or accreditation- this is evidenced by the recent publications of journals and call for papers and the academic interest in these areas.

Many of the security issues debated involve technically based solutions, currently being developed, to thwart attacks on the exam bank. It may be years, or never, before a 100-percent-secure, risk-free internet service, exam bank, reaches its full potential. (Husztli & Petho, 2008) proposed a cryptographic scheme that possesses security requirements, such that authenticity, anonymity, secrecy, robustness, correctness without the existence of a Trusted Third Party. Another research work proposed a theoretical approach that incorporates available fingerprint biometrics authentication technologies in conjunction with exam bank environments to curb unethical conduct during the automated exam bank (Levy & Ramim, 2007). These two theses tried to show the importance of security in the assessment of examinations. But, the same can be said about the numerous examination banks systems that are currently in place, and for most part, nations still conduct their business and the automated assessment systems are still relatively secure despite the controversies associated with examination leakages.

An ideal system developed must be able to generate an examination-paper formation algorithm of a no-paper examination system automatically ensuring the generated exam-paper meet pre-demands of exam-grade distribution. The quality of random auto-examination set is based heavily on the accuracy of examination question in the exam database score probability and probability distribution of answer-question time. This mode has three problems-experienced errors, no-adaptive adjusting suiting to different students. (Rongrong, 2015) Therefore on the basis of the presented problems the researcher felt that there is need to develop a system that is accurate and a system that overcomes the stated problems. The biggest problem that rendered this system to be absolute is the problems of errors this is because examinations are very important and crucial hence there is need to create a system that is reliable and error. The problem of errors is also unacceptable since that is the main objective of developing the system to curb all the problems.

This study aims at designing and implementing syllabus-oriented question-bank system that is capable of producing paper-based exams with multiple forms along with answer keys. The developed software tool is named X(Chi)-Pro Milestone and supports four types of questions, namely: Multiple-choice, True/False, Short-Answer and Free-Response Essay questions. The study is motivated by the fact that student number in schools and universities is continuously growing at high, non-linear, and uncontrolled rates. This growth, however, is not accompanied by an equivalent growth of educational resources (mainly: instructors, classrooms, and labs). A direct result of this situation is having relatively large number of students in each classroom. It is observed that providing and using online-examining systems could be intractable and expensive. As an alternative, paper-based exams can be used. One main issue is that manually produced paper-based exams are of low quality because of some human factors such as instability and relatively narrow range of topics.

Further, it is observed that instructors usually need to spend a lot of time and energy in composing paper-based exams with multiple forms. Therefore, the use of computers for automatic production of paper-based exams from question banks is becoming more and more important. Methodology: The design and evaluation of X-Pro Milestone are done by considering a basic set of design principles that are based on a list of identified Functional and Non-Functional Requirements. Deriving those requirements is made possible by developing X-Pro Milestone using the Iterative and Incremental model from software

engineering domain. Results: We demonstrate that X-Pro Milestone has a number of excellent characteristics compared to the exam-preparation and question banks tools available in market. Some of these characteristics are: ease of use and operation, user-friendly interface and good usability, high security and protection of the question bank-items, high stability, and reliability. Further, X-Pro Milestone makes initiating, maintaining and archiving Question-Banks and produced exams possible. Putting X-Pro Milestone into real use has showed that X-Pro Milestone is easy to be learned and effectively used. We demonstrate that X-Pro Milestone is a cost-effective alternative to online examining systems with more and richer features and with low infrastructure requirements.

2.6 Summary of Literature Review

This chapter gave a summary of what other researchers discovered about automating the examination process which will pave way to the newly introduced automated exam bank system. In view of the literature obtained from the various researchers the general view that was discovered by the researchers is that exam bank automation is a promising field with a brighter idea that can drive the globe to automated assessment. The main question that comes with the research is that, is automated assessment capable of saving costs(associated with printing hard copies)and the time and space(that the manual method consumes) at the same time maintaining integrity, authenticity and confidentiality of the examination setting process? If it can bring change to what extend and are the generated examination similar in terms of the level of difficulty? How will the generated examination balancing marks and content of examinations. The next chapter highlights the research methodology.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

Methodology has included the use of fact finding methods such as data collection, analysis, design tools and development. Information system project methodology can be captured from the activities of the System Development Life Cycle (SDLC)

This chapter takes an in-depth look into methodologies for the user interface design, ontology design and inference engine design process, and implementation of the suggested theories and strategies and how they were carried out. In this chapter the researcher also provides a step by step implementation of the proposed model.

Two exams are set for computer security and the exams officer is asked to generate examinations using both the automated method and the manual method. The two exams are compared in terms of the number of repeated questions. Effectiveness of the system is analysed by comparing the repeated questions compared with that of the manual method.

Requirements specification

It is a description of the software system to be developed laying out functional and non-functional requirements and may include a set of use cases that describe the interactions the users will have with the software.

System users:

- Examiners
- Chairpersons
- Exams officer

The requirements will be classified according to each user;

✓ Functional requirements

Statements of services the system should provide how the system should react to particular inputs and how the system should behave in particular situations. It also defines a function of the system and its components. A function is described as the set of inputs, the behaviour and

the output. In short functional requirements describe how a system is supposed to accomplish its objectives. A function is described as a set of inputs, the behaviour, and outputs. Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish for example authentication and administrative functions.

✓ **Non- functional requirements**

They define how a system is supposed to be. They specify the criteria that can be used to judge the operation of a system rather than specific behaviours. Non-functional requirements essentially specify how the system should behave and that it is a constraint upon the systems behaviour. One could also think of non-functional requirements as quality attributes of a system for example security and reliability.

✓ **The system development model**

A system development methodology refers to the framework that is used to structure, plan, and control the process of developing an information system. A wide variety of such frameworks have evolved over the years, each with its own recognized strengths and weaknesses. One system development methodology is not necessarily suitable for use by all projects. Each of the available methodologies is best suited to specific kinds of projects, based on various technical, organizational, project and team considerations. For this research the author choose the spiral model.

The spiral model is the software development model that the researcher is going to use. This is because the spiral model is a risk-driven process model generator for software projects. The spiral model will guide the researcher to adopt elements of one or more process models. The risk-driven sub setting of the spiral model steps allow the model to accommodate any appropriate –mixture of a specific –oriented, prototype-oriented simulation-oriented or other approach to software development.

The spiral model combines the idea of iterative development with the systematic, controlled aspects of the waterfall model. Spiral model is a combination of iterative development process model and sequential linear development model i.e. waterfall model with very high emphasis on risk analysis. It allows for incremental releases of the product, or incremental refinement through each iteration around the spiral. The spiral model has four phases. A software project repeatedly passes through these phases in iterations called Spirals.

- **Identification:** This phase starts with gathering the business requirements in the baseline spiral. In the subsequent spirals as the product matures, identification of system requirements, subsystem requirements and unit requirements are all done in this phase.

This also includes understanding the system requirements by continuous communication between the customer and the system analyst. At the end of the spiral the product is deployed in the identified market.

- **Design:** Design phase starts with the conceptual design in the baseline spiral and involves architectural design, logical design of modules, physical product design and final design in the subsequent spirals.
- **Construct or Build:** Construct phase refers to production of the actual software product at every spiral. In the baseline spiral when the product is just thought of and the design is being developed a POC (Proof of Concept) is developed in this phase to get customer feedback.

Then in the subsequent spirals with higher clarity on requirements and design details a working model of the software called build is produced with a version number. These builds are sent to customer for feedback.

- Monitoring technical feasibility and management risks, such as schedule slippage evaluates the software and provides feedback.

The figure below shows the processes of the spiral model

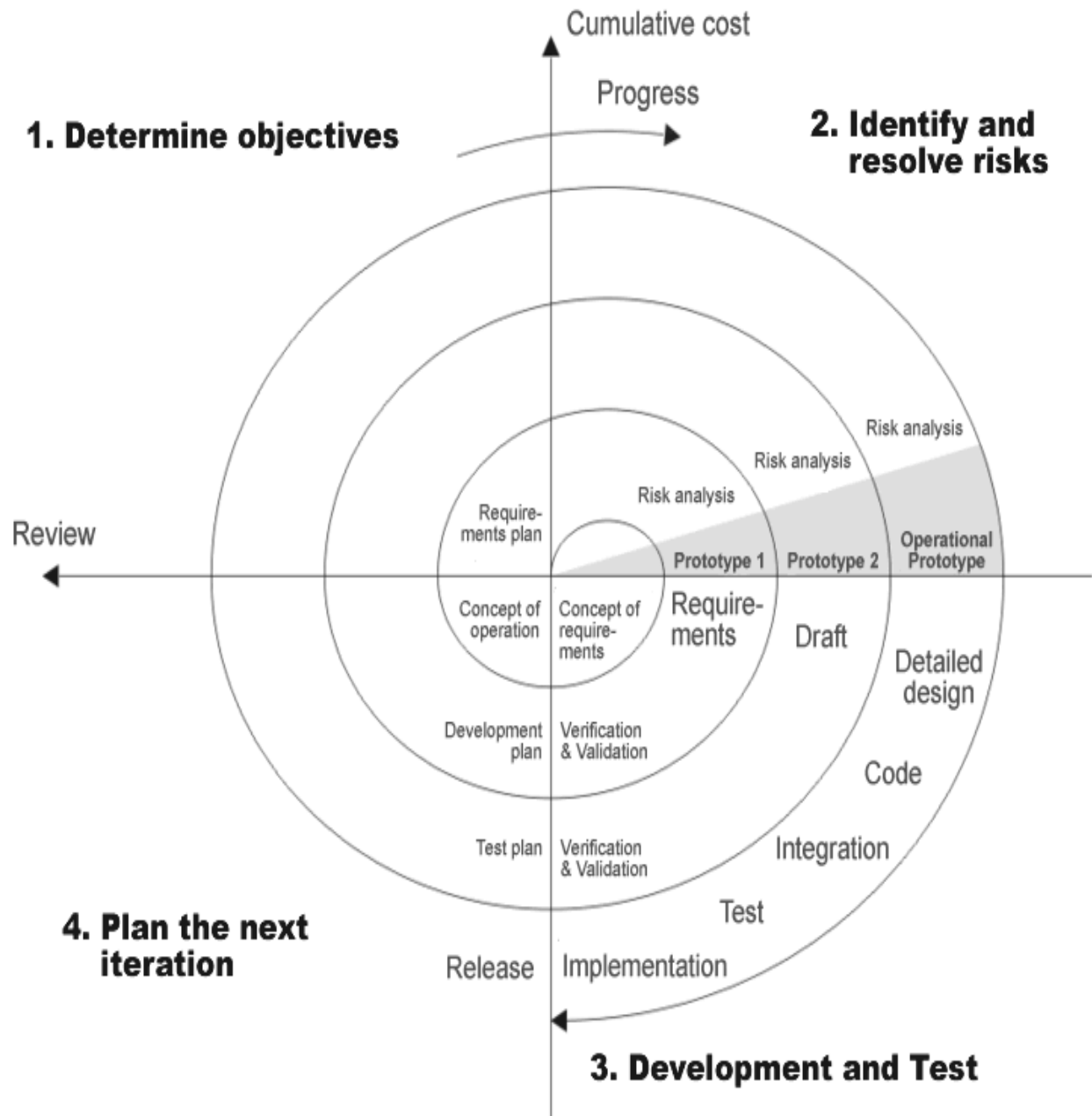


Figure 1:Spiral Model

3.1 Research design

The key to a successful project is proper design, the design stage involves coming up with the different modules of the system and their intended functionality. The design has to be based on the information collected during system analysis. The system interfaces should be designed with the end user in mind making the design process easier and make the design work easier to implement.

NB: There should be a balance between user friendly interfaces and functionality; one aspect of the system should not cause a downgrade on another aspect of the system. The interaction between the different modules should also be clearly shown with the use of relevant UML diagrams while the database design should be done with the use of Entity –Relationship diagrams

3.2 Design methods

Design process of both the administrator's and user interface needs software development model that can be accessed via the internet and limiting the graphics in the design. The automated examination system was implemented using:

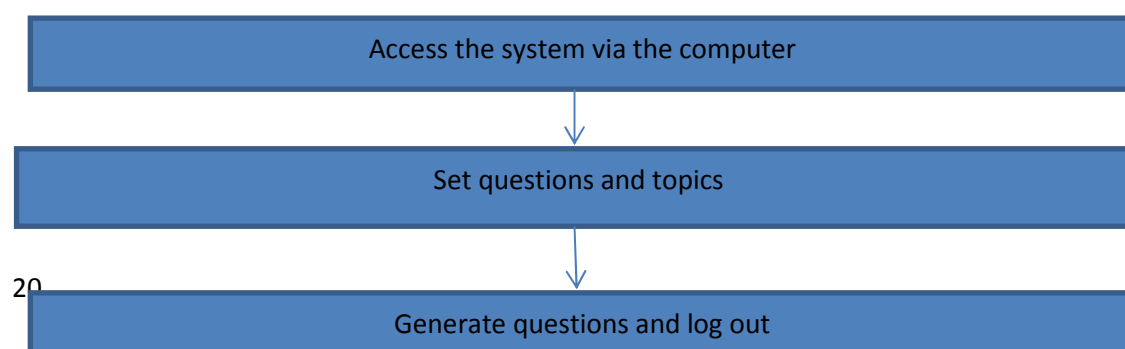
- PHP language
- The researcher used MySQL database management system that is well known for its reliability and dynamics when it comes to database management.
- ASP.NET
- C Sharp
- Java
- Visual studio

3.3 Design Structure

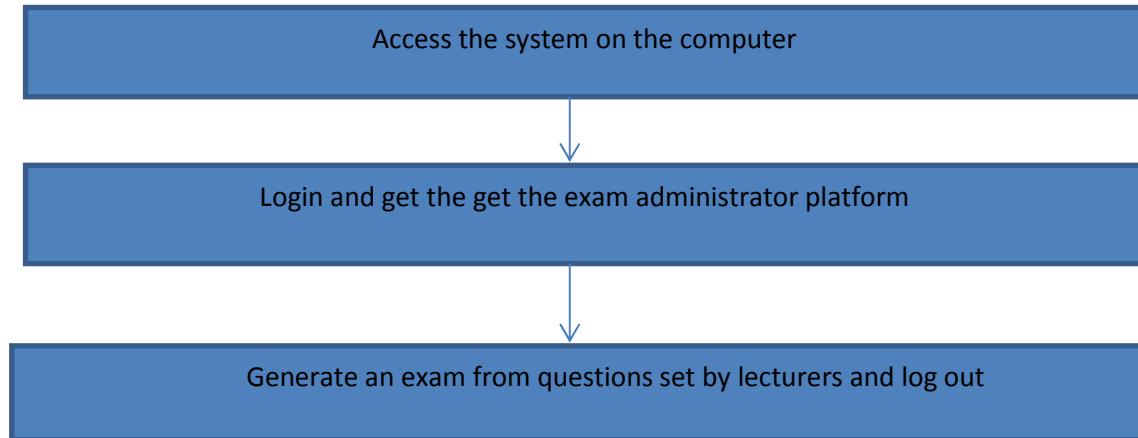
The figure below illustrates the flow of data at the front-end and the backend

NB: the system is meant for the exam administrator, the examiner (lecturer) and the chairperson.

User (lecturer)



User (Exam administrator)



User (chairperson)

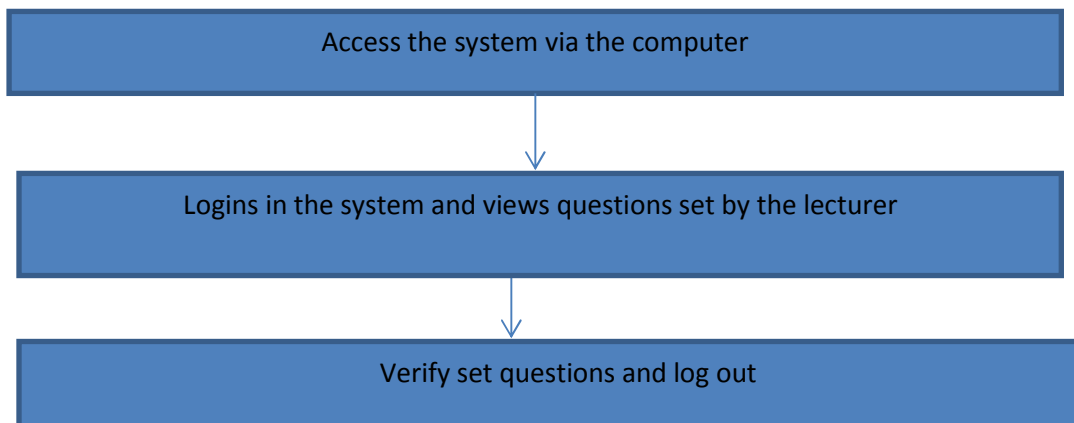


Figure 2 Design of the system

❖ **Design hardware**

- PC or Laptop

In the development work, PC has been used as a workstation for website hosting and programming.

3.4 Development of the system

- **System design**

The system analysis and design methods that will be used include, class diagrams and entity-relationship diagram

A simple outlook of what happens in the automated examination system

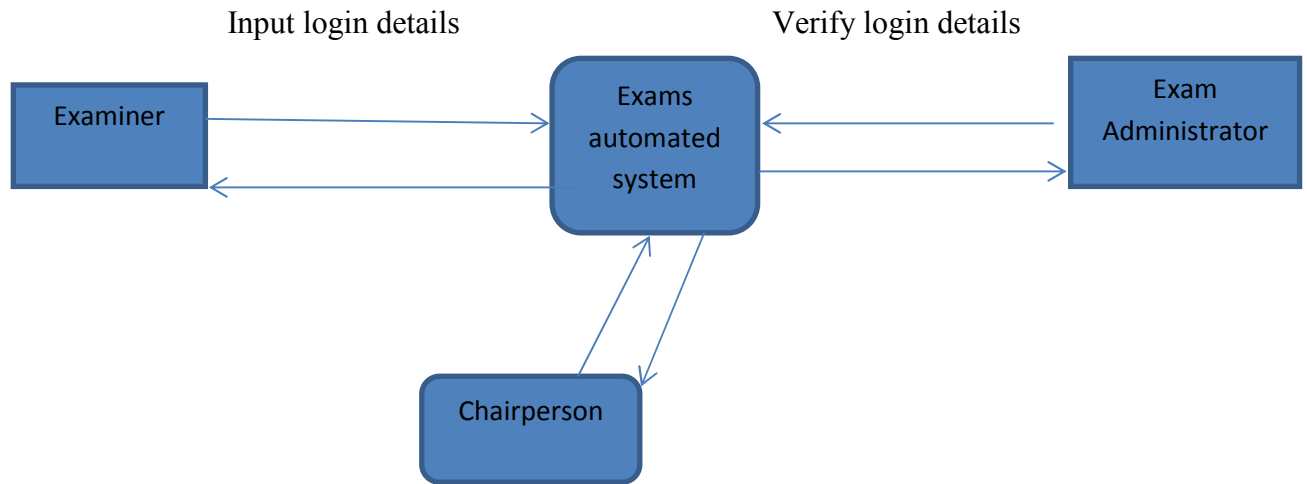


Figure 3: Outlook of the automated examination system

This is how the automated examination system design looks like. First the examiner supplies his or her login details and they are authenticated in the system. The system checks if the user is the right or authentic person to access the system after the examiner supply the system with account activating credentials. In the system the user is able to choose the course which they want to examine. After confirming that the examiner has finished setting the exam, the user log out of the system. Even if the examiner tries to enter the system using the back door the exam cannot be altered after the examiner has verified the set questions.

3.5 Methods used in the system design

I. Use case diagrams

Use-case modelling is a technique used to describe the functional requirements of a system. It makes it easier to show the functional requirements in an abstract way that can easily be understood even by the stakeholders of the system, therefore acting more like a communicating tool between the stakeholders and the developers.

Use case name	View set questions and topics	
Actor	Chairperson	
Description	View and verify exam questions in the database	
Typical flow of events	Action :use case is initiated when the chairperson logs in the set exam questions	System response: the system shows all the questions in the exam database
Precondition	User has the examiner security level to login in and view exams	
Post condition	Questions set have unique Qn_id	

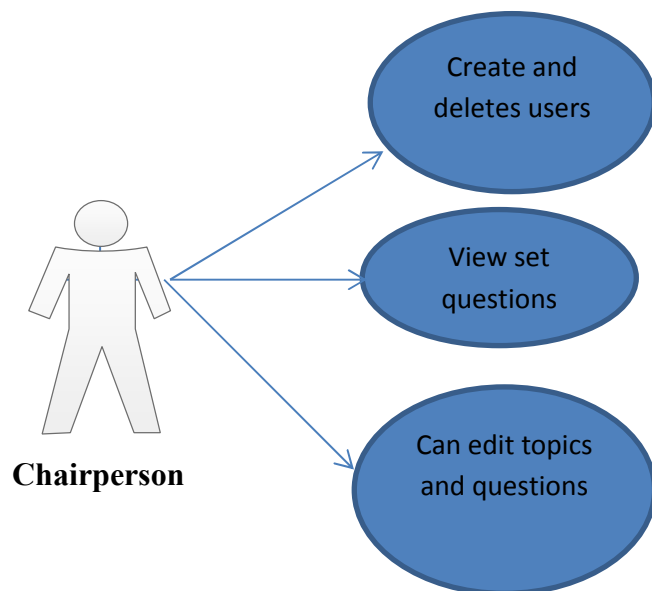


Figure 4 :Use case of the chairperson

Use case name	Generate examination	
Actor	Exams officer	
Description	Generate examination from questions in the database	
Typical flow of events	Action :use case is initiated when the exams officer logs in the exam questions database	System response: the system generates an examination
Precondition	User has the examiner security level to login in and generate an examination	
Post condition	Questions set have been set in the database	

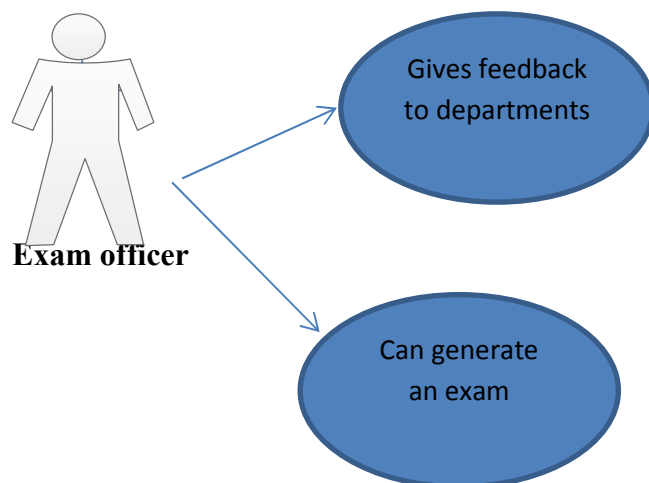


Figure 5:Use case of Exams officer

Use case name	Set questions	
Actor	Examiner	
Description	Set exam questions and insert into database	
Typical flow of events	Action :use case is initiated when the examiner logs in the set exam questions	System response: the system enters questions into the exam database
Precondition	User has the examiner security level to login in and set exams	
Post condition	Questions set have unique Qn_id	

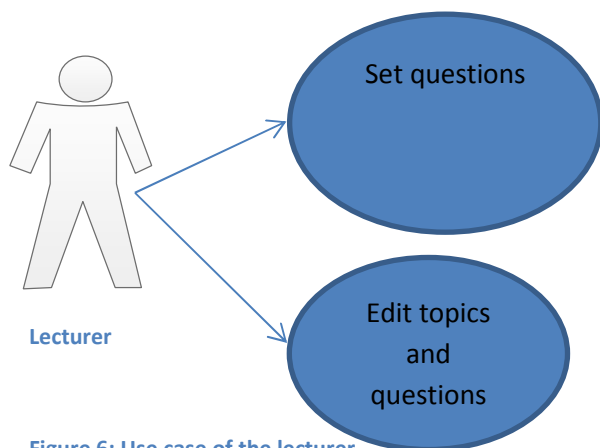


Figure 6: Use case of the lecturer

3.6 Activity diagram for examiners

The activity diagram below (figure 4) shows the sequence of activities the examiner can do when they log into the system. The activity diagram also illustrates the authentication procedures that are followed when an examiner supplies the login details.

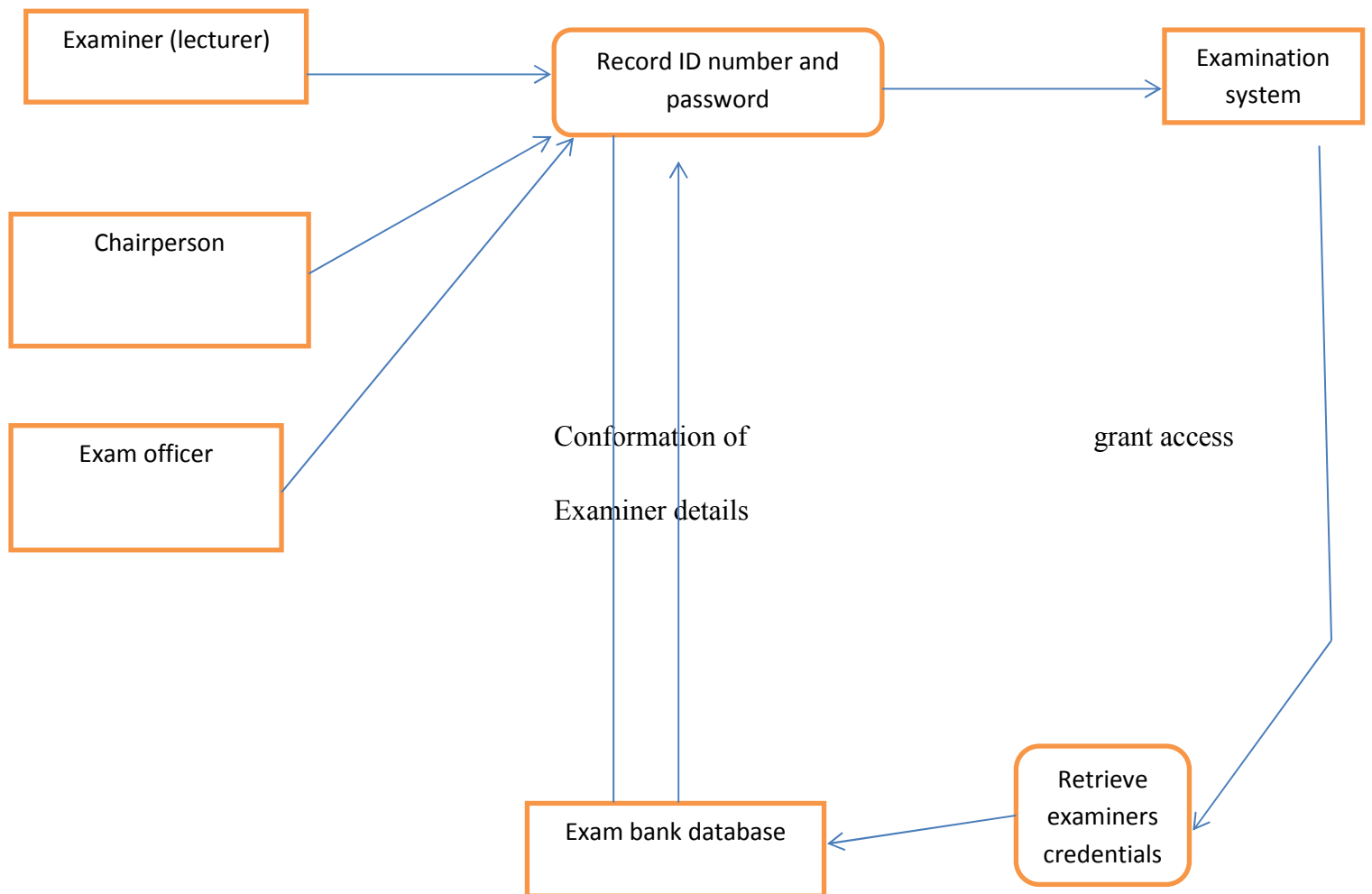
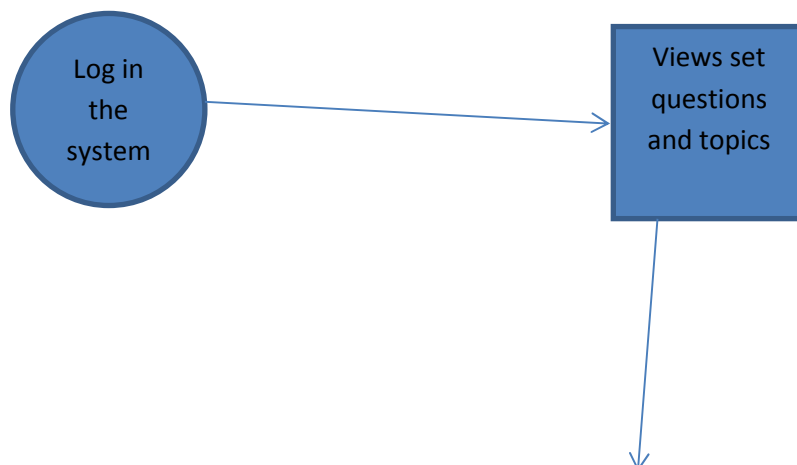
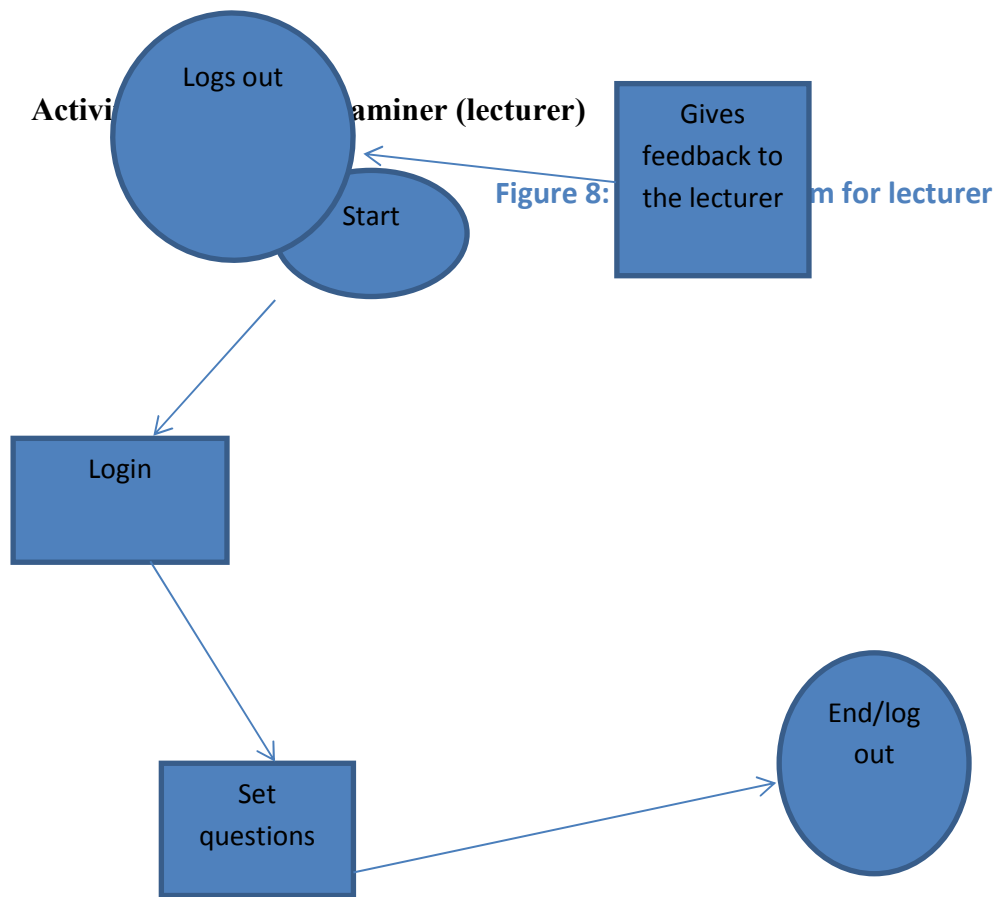


Figure 7: Activity diagram for the automated exam bank

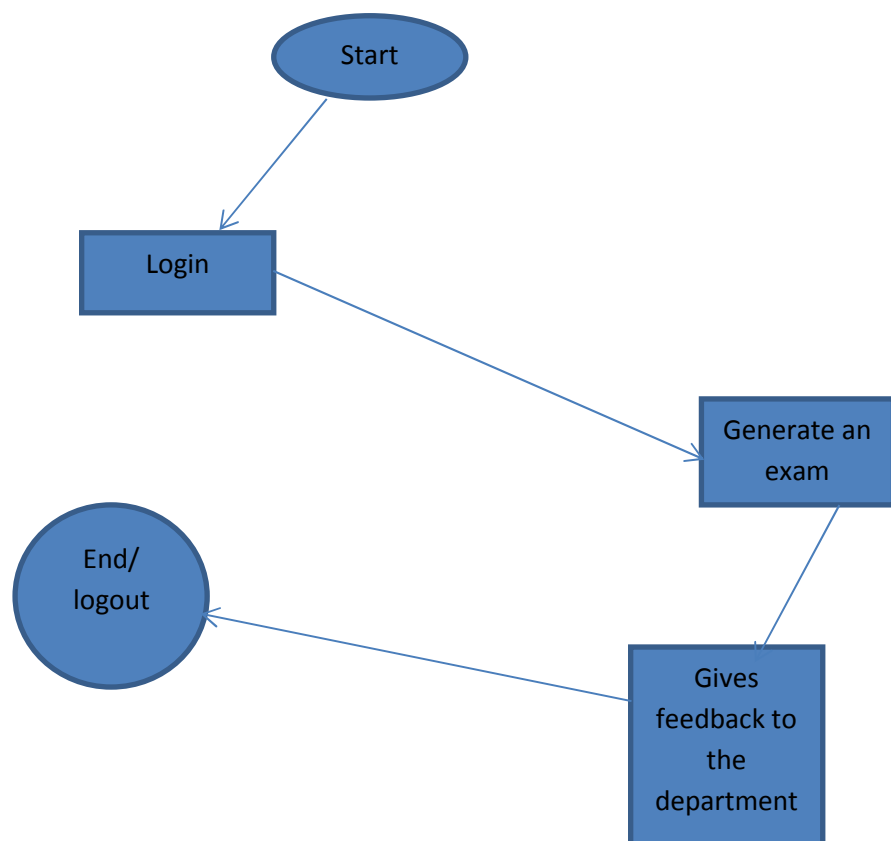
Activity Diagram for the chairperson





Activity diagram for exam officer

The activity diagram shows the sequence of activities that the systems administrator follows when he enters the system.



3.7 Database design

MySQL is a relational database management system that is well known for its reliability and dynamics when it comes to database management. It offers good security for database, at the same time allowing for rapid insertion, deletion and updating of entries into the database.

The database includes the following tables

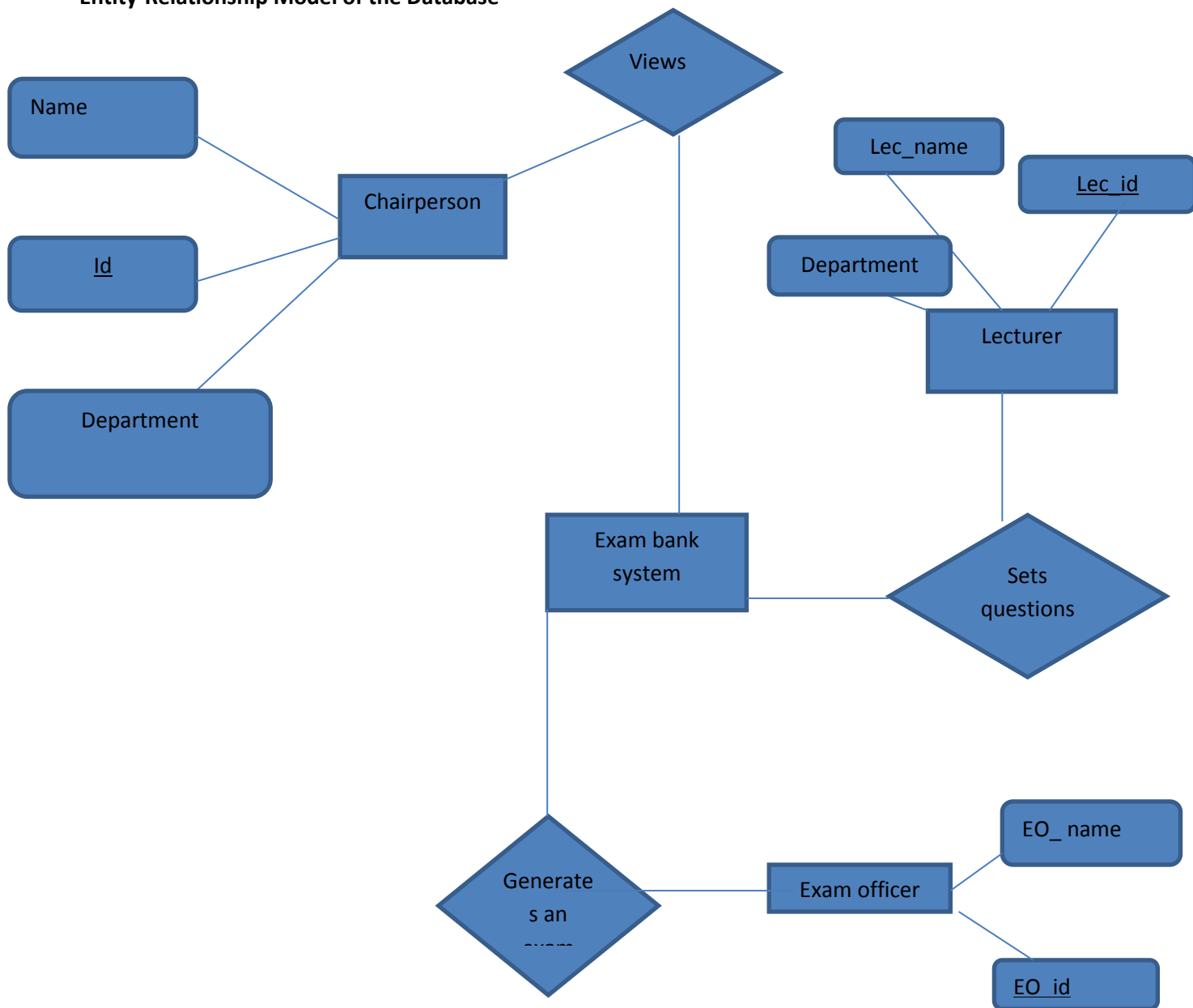
Admin (**level**, password username)

Examiner (**course code**, course name, examiners name, position)

Position (**ID No**, position, level)

Generated exam (course code, course name, status)

Status (course code, questions to be set)



3.3.1 Quantitative methodology

Quantitative methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories (Johnston, 2014). They produce results that are easy to summarize, compare, and generalize. It is concerned with testing hypotheses derived from theory and or being able to estimate the size of a phenomenon of interest. Depending on the research question, participants may be randomly

assigned to different treatments. To collect quantitative data one is measuring variables and verifying existing theories or hypothesis or questioning them. Data is often used to generate new hypotheses based on the results of data collected about different variables. The researcher gave out questionnaires to respondents which are lecturers, chairpersons and exam officer in order gather statistical data about responses.

However, often collections of statistics are not the answer to understanding meanings, beliefs and experience, which are better understood through qualitative data.

3.3.2 Qualitative methodology

(Tewksbury, 2011) postulates that qualitative methods play an important role in impact evaluation by providing information useful to understand the processes behind observed results and assess changes in people's perceptions of their well-being. Furthermore qualitative methods can be used to improve the quality of survey-based quantitative evaluations by helping generate evaluation hypothesis; strengthening the design of survey questionnaires and expanding or clarifying quantitative evaluation findings. Observations are examples of qualitative methodologies. These methods are characterized by the following attributes:

- ❖ They tend to be open-ended and have less structured protocols (i.e., researchers may change the data collection strategy by adding, refining, or dropping techniques or informants).
- ❖ They rely more heavily on iterative interviews; respondents may be interviewed several times to follow up on a particular issue, clarify concepts or check the reliability of data.
- ❖ They use triangulation to increase the credibility of their findings (i.e., researchers rely on multiple data collection methods to check the authenticity of their results).
- ❖ Generally their findings are not generalizable to any specific population; rather each case study produces a single piece of evidence that can be used to seek general patterns among different studies of the same issue.

3.8 Methods of data analysis and presentation

The data analysis methods used are: tabulation, representative diagrams such as histograms, graphs and pie charts. Critical analysis was carried out from the data obtained examiners with much emphasis being put towards the independence of opinion to facilitate an unbiased result. Both qualitative and quantitative data was collected. As for qualitative data a

descriptive approach was used to present and analyse data. Quantitative data was presented in tabular and graphical forms. Graphs include pie charts and bar graphs. Data was analysed using percentages and decimals. This measures the proportion that a given category constitutes to every element in the group.

3.9 Screen shots for the system

Screen shots for the chairman's view

The figure below shows the screen shot for the chairman's view and the rights that he is entitled to. The chairman can create or delete users, edit topics and also edit questions.

Figure 9: Screen shots for chairman's view



Screen shots for the lecturer's view

The below screen shot represents the lectures view and the rights entitled to the lecturer. The lecturer can only edit topics and questions.

Figure 10: Screen shots for lecturer's view



Figure 11: Screen shots for exam officer's view



The above screen shot represents the exams officer view. The exams officer is responsible for generating the exam. He is able to generate the exam after the chairperson has confirmed the set questions. He can also give feedback to the departments

System administrator module

The system administrator keeps the system running and therefore should have more access than any other user. Only the administrator can access the administrative site after supplying a unique user name and password. To ensure security, the administrator is denied access to the administrative site after the final exams have been generated lest he can alter the exam generated by the system.

Administrator should be able to form the back end.

- Update the examination rules and regulations
- Delete user (examiners) profiles
- Reset passwords – administrator should be able to reset passwords for users who would have forgotten their passwords and notify users any changes since the passwords will be valid for one semester.
- Should have access to all system components except the part that sets exams.

Below is the design of the administrative panel

Automated system administrative panel

HOME
EXAMINATION RULES AND REGULATIONS
EXAM BANK STATUS
GENERATE AN EXAM
DISPLAY INFORMATION
RESETING PASSWORDS
CREATING PROFILES FOR DIFFERENT USERS

Table 1: Administrators panel

3.10 Implementation of the exam bank system

- Hardware

Testing on the pc/laptop was done and all over the testing it was found the system responded very well in all the times. There was not even a single occasion where the system could not respond or where the system could produce unanticipated results.

- Graphics

The usage of graphics in this program was at its lowest levels. The reasons are two fold-first to reduce any processing and the unnecessary space imposed on the PC. Since the usage of this program

3.11 Data collection approaches

The author used two methods: Observation and document review. Research instruments used were interviews, hypothesis and questionnaires. People to be interviewed include a representative from the chairpersons, examiners and exams officer's administrators.

3.12 Research instruments (Interviews, hypothesis and questionnaires)

In the researchers quest to achieve the objective of selecting a balanced examination in terms of marks and content , the researcher conducted a mock(in class) which examiners set examination questions into the exam bank database and the system automatically generated an examination , the examiners where customizing well with the new setup through interviewing. Questionnaires were of prevalence importance as they gave a more unbiased report of this projects status. Questionnaires were designed to measure people's perceptions on a phenomenon and assess the time taken to prepare the exams.

3.13 Population sampling

The researcher engaged BUSE examiners. The sample size is twenty five examiners (lecturers) and eight chair persons and one exam officer. The researcher did random sampling technique which assumes that all entities in which the research was carried out had an equal value. The researcher thought the engaged population will accurately represent the whole examiners body of the University. The researcher collectively and selectively interviewed the examiners and exam officers to evaluate the effectiveness of the automated exam bank system amongst the examiners and exam officers who would have used the system. The researcher put all mechanisms which will guarantee an unbiased result extraction from this sample space.

3.14 Data analysis procedures

The data from questionnaires and interviews is compiled and analysed in a deductive and objective manner. Trends are illuminated through such techniques as linear regression of statistical data, which allows the researcher to make both conclusions and predictions about the behaviour of a population. During this analytical process (as was the case throughout data collection), the researcher aims to remain removed and impartial, striving to uphold the ideal of empiricism and objectivity.

There was a close comparison on the observations done from examiners' response during the day of in class exams (mock exams), assessing which examination assessment system the examiners opted for, the automated examination system or the manual method. Enough time was given to examiners and exams officers to freely complete the questionnaires and the results from the in classes are collected, put together and analysed. A graph was drawn to compare the amount of time taken. The questionnaires provided the researcher with the examiners, chairperson and exams officer perception to automated exam bank system, hence all strengths and shortfalls of this platform was ascertained.

3.15 Summary of methodology

This chapter looks at different methodologies, outlining advantages and disadvantages of each and giving the reasons why the other pursued them, the implementation process was also outlined and screen dumps were included to clarify the main components of the proposed model. The overall purpose of this chapter is to describe how the researcher carried out the research methodology which is data collection and procedures. The next chapter is on data presentation and analysis

CHAPTER FOUR: RESULTS AND ANALYSIS

4.0 Introduction

After successfully implementing the system and collecting data there is need to analyse data collected in order to derive meaningful conclusions. This chapter examines results obtained from research and try to present them in a more meaningful way. Various forms of data presentation will used in this chapter.

4.1 Data Presentation and analysis

Analysis of respondent's answers to questionnaires

The respondents that the researcher obtained were 71.5% which represent a higher portion of the population. The cross-section of respondents is wide enough to warrant reliable findings to conclude that most of the respondents, examiners in particular are aware of the subject under study and are also eager to control.

The largest number of questionnaires was distributed to examiners and exams officers since they are the final users of the system and are somehow directly affected by the system. The table below shows a summary of questionnaire sent and responses received.

Table 1: Questionnaires' Respondents

TARGET GROUP	QUESTIONNAIRE SENT	RESPONSES RECEIVED	RESPONSE PERCENTAGE
EXAMSOFFICER and CHAIRMAN	8	5	63
EXAMINERS	25	20	80
TOTAL	33	25	71.5

4.2 Summary of questionnaire responses

Table 2: The automated exam bank is very easy to use

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	12	60.0	60.0	60.0
agree	8	40.0	40.0	100.0
Total	20	100.0	100.0	

Both the examiners and the exams officers agree that the system is very easy to use. This is because 60% of the respondents strongly agreed that the system was easy to use and 40% agreed that the system was easy to use. This is attributed mainly to the user friendliness of the system

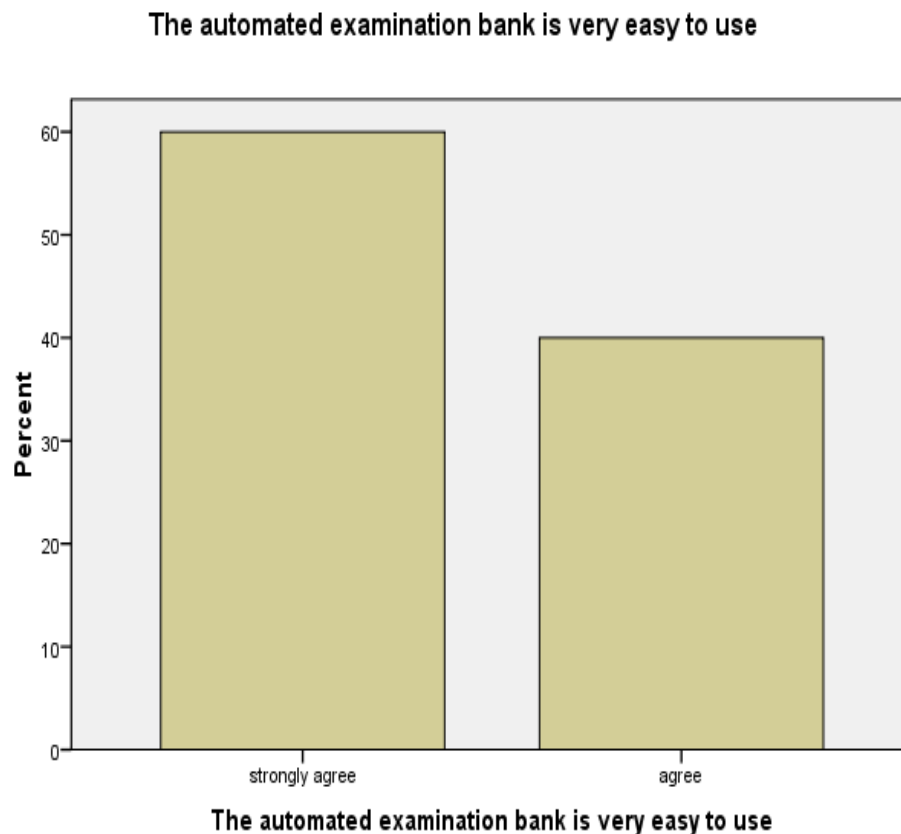


Table 3: You are confident about your number one and your vote will not change

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	14	70.0	70.0	70.0
agree	6	30.0	30.0	100.0
Total	20	100.0	100.0	

Most users were very confident about their number one and they felt that they would not need to change. This is supported by the statistics obtained from question two which shows that 70% of the users strongly agreed and 30% agreed and there were no users with the otherwise. This is because the viewed the system as user friendly hence easy to use. The pie chart below summarises the table above

You are confident about your number one and your vote will not change

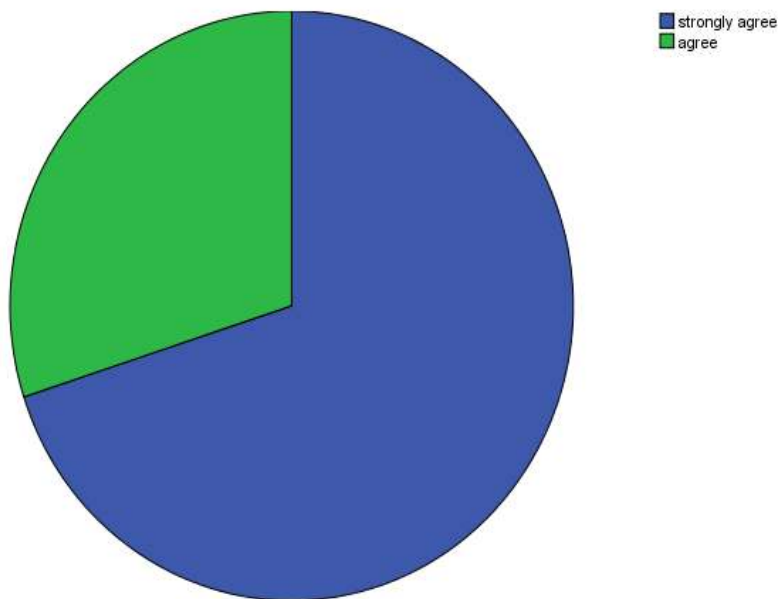


Table 2: Automated system can increase fairness by not repeating exam questions

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	strongly agree	7	35.0	35.0	35.0
	Agree	9	45.0	45.0	80.0
	disagree	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

The system seems to be answer to situations where exams are picked in the exam bank whilst they are out dated and also in cases where the exam stays in the exam bank forever. The system seems to provide an easy way to track and monitoring the activities of the exam bank especially the number of repeated questions. The histogram below helps to summarizes the table above

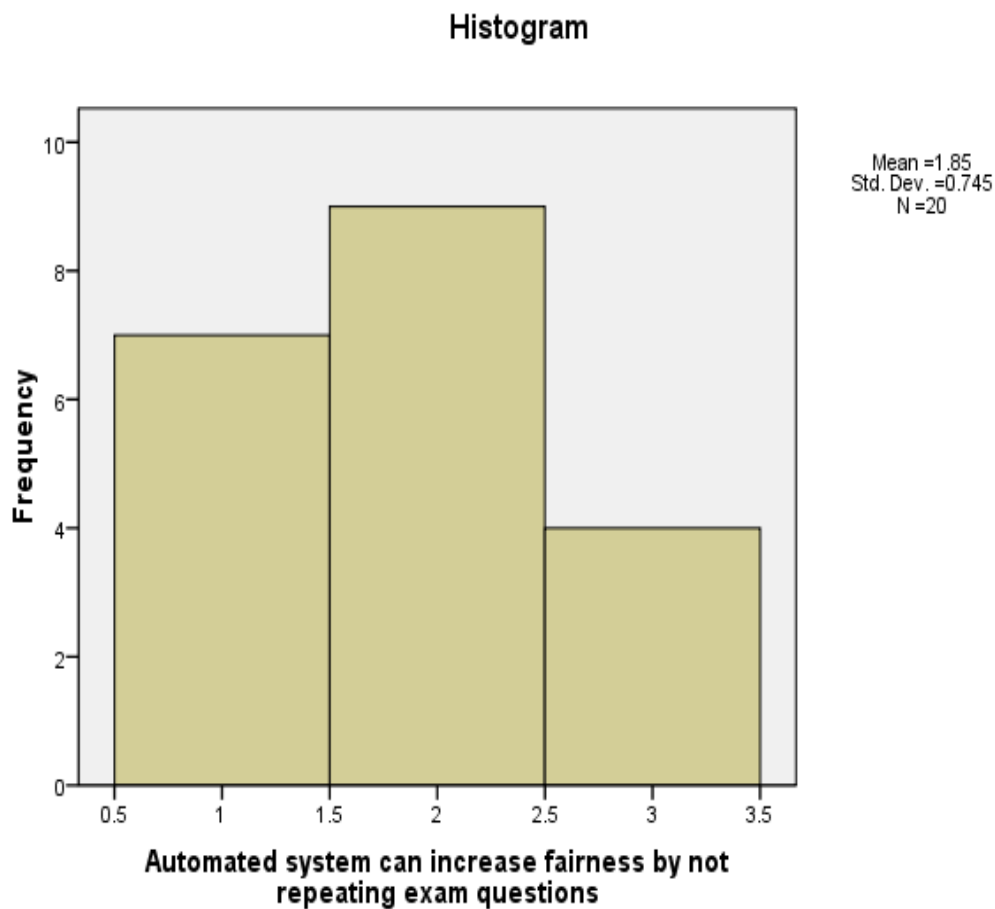


Table 3: Automated system can help reduce examination costs (in terms of time and money)

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	11	55.0	55.0	55.0
Agree	6	30.0	30.0	85.0
disagree	2	10.0	10.0	95.0
strongly disagree	1	5.0	5.0	100.0
Total	20	100.0	100.0	

The table above shows that most of the participants feel that the system saves costs in terms of money and time. This is because on printing of hard copies is needed hence cost are saved. Those who thought otherwise were citing the initial cost of setting up the system but the

researcher explained to them the long term benefits of the system. The bar chart below summarises the table above

Automated system can help reduce examination(costs in terms of time and money)

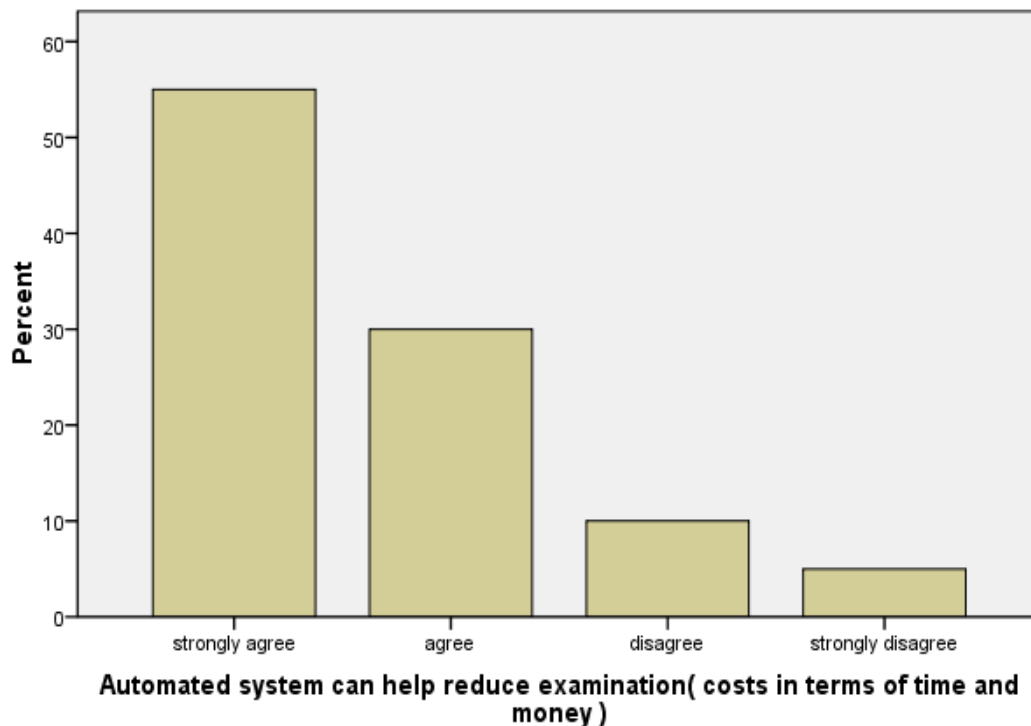


Table 4: The automated examination system can be used in the future for setting exams

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	6	30.0	30.0	30.0
agree	7	35.0	35.0	65.0
disagree	4	20.0	20.0	85.0
strongly disagree	3	15.0	15.0	100.0
Total	20	100.0	100.0	

The question was for predicting if the users thought the system would be used in future for setting exams. About 65% of the users predict that the system would be adopted whilst 35% did predict that the system would not be adopted. The pie chart below helps to summarize the table above. This is because of the advancement in technology.

The automated examination system can be used in the future for setting exams

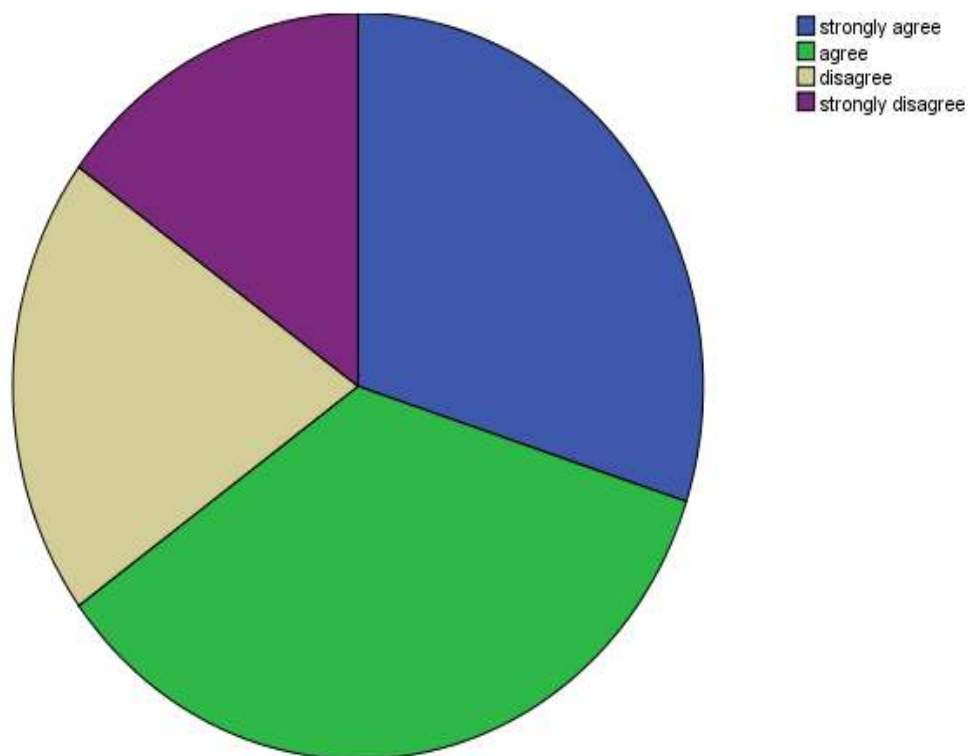


Table 5: How would you rate the system in terms of understanding the system that is did you quickly understand the system

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	8	40.0	40.0	40.0
agree	10	50.0	50.0	90.0
disagree	2	10.0	10.0	100.0
Total	20	100.0	100.0	

Both the lecturers and the exams officer were of the view that the system was easy to understand. This is supported by the statistics obtained which showed that 90% of the users were of the support that it was easy to understand whilst the remaining 10% thought otherwise. The histogram below helps to summarize the table above

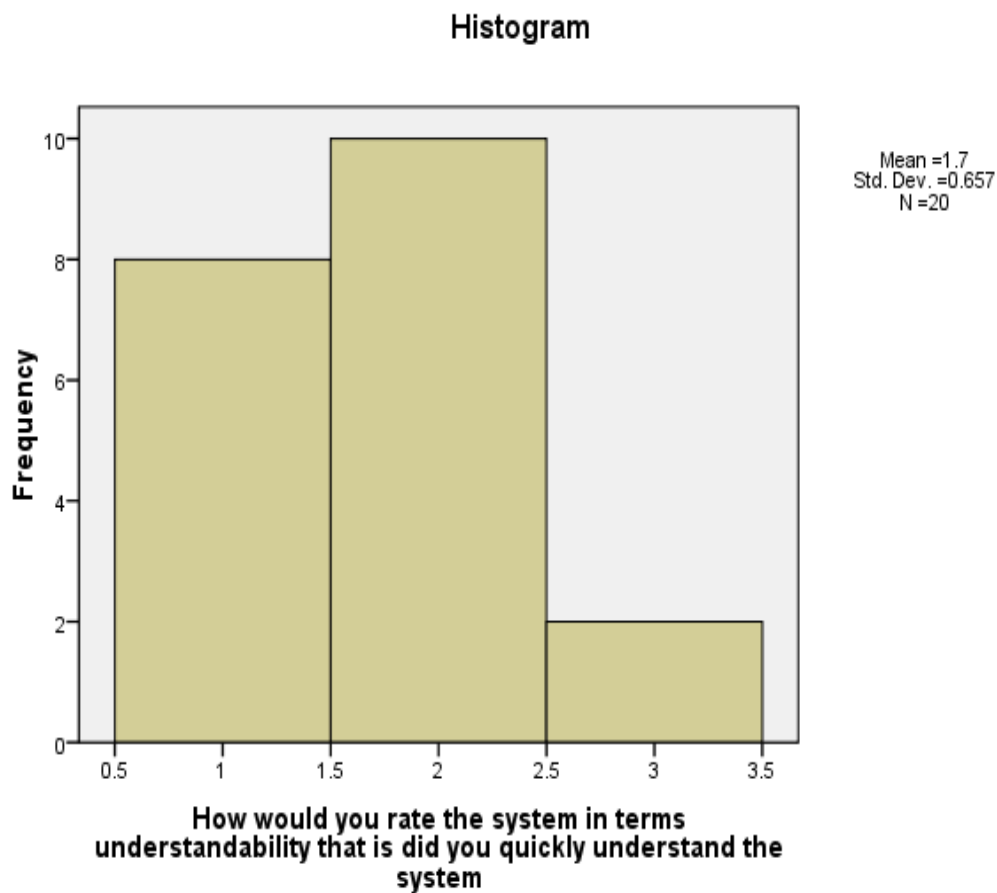


Table 6: Would you enjoy using the system if it is to be adopted

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	15	75.0	75.0	75.0
agree	5	25.0	25.0	100.0
Total	20	100.0	100.0	

All of the users were of the support that the system must be adopted because of the 20 respondents received 75% strongly agreed whilst the remaining 25% agreed. The bar graph below help to summarize the table above

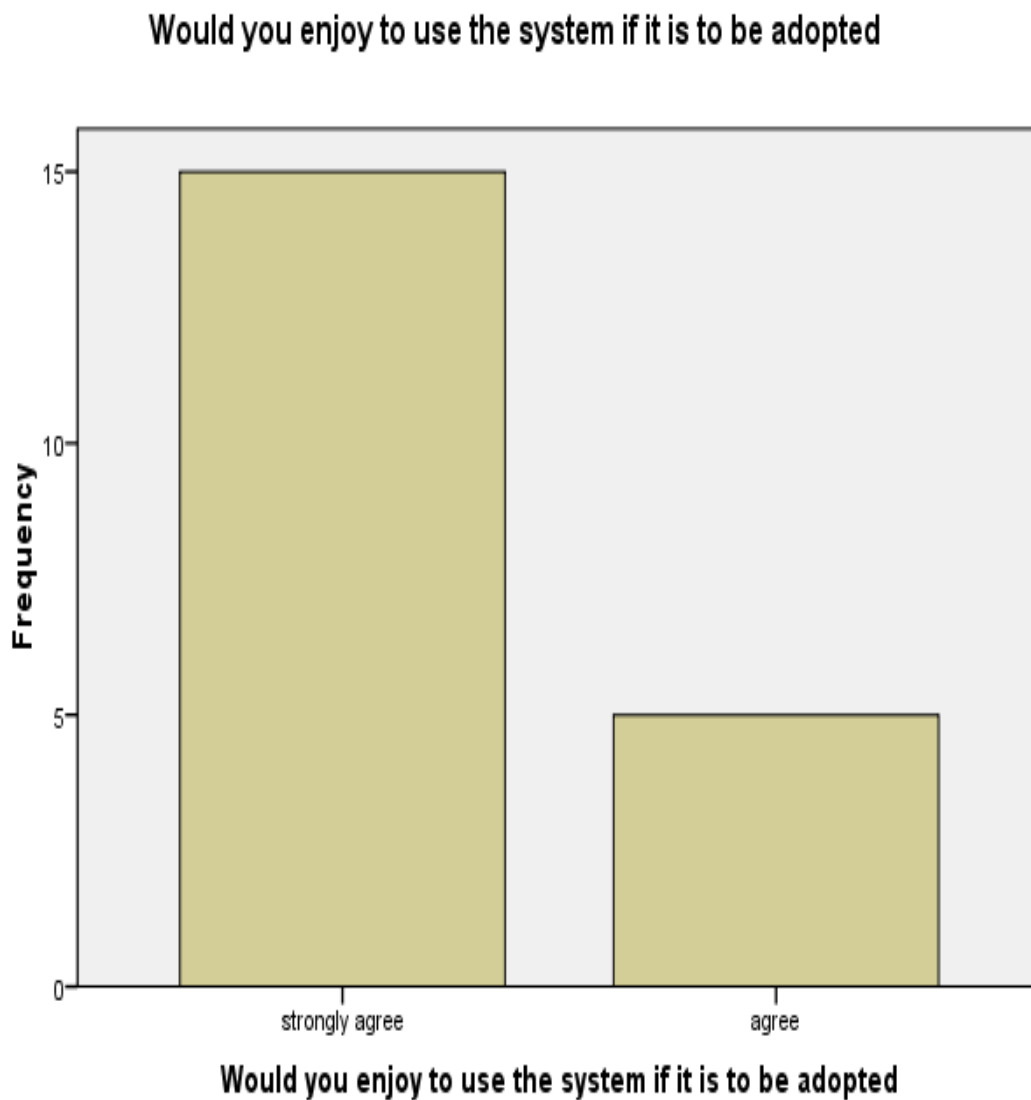


Table 7: Comparing with the manual way of setting the exams how would you rate the automated system

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	14	70.0	70.0	70.0
Agree	6	30.0	30.0	100.0
Total	20	100.0	100.0	

Comparing with the traditional way of setting the exams both the lecturers and the exams officer were of the view of adopting the new system. This is because of the respondents

obtained 70% were strongly agreeing and 30% agreed to the adoption of the new system. The pie chart below helps to summarise the table above. The main reason they want to move away from the manual method is it's tedious and associated with a lot of problems

Comparing with the traditional way of setting the exams how would you rate the system

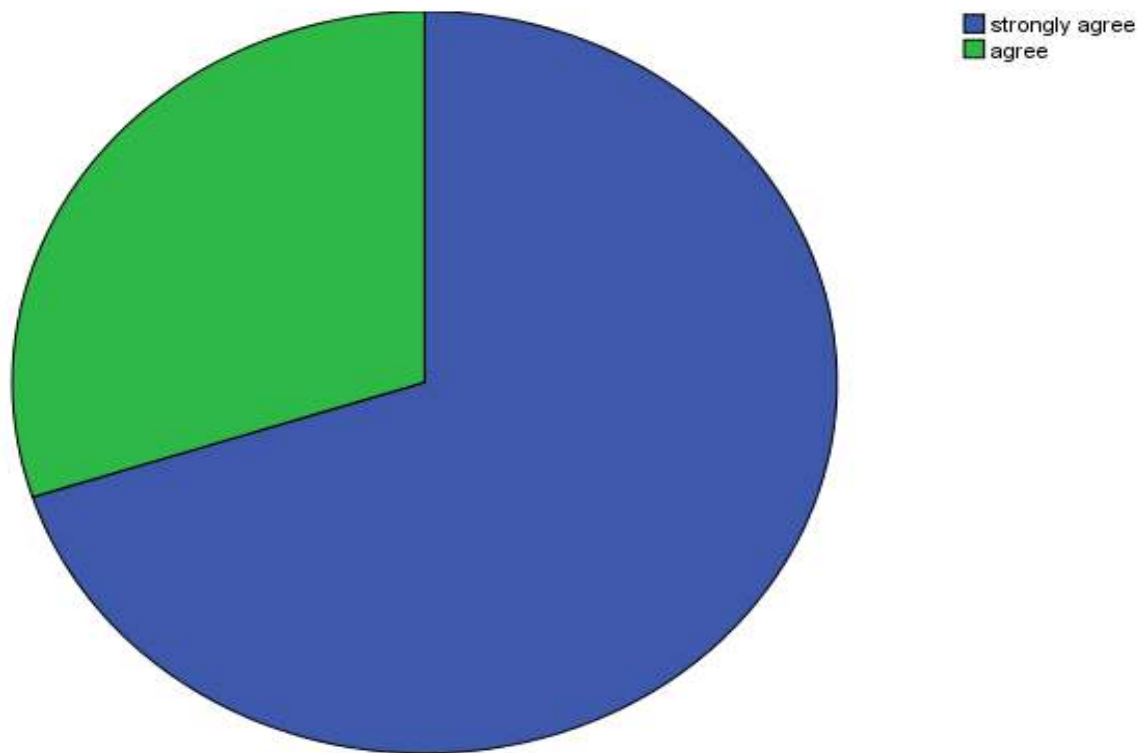


Table 8: Was the system effective in terms of saving time?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	8	40.0	40.0	40.0
Agree	8	40.0	40.0	80.0
Disagree	4	20.0	20.0	100.0
Total	20	100.0	100.0	

The system seems to offer a solution in terms of saving time especially on reduction of the time that is taken when printing the hard copies. About 80% of the users were in agreement that the system saves time and 20% of the users thought otherwise. The histogram below summarizes the table above

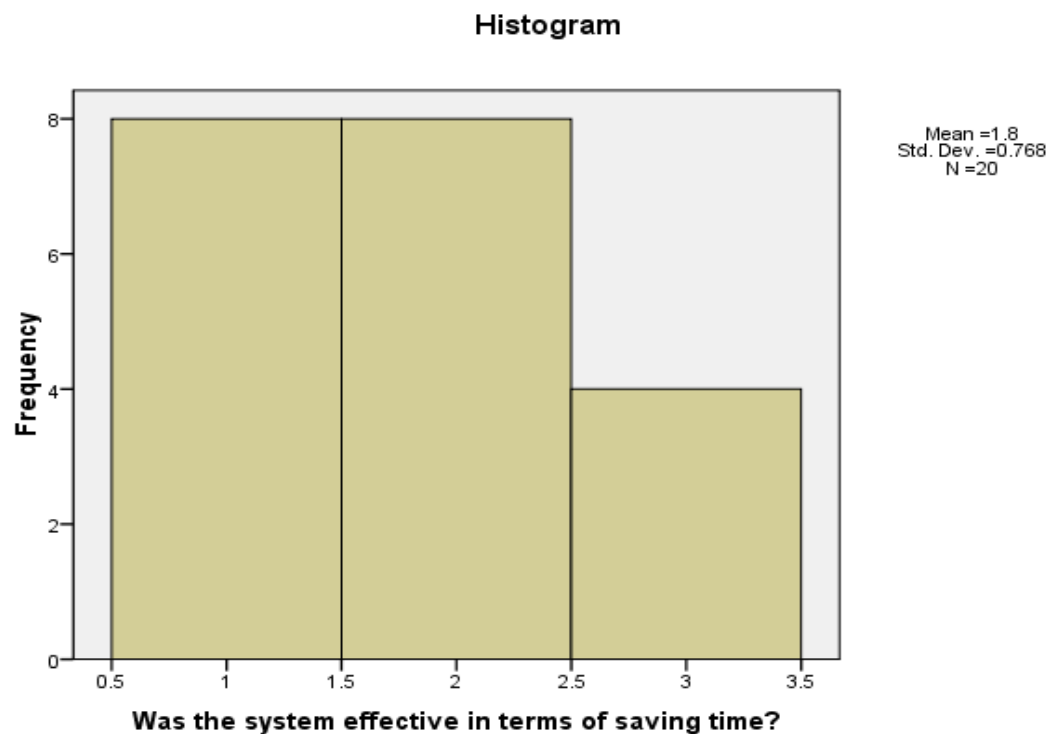


Table 9: The automated examination system can be used in the future for generating exams

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	5	100.0	100.0	100.0

This question was for the exams officers since they are the ones who are responsible for generating the exam. From the five respondents that I got it seems like all of them were predicting that the exams would be generated by the system in the future. The bar graph below summarises the table above.

The automated examination system can be used in the future for generating exams

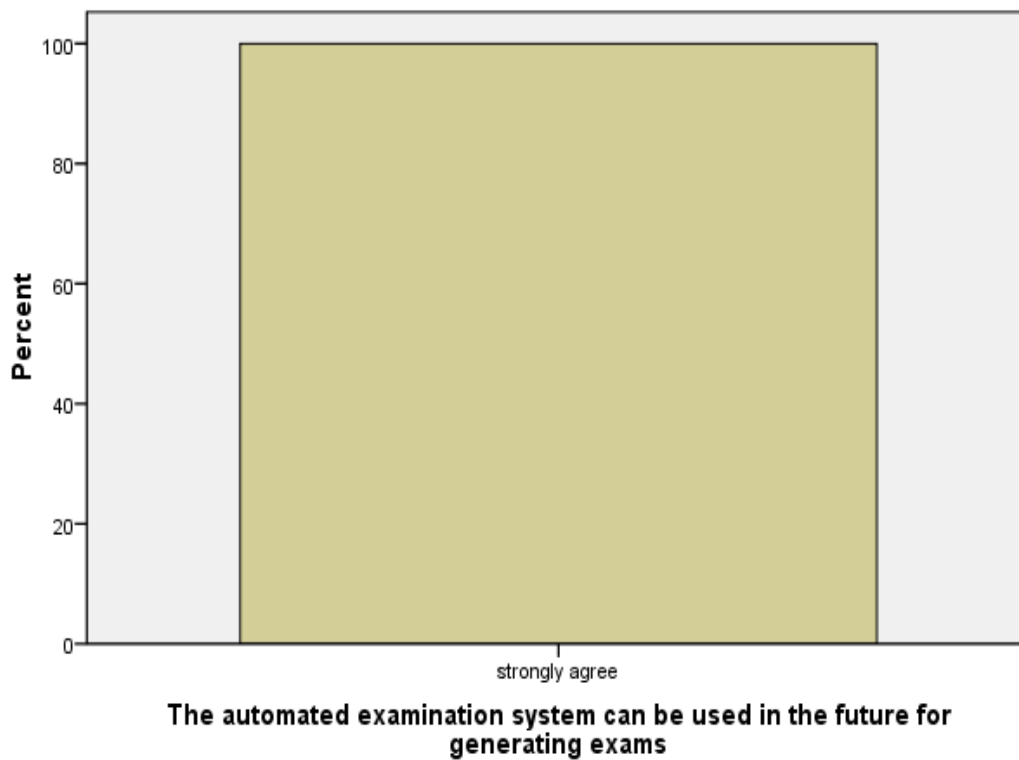


Table 10: No report of difficulty have been reported throughout the examination process

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	5	100.0	100.0	100.0

This question was only meant for the system administrators (exams officers) and chairpersons as they are the ones who deal with any difficulties that are reported to them. From the responses that I got it seems they did not face any challenge during the time of the implementation of the system. The pie chart below summarizes the table above.

No report of difficulty have been report have been reported throughout the examination process

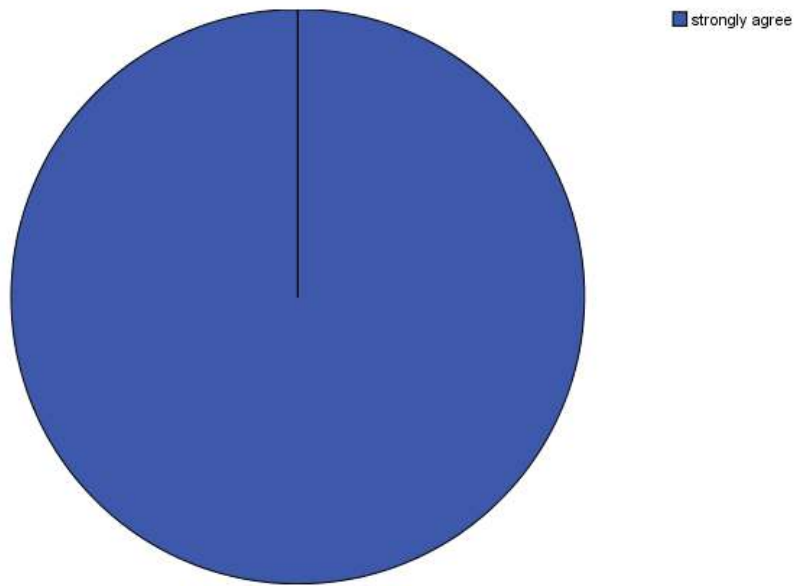


Table 11: Did the automated examination system help in easing the exam management process

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	3	60.0	60.0	60.0
Agree	2	40.0	40.0	100.0
Total	5	100.0	100.0	

The question is what prompted the researcher to carry out the research in the first place. This is because the exams officers were complaining of the data management problems since they were dealing mainly with hard copies. From the responses received it seems like the system seems to offer a solution as all the respondents were of the view that the data management process is now easy. The histogram below helps to summarise the table above.

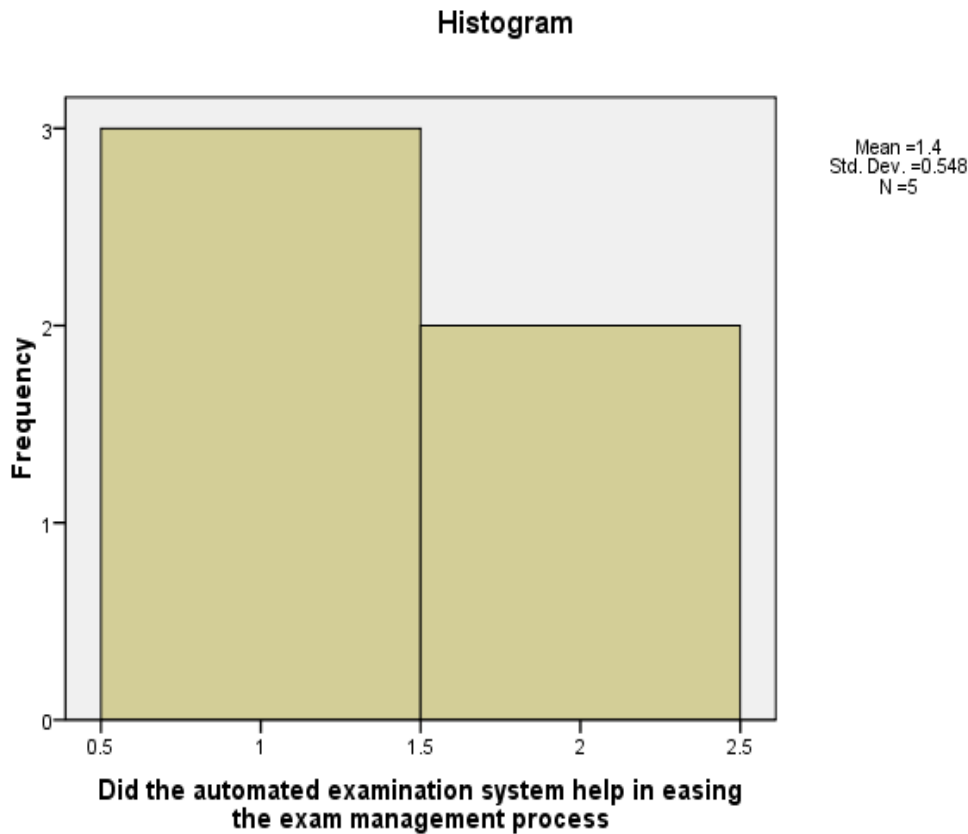


Table 12: Comparing with the traditional way of generating exams how would you rate the system

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid strongly agree	4	80.0	80.0	80.0
Agree	1	20.0	20.0	100.0
Total	5	100.0	100.0	

The traditional way of generating exams is that the chairperson of each and every department selects the exams that are going to be written. This method has its own drawbacks as some exams are picked in the bank whilst they are out dated and also the exams in the bank do not have a maximum period so comparing the two methods the exams officers seems to be preferring the automated method. The histogram on the next page summarises the table above



4.3 Summary of research findings

From the research findings above, we see that in all the questions asked on the effectiveness of the automated exam bank, a greater majority saw it as a noble idea. Many issues were explored in order to reach a conclusion of the effectiveness of the automated exam bank.

4.4 Chapter Summary

For the research to be worth its name, it must be able to answer most of, if not all of the research questions. This chapter analysed data obtained through questionnaires and observations. The next chapter looks at the summary of research, findings and recommendations. The summary highlights the main aims of the study, conclusions are the findings of the study and recommendations are the suggestions for solving the problems identified.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter gives a summary of the research giving in a nut shell what happened. It presents a summary of the findings and gives the conclusions drawn from the research. This chapter also gives suggested recommendations after carrying out this research.

5.1 Aims and objectives realization

The aim of the project was to design an automated exam bank system that can be used by the BUSE exams office that will enable the exams officer to check the content of the exams and to store the exams as soft copies not the current system which uses hardcopies and it was difficulty for the exams officers to check the contents in the exam papers one by one and it was resulting in some papers containing more than 30% of the same content. In fact with the current method the level of repetition cannot have accurate statistics.

The researcher developed a system that can perform the following functions. Every user is authenticated as he/she logs in the system. This means all the users of the system are given passwords that they use when logging in the system. The lecturer logs in the system and after logging the system the lecturer can edit questions and topics. Those are the two rights entitled to the lecturer. The chairperson has the right of viewing the topics and questions and giving feedback to the lecturer. The exam officer has the right to generate the exam and nothing else. The ICT depart has all the administrative rights as since there the ones who will be responsible for maintain the system and making sure that it is up and running.

5.2 Discussion of Results

It is clear from the data obtained that the automated examination bank system makes life easier for both the lecturer and the exams officer to manage the examination database. On the mock examinations picking that was carried out it was seen that the automated exam bank is a bit fair due to the fact that exam questions are not repeated and also that the exam database is fed with new questions after the time period for which the exam bank was set for has expired. Since it is mainly soft copies which are involved it is easy to manage and check the contents inside the examinations and also with automated exam bank system they are very rare cases that a question will be repeated. Of the three question papers that were generated for the testing purposes they were no repeated questions.

5.3 Conclusion

The major objective of developing the system was to develop a system that will randomly select the questions from the exam bank by picking and arranging questions from lower order to higher order questions. The selected examination questions must be balanced in terms of the marks and content asked. The main objective was met. The requirements of the system are that the marks for the lower order questions are range from 1-5 and the middle questions ranges from 6-8 and the higher order questions marks range from 9-20. The system has key words which are used as a guideline. The key words, marks and the topic (sub topics) words help the system to locate the questions. When generating an exam, the system is guided by the three parameters. The generated exam constitutes all the topics in the exam bank and also another guideline is that each and the maximum number of marks is 20. the above stated guidelines helped the system to meet the set major objective.

5.4 Recommendations and Future work

The researcher recommends the design and implementation of a more advanced automated examination bank which can be used at higher learning institutions that is universities and colleges and even other examination bodies to adopt to that system, if educational institutions can move towards a more technological and reliable method of automatic generation so that we conclude that automated assessment can indeed generate exams fairly without any bias.

Future research is needed to evaluate the appropriateness of the selected model to alternative samples. The chosen model should be applied to different courses or subjects and in addition to different examination boards in order to paint a clearer picture of the general public intention to use of the automated examination system. Specific suggestions would be to target to develop a system that can check the level of repetition that has occurred in each and every question that is typed into the exam database. The developed system should be able to cater for questions that have a one word difference so that those questions are not ignored in the system. The system must be able to decide whether the questions have been repeated or not. The developed system should be able to cater for all the types of questions that is multiple choice questions, structured and unstructured questions.

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Appendix 1

Questionnaire (For chairperson and exam admin)

The broad aim of this questionnaire is to inquire from participants on their feeling judgement or perception of the automated exam bank system. The researcher therefore kindly asks for your contribution by completing the questionnaire. May you kindly assist by responding to the following questions in the questionnaire pertaining functionality and feasibility of the automated exam bank system? Your honest assessment is kindly required and thanks you in advance for your responses.

Section A: Personal information

Tick where appropriate

1. Gender: male ☐ female ☐
2. I have prior experience with automated exams system :yes ☐ no ☐
3. I have used an automated examination system before : yes ☐ no ☐

Section B: Automated examination System responses

USE THE FOLLOWING KEY

1=Strongly agree 2=agree 3=disagree 4=strongly disagree

Rating	1	2	3	4
1.The automated examination bank is very easy to use				
2. You are confident about your number one and your vote will not change				
3.Automated system can help reduce examination(costs in terms of time and money)				
4.The automated examination system can be used in the future for generating exams				
5.No report of difficulty have been report have been reported throughout the examination process				
6.Did the automated examination system help in easing the exam management process				

For questions 7-11 use the following key 1=strongly agree 2=agree 3=disagree 4=strongly disagree.

Rating	1	2	3	4
7.How would you rate the system in terms understand ability that is did you quickly understand the system				
8. Would you enjoy to use the system if it is to be adopted				
9. Comparing with the traditional way of generating exams how would you rate the system				
10. Was the system effective in terms of saving time.				
11.How would you rate the cost effectiveness of the system				

Other comments

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Appendix 2

Questionnaire (for lecturers)

Section A: Personal Information

Tick where appropriate

4. Gender: male ☐ female ☐
5. Faculty : Science ☐ Agriculture and ES ☐
6. I have prior experience with automated exams system :yes ☐ no ☐
7. I have used an automated examination system before : yes ☐ no ☐

Section B: Automated examination System responses

USE THE FOLLOWING KEY

1=Strongly agree 2=agree 3=disagree 4=strongly disagree

Rating	1	2	3	4
1.The automated examination bank is very easy to use				
2. You are confident about your number one and your vote will not change				
3. Automated system can increase fairness by not repeating exam questions				
4.Automated system can help reduce examination(costs in terms of time and money)				
5.Automated system can help reduce the burden of having to set exams frequently				
6.The automated examination system can be used in the future for setting exams				

For questions 7-10 use the following key 1=strongly agree 2=agree 3=disagree 4=strongly disagree.

Rating	1	2	3	4
7.How would you rate the system in terms understandability that is did you quickly understand the system				
8. Would you enjoy to use the system if it is to be adopted				
9. Comparing with the traditional way of setting the exams how would you rate the system				
10. Was the system effective in terms of saving time.				
11.How would you rate the cost effectiveness of the system				

Other comments

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