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**AN IMPLEMENTATION FRAMEWORK FOR ONLINE ASSESSMENTS IN
PUBLIC UNIVERSITIES: A CASE OF MASENO UNIVERSITY**

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Submitted in partial fulfillment of the requirement of the Master of Science degree in
Information Systems

DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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APPROVAL

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ABSTRACT

Public Universities in Kenya have embraced ICTs in the management of educational programs. In 2007, Maseno University set up an e-campus to facilitate online delivery of education programmes to students within the country, East Africa and beyond.

Assessments play an essential part in education as it assists one in finding the quality of learning and examining what the student knows. The increase in students' enrolments in public universities has put pressure on lecturers who cannot mark and give timely feedback to students. The growing need to cater for adult learners living in far off places, to improve the operational reliability of assessment processes, to provide quicker end to end services, to mitigate the decreasing availability of expert assessment personnel, to control overheads and running costs, the maturing user capability and increasing availability of technological options and solutions are driving online assessments in public universities.

The researcher carried out an extensive review of online assessments in public universities, identified challenges that students, lecturers and institutions face in the use of online assessments, established the extent to which online assessments can be implemented in public universities and developed an implementation framework for online assessments.

An implementation gap exists between the desired online assessments systems and how to get there. This gap prevents public universities from developing an effective online assessment plan to yield meaningful results at the student, course, program and college levels. To alleviate this, Service oriented framework for assessment (SOFA), Sabbah model, Modular assessment system for modern learning settings (MASS), E-assessment procedures checklist (EPC) and Lloyd framework were compared and contrasted using a Venn diagram, and Lloyd framework was then extended by incorporating key components from the frameworks studied to develop an implementation framework. Data was collected through the use of questionnaires distributed to students and lecturers of Maseno University, focused interviews were conducted with the lecturers to offer method triangulation.

The results of the study showed that summative assessment is the main form of online assessments used in public universities; the online assessments offered are relevant to learning outcomes since they are aligned to the curriculum. Numerous challenges including lack of human capacity, unreliability of the technology and high costs of implementations plague the use of online assessments in public universities. The facilities necessary for implementation of online assessments were found to be inadequate in public universities. The Extended Lloyd framework was tested and validated through the research conducted and was found to be adequate for adoption in the implementation of online assessments across public universities.

The study revealed that public universities must create awareness, provide necessary facilities for online assessments and train user support team to encourage the use of online assessment, however, further research is necessary to enhance the credibility of online assessments practice.

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Abbreviations, acronyms

CD-ROM	Compact Disc Read-only memory
CATs	Continuous Assessment Tests
DVD-ROM	Digital Versatile Disc - Read Only Memory
MASS	Modular Assessment System for Modern Learning Settings
E-assessment	Electronic Assessment
E-learning	Electronic Learning
E-campus	Electronic Campus
EPC	E-assessment Procedure Checklist
FPA	Fingerprint Authentication
ICT	Information and Communication Technology
IS	Information system
KDA	Keystroke dynamic Authentication
LMS	Learning Management System
Moodle	Modular Object-Oriented Dynamic Learning Environment
QCA	Qualification and Curriculum Authority
SOFA	Service-Oriented Framework for Assessment
VFKPS	Video / FPA / KPA

Definition of Terms

1. Adaptive assessment is a form of assessment which changes as the assessment progresses based on student's response to earlier questions, the questions may get harder or easier.
2. Diagnostic assessment is a non-accredited assessment used to identify the learner's strengths and weaknesses with a view to providing an appropriate learning program.
3. E-assessment is the use of digital devices to assist in the construction, delivery, storage and reporting of student assessment tasks, responses, grades and feedback. It is the end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity and the recording of responses.
4. E-Portfolios refer to personal online space that acts as an assessment framework and supports a variety of functions, including information repository, organization of learning and collaboration.
5. Formative assessment is performed by teachers at the beginning of a course to identify the knowledge background of the students.
6. Moodle is a free source learning management system
7. Summative assessment is a form of assessment which occurs at the end of a set of learning activities and the results achieved by the student is registered by the teacher as a final mark.
8. Online assessment is an on-screen assessment which relies on internet connection to download questions and upload candidate's responses.

1.0 INTRODUCTION

1.1 Background

Public universities have embraced ICTs in an effort to avail learning programmes to students on campus and in distant locations. The e-campus at Maseno University is an innovation to facilitate online delivery of quality certificate, diploma and degree programmes to learners in various parts of the country, the East African region and beyond. All programmes offered at the e-campus are delivered through the Internet, some support material is provided on CD/DVD-ROM and print, Maseno in Brief (2013).

Maseno University e-learning center's quality objectives are to annually increase the enrolment of students in e-learning programmes by 30%, the number of modules offered through e-learning by 40%, and the number of Lecturers with the capacity to develop online course by 30%, About Maseno University eCampus (n.d).

Assessment is an integral part of the learning experience for students, it aims at finding out the quality of learning and of teaching; examination of what the student knows and does not know, Keppell (2006). According to Buzzetto-More and Alade (2006), web-based testing has advantages in terms of cost, ease of use, reliability, replicability, scoring, aggregating results and data management. In support of this, Veeramani (2010) stated that students' evaluation can be done more effectively online than in a traditional classroom setting because of the ease of creating online tests and other forms of assessment. Online tests can hide students' as well as teachers' identity hence reducing biasness.

Although it has numerous advantages, the use of online assessment has remained minimal in public universities, hence the motivation to carry out a research to identify the extent of use, implementation processes and challenges that has brought about the current situation.

Online assessment is an on-screen assessment which relies on Internet connection to download questions and upload candidates' responses. Electronic assessment on the other hand is the end-to-end electronic assessment process where ICT is used for the presentation of assessment activity and the recording of responses. ICT plays a significant role in both online and electronic assessments; the researcher will study online assessments. In this research, online assessment is considered a form of electronic assessment and hence the research work will be useful to a large extent to those implementing electronic assessment.

1.2 Problem Statement

The demand for higher education has been on the increase; public universities are not able to sustain current enrolment needs using the limited resources available. To address this, public universities have introduced ICTs in their learning and teaching programs. The increase in students' enrolment has made it increasingly difficult and expensive for lecturers to provide their students with sufficient feedback, this is a serious challenge especially for those under distance-learning programmes. Kim et al (n.d) noted that, feedback directly affects what students learn and how effectively they do so.

Work pressure has made lecturers in public universities to give feedback when it is late for the students to understand and act upon it. Proper and immediate feedback has the potential of transforming an assessment experience into an instructional experience for learners. Silva and Restivo (2008) noted that formative assessment is not used very often during the learning process, as teachers do not have enough time to do several assessment tests and perform the compilation and management of assessment results. The solution to this dilemma lies with the use of online assessment, Jordan (2009).

Maseno University has pioneered the use of modern technologies not only to realize equitable access to higher education through e-learning but also to improve the quality of educational experience for learners. Most under-graduate and post-graduate modules are fully online but only a number of Continuous Assessment Tests (CATs) are delivered online. All students enrolled at the e-campus take sit-in examinations at the end of each semester, M. Ayere 2013, pers. comm. 23 February. The full benefits of the increased use of e-learning cannot be realized when students have to take sit-in examinations. There is need to implement online assessments in public universities to harness full benefits of e-learning in order to effectively manage students using the limited teaching staff.

1.3 Objectives

The overall objective of the study was to develop an implementation framework for online assessments in public universities in Kenya. To achieve the objective, the following specific objectives were pursued:

- i. To carry out an extensive review of online assessments in public universities.

- ii. To identify challenges facing the adoption and use of online assessments in public universities.
- iii. To establish the extent to which online assessments can be implemented in public universities.
- iv. To develop an implementation framework for online assessments in public universities.

1.4 Research Questions

- i. What forms of online assessments are used in public universities?
- ii. How relevant are the online assessments used to the learning outcomes in public universities?
- iii. What challenges face lecturers, students and institutions in the use of online assessments in public universities?
- iv. To what extent are the students in public universities willing to take online assessments?
- v. What online assessments facilities exist in public universities?
- vi. What factors hinder the implementation of online assessments in public universities?
- vii. Which online assessments implementation frameworks exist, how appropriate are they?

1.5 Assumptions and limitations of the research

- i. It was assumed that the selected university had implemented online assessments and thus the findings would apply to all public universities in Kenya.
- ii. It was assumed that public universities in Kenya have integrated ICTs in their learning processes, and that the use of online assessments is yet to reach its full potential.
- iii. It was assumed that respondents would provide full information freely.
- iv. It was assumed that all respondents would accept and have time to respond to the questionnaires with little or no difficulty.
- v. This study was limited to one public university and therefore results may not be reflective of the situation in all public universities.
- vi. There may have been errors arising from data collection. Focused interviews were used together with questionnaires to offer method triangulation and ensure validity in the data collected.

- vii. There was limited finance to facilitate collection of data; to overcome this challenge online questionnaire and interviews were conducted.

1.6 Research Justification

Assessment is an important aspect of learning; online assessment helps in certification as well as in providing prompt feedback to teachers and students. Airasian and Miranda (2002) observed that misalignment of assessment can cause numerous difficulties which can lead to poor students' performance irrespective of quality of instructional approach.

Keing (2007) warned that online assessment methods might not be perceived well by lecturers and students, it is different from the usual practice. Considering the unswerving enthusiasm from many in politics and education on the transformative potential of e-learning, online assessments are under pressure to help facilitate assessment reforms in Education. Timmis et al (n.d) observed that despite predictions of an e-assessment 'revolution' and a number of drivers for change in both technology-enhanced learning and shifting models of learning, educational assessment has been notably slow to adopt these innovations.

While the need for assessment is clear, an implementation gap exists between the desired end result and how one gets there. This gap prevents colleges from developing an effective assessment plan that will yield meaningful data at the student, course, program, and college levels. The breadth and width of the gap varies from institution to institution. The developed framework will begin by filling the assessment information gap, outline a practical online assessment implementation process and establish the methodology of how to use assessment data in an integrated fashion across a campus, Choban et al (2004).

1.7 Significance of Research

E-learning has been fronted as the key pillar in delivering education to all. With it, comes the online assessment where students are able to log on to a computer system and take examinations. This is critical considering that with online assessment, feedback is instant. It is hoped that institutions of higher learning would use the study as a platform to offer deeper understanding of the implementation processes of online assessments. The increasing influence of digital world means that, many people are learning online and outside the classroom. It is essential to develop systems for assessment that reflect the core educational goals, and proper reward systems for students, Brahmhatt (2012). It is believed that

knowledge gained through the study will stimulate further studies. There are a number of issues that are vital to implementers of online assessments prior to deployment of an online learning system; the developed framework will guide these important decisions.

1.8 Scope

The study entailed the development of an implementation framework for online assessments in public universities in Kenya. Although the researcher was determined to consider most factors affecting implementation of online assessments, some factors that may directly or indirectly affect the implementation process may not have been considered due to time and other resource constraints. The research was carried out within a period of six months; research target groups were students under the e-learning programmes at Maseno University and the lecturers who took part in the implementation of e-learning at Maseno University.

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The main purpose of assessment is to improve students' learning; identify students' strengths and weaknesses; review, assess and improve the effectiveness of different teaching strategies; review, assess and improve the effectiveness of curricular programs; improve teaching effectiveness; provide useful administrative data to expedite decision making; and communicate with stakeholders, Buzzetto-More and Alade (2006).

2.2 DRIVERS OF ONLINE ASSESSMENTS

In their study, Blanco and Ginovart (2012) observed that *Moodle* quizzes present a consistent alternative to open-ended tests. The online assessments systems provide a continuous and formative assessment to a considerable number of students without overburdening the lecturers with marking or jeopardizing the assessment quality.

Craven (n.d), summarized drivers for adoption of e-assessment as the constant pressure to improve reliability of operational and assessment processes, increased demand for quicker end to end services, increased demand for but decreasing availability of expert assessment personnel, ongoing desire to review and control overheads and running costs, maturing customer capability and confidence in the use of technology, and the ever increasing availability of technological options and solutions.

2.3 HINDRANCE TO ADOPTION OF ONLINE ASSESSMENTS

Bacigalupo et al (n.d), identified lack of confidence in universities' online assessment systems, difficulty in motivating students to take online assessments; poor accessibility and usability, inability to write high quality questions, difficulty in choosing appropriate ways of using online assessment tools, loss of service through power, equipment, software or network failure, manipulation, copying, and misuse of the answers as the factors that hinder the adoption and use of online assessments.

Implementation of online assessments requires purchase of hardware, software, Internet bandwidth, manpower, training users, development of test questions, maintenance and security, Dube and Ma (2010), these requirements are above reach for some institutions which have set aside limited budget for this function. Despite the relentless advances made

around power, portability and accessibility of this technology, Craven (n.d) concludes that it is still not a sufficiently robust and reliable medium for delivery in all areas of education and training.

2.4 PRACTICES IN ONLINE ASSESSMENTS

The new technologies and tools have the ability to offer personalized, instantaneous assessment experiences, immediate feedback, a choice in approach, format, timing of assessment and location. It reduces teachers' workload, improves efficiency in marking, moderating and storing and improves assessment validity and reliability. When examinations are taken on demand, as is the case with many professional qualifications, individuals can fast track when they excel in certain aspects of the curriculum.

QCA (2007) and PSI (n.d), defined a set of regulatory principles for conducting online assessment to ensure they are effective, these principles ensures that online assessments:

- i. are fit to measure candidate's skills, knowledge, understanding and competence,
- ii. regularly maintain and review its security,
- iii. have sufficient capacity to store, retrieve, generate and share the necessary data,
- iv. do not disadvantage the disabled learners,
- v. do not create barriers for learners,
- vi. have effective business continuity measures to address business interruption,
- vii. have a sufficient volume of assessment items to provide consistently secure, robust, balanced and unique on-demand tests,
- viii. centers manage the controls on test conditions in relation to on-demand testing, invigilation and secure test environments,
- ix. offer suitable support for system users, assessors and moderators,
- x. have adaptive testing that produce robust assessment that reliably identifies the appropriate level of each learner,
- xi. e-portfolio securely store and maintain performance evidence for access by all required parties,
- xii. meet the evidence needs for a range of qualification types and enable learners to move their portfolios from one centre to another.

2.5 ONLINE ASSESSMENTS IMPLEMENTATION FRAMEWORKS

Allen (2007) and Alade (2007, while citing Martell & Calderon, 2005) noted that the identification of students' knowledge, skills, abilities, appropriate techniques and budget are key in conducting assessments, they should be evaluated on a continuous basis.

Astin et al (1996) quoting the American Association on Higher Education (AAHE), enumerated the following principles of good practice for assessing students:

- i. The assessment of student learning begins with educational values. Assessment is not an end in itself but a vehicle for educational improvement.
- ii. Assessment is most effective when it reflects an understanding of learning as multidimensional, integrated, and revealed in performance over time. Learning is a complex process which entails what students know, their abilities, values, attitudes and habits that affect academic success and performance beyond classroom.
- iii. Assessment works best when the programs it seeks to improve have clear, explicitly stated purpose.
- iv. Assessment requires attention to outcomes as well as to the experiences that lead to those outcomes. Successful assessment is dependent upon involvement of many individuals; each person contributes his or her knowledge, expertise and perspectives, thereby enhancing the overall assessment program.
- v. Assessment works best when it is ongoing not episodic. Assessment strategies must be continually nurtured, evaluated, and refined in order to ensure success.
- vi. Assessment fosters wider improvement when representatives from across the educational community are involved. Successful assessment is dependent upon the involvement of many individuals, each contributing his or her knowledge, expertise and perspectives, thereby enhancing the overall assessment program.
- vii. Assessment makes a difference when it begins with issues of use and illuminates questions that people care about. Assessment makes a difference when meaningful data is collected, connected and applied creatively to illuminate questions and provide a basis for decision making.
- viii. Assessment is most likely to lead to improvement when it is part of a large set of conditions that promote change. Successful assessment is directed towards improvements which may occur in teaching, student learning, academic and support programs or institutional effectiveness.

- ix. Through assessment, educators meet responsibilities to students and to the public. Assessment is an important component in demonstrating institutional accountability.
- x. Assessment is most effective when undertaken in an environment that is receptive, supportive, and enabling.

2.5.1 Service Oriented Framework for Assessment

The Service Oriented Framework for Assessment (SOFA) was proposed by Al-Smadi et al (n.d), it aims to identify important services and assign one or more open standards and specifications to each service.

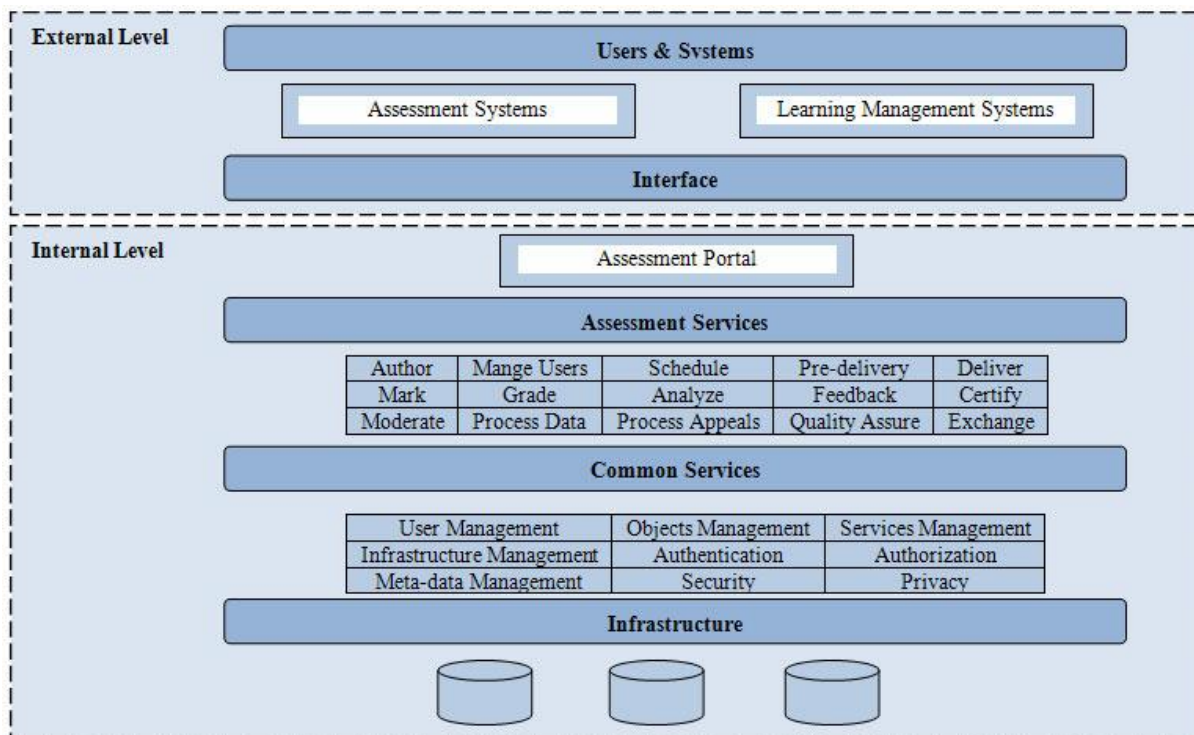


Figure 1: Service oriented framework for assessment (Source: Al-smadi et al, n.d)

This framework is not designed to build a generic online assessment system, rather, it encourages a system where common service definitions are provided and used to achieve the diverse goals of an organization. The framework supports a system that easily share and exchange test between each other.

SOFA has five abstraction layers: *Users and Systems*, which represents the external possible users, tools and systems that interact with the online assessment system. *Interface* is used for communications between the online assessment system and the other external systems, users

and tools. *Assessment Services* represent the fundamental services for the online assessment system. *Common Services* are services that are not assessment-specific but facilitate assessments; these include user management, authorization, authentication etc. *Infrastructure* represents the internal networks, storage and processing capabilities that the online assessment system requires.

2.5.2 SABBAH model

The SABBAH model was proposed by Sabbah et al (n. d). This is a secure and smart model for summative electronic assessment. The exams are conducted distantly, e.g. at home. Lack of trusted, secure and cheating free assessment systems is the main reason for unsuccessful e-learning; this model focuses on eliminating this problem.

Initiation, in this stage, the hardware of the required devices are enabled, checked, configured and calibrated. The Fingerprint Authentication (FPA) process enables the scanner and prompts the student to enter his imprint by placing the finger on the scanner. The Video / FPA / KDA (VFKPS) Processing Server matches the process with the saved profile. The Keystroke Dynamic Authentication (KDA) records typing rhythm, which is assumed to be different for each user. Video initialization matches current video and stored video to identify the examinee. *Operations*, on examination initialization, the system chooses randomly from a large pool of questions. The imprints are transferred to VFKPS server for a continuous processing and matching, examinee's activities are continuously captured and sent to the VFKPS server for processing and matching. The video takes video shots randomly and sends them to the VFKPS for continuous matching. *Violation*, occurs when rules are not followed, if this occurs, exam saves its status, pauses and a procedure is followed for troubleshooting to resolve the problem before exams can continue. System violation occurs when keyboard, mouse or camera stops responding, is switched off or removed.

Examination violation occurs when one tries to cheat e.g. through impersonation, getting assistance etc. *Termination*, the normal termination occurs when exam's time is over or when an examinee submits all questions and finishes. Abnormal termination occurs when a student commits a violation, it is evaluated and rated and depending on institution's rules may be terminated. *Finalization*, after the exam terminates, a session report is generated; session recording is stopped and saved. Then the grade is calculated.

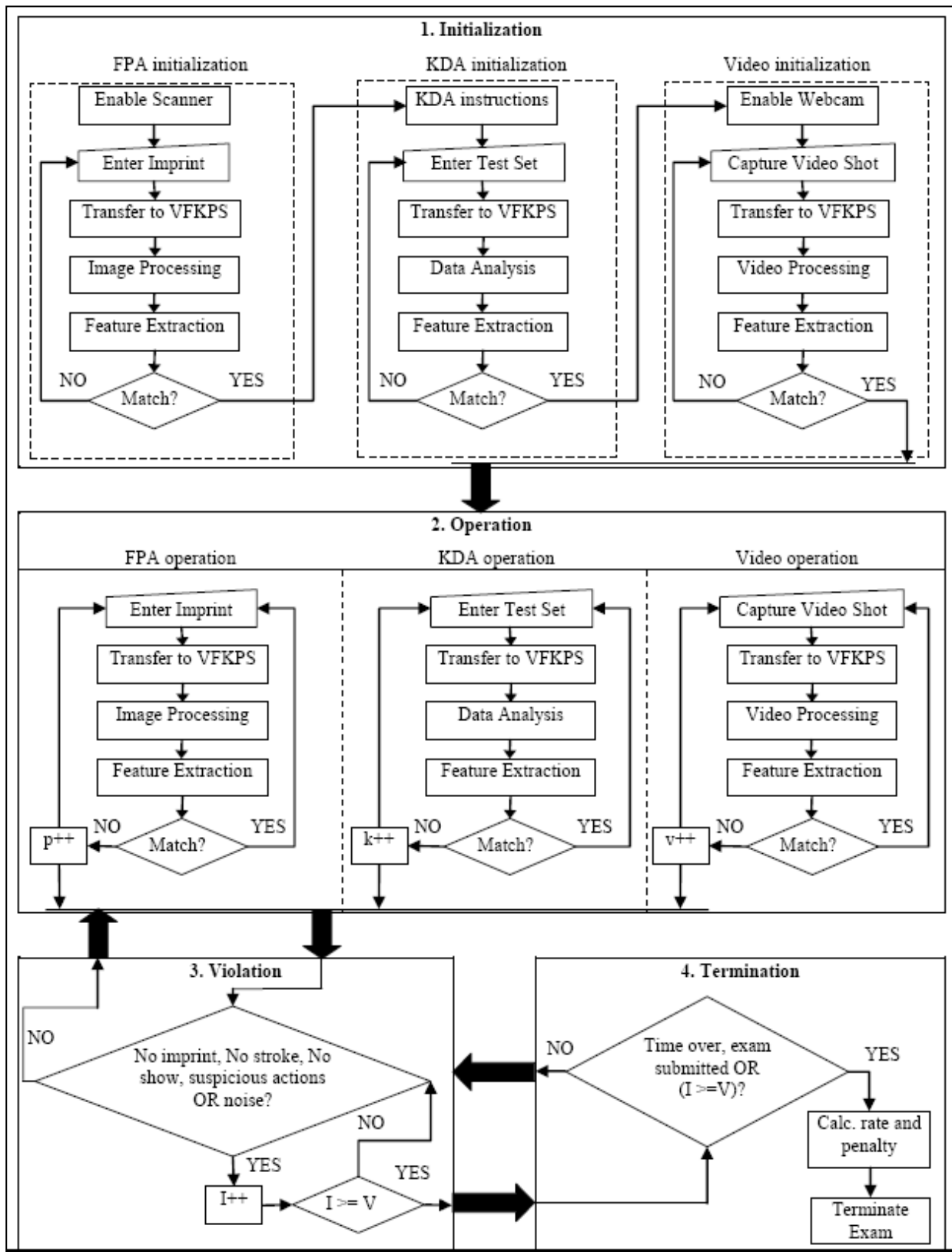


Figure 2: SABBAH model (Source: Sabbah et al (n.d))

2.5.3 Modular Assessment System for Modern Learning Settings

The Modular Assessment system for Modern Learning settings (MASS) was proposed by Al-Smadi & Gütl (2010); it gives a service-oriented architecture for a generic and flexible assessment system that can be used across university campuses.

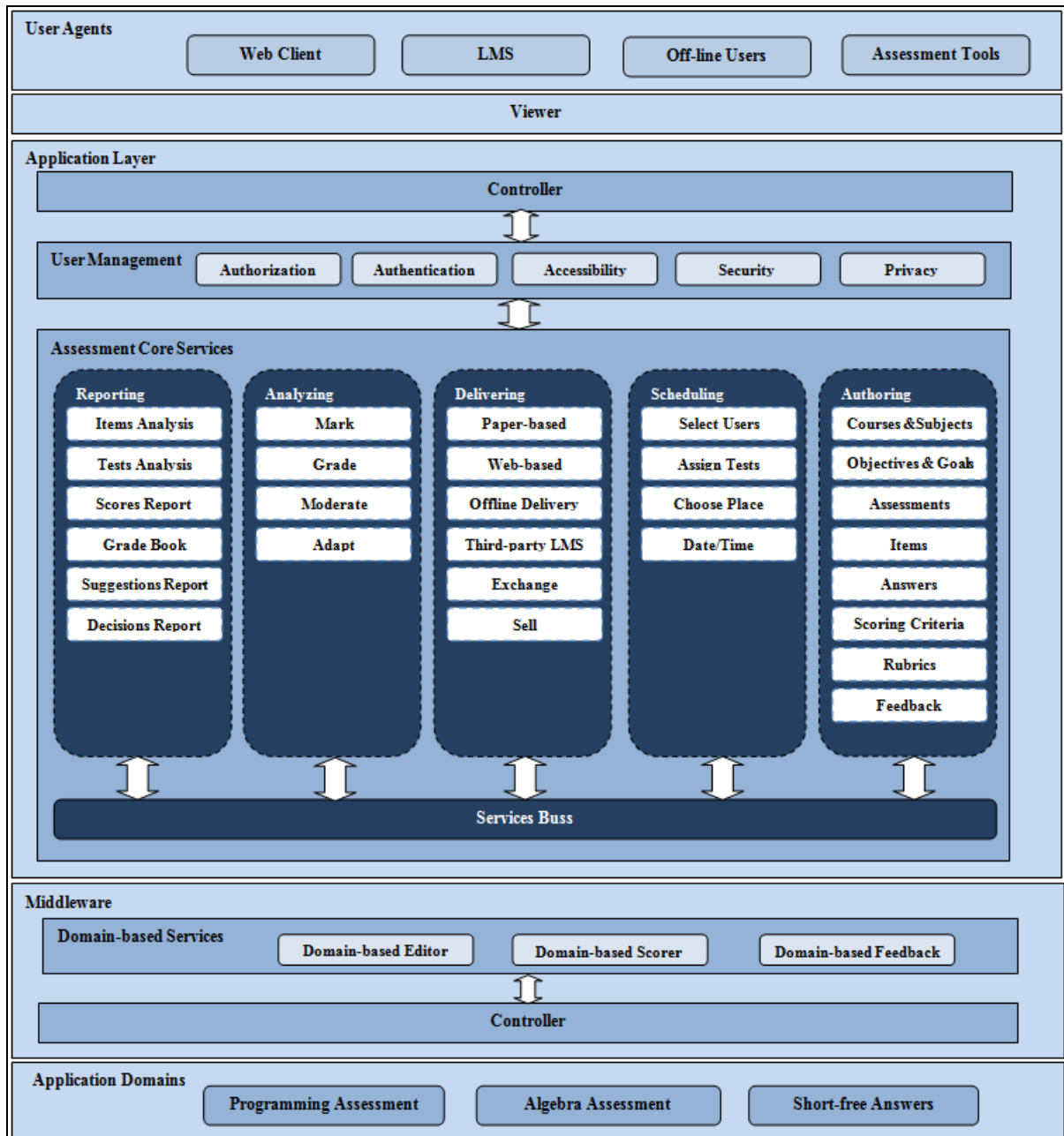


Figure 3: Detailed architecture of MASS (Source: Al-Smadi & Gutl, 2010)

User Agents layers, represents the possible users of MASS. User agents are native users such as students, teachers, and administrators and external users such as related tools or LMS. Application Layer represents the assessment native services that include controller, user

management and assessment core services. Middleware Layer, this has been added for the sake of generality and flexibility. The middleware forms a run-time platform where the domain-based services (e.g. Domain-based Editor) are registered in order to be used by MASS modules. The domain-based services are used to extend the services provided by MASS. Application Domains Layer represents the systems and tools that are used in specialized application domains such as algebra and programming assessment.

2.5.4 E-Assessment procedures checklist

The e-assessment procedures checklist (EPC) was proposed by Sangi et al (2007), the implementation is divided into three main stages, pre-assessment, assessment and post assessment, and three active stakeholders are student, faculty and institution.

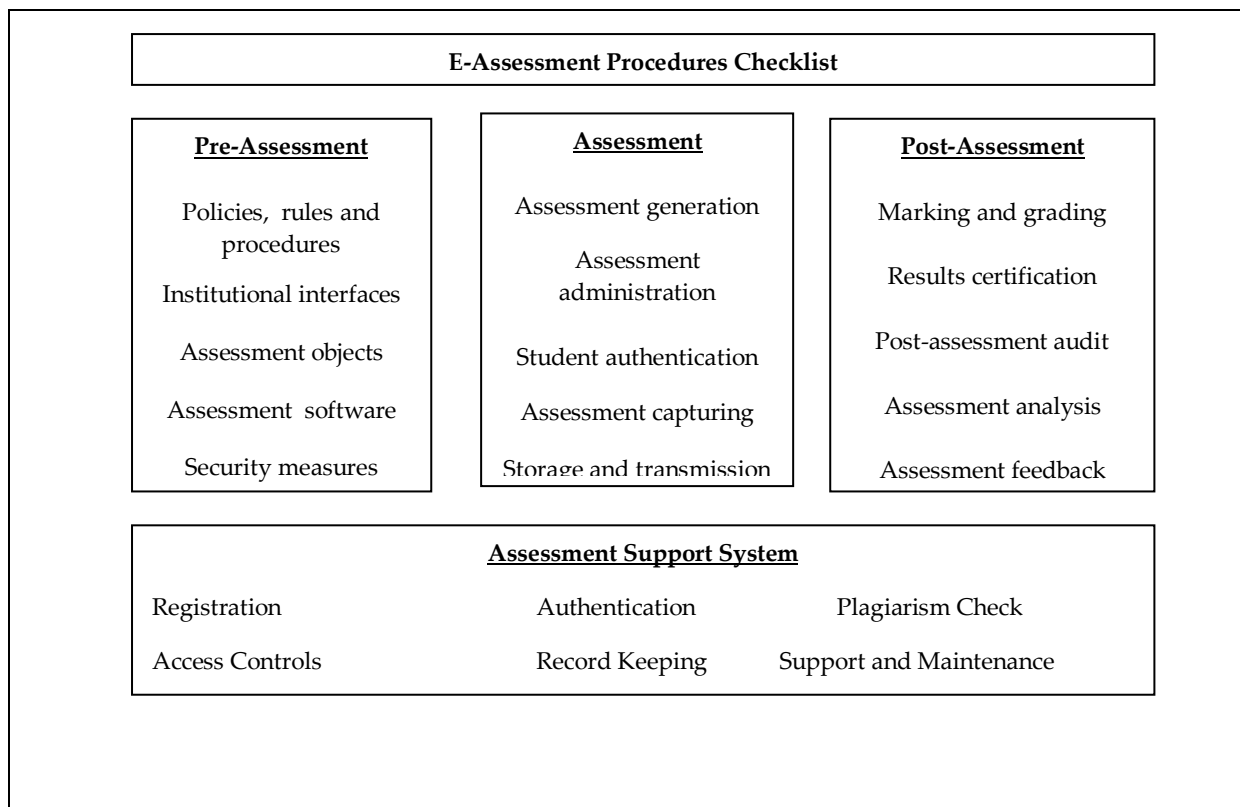


Figure 4: E-assessment procedure checklist model (Source: Sang, n.d)

The assessment stage handles the generation of the tests. The assessment generation procedures control the selection and assembly of objects and test items, and their archival storage. Post-assessment, handles grading, scoring, results compilation and certification process.

2.5.5 Lloyd Framework

The Lloyd framework was proposed by Lloyd et al (2012). The framework is subdivided into three main functions: assess, analyze and intervene. The functions are further sub-divided into twelve sub-functions.

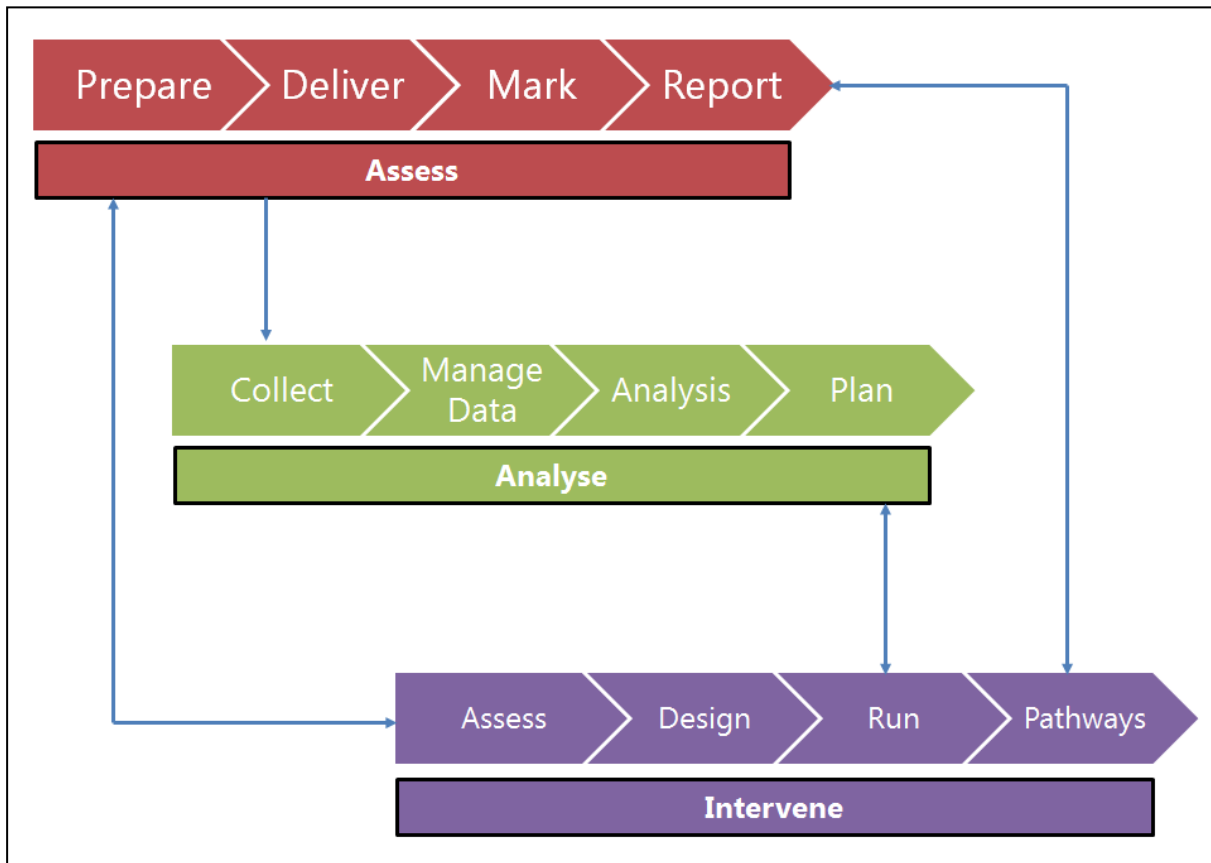


Figure 5: Lloyd framework (Source: Lloyd et al, 2012)

Assess, this is made up of four functions: *Prepare*, authors develop testing packages and avail them to teachers. The teachers then assemble the assessment for students who undertake and submit them back. *Delivery*, assessment is delivered through the web, learner management system or through thick clients. The candidate's responses may be cached locally and periodically sent to the main server. *Marking*, this ranges in sophistication according to the type of assessment being done, from automatically marked assessments, to scripts requiring human intervention. *Reporting*, online assessments give immediate feedback to students and to the University for appropriate decision making.

Analyze, data from the system is analyzed to drive better performance, increase accountability, resources management, administrative efficiencies and for planning. Assessment of the students is a permanent and ongoing activity.

Intervene; risk factors that affect learning are identified and interventions put in place. The triggers, i.e. the thresholds above or below which a student should be at for their particular grouping. The intervention process is designed through a series of automated workflows.

2.5.6 REVIEW OF IMPLEMENTATION FRAMEWORKS

Table 1: Comparison of various implementation frameworks

		SOFA	SABBAH	MASS	EPC	Lloyd
1	Originator	Al-Smadi et al	Sabbah et al	Al-Smadi & Gütl	Sangi et al	Lloyd et al
2	Aim	To provide common service definitions are provided and used to achieve diverse goals.	To provide secure and smart model for summative e-assessment.	To achieve a common goal across university campuses	To address the needs of different assessment programmes in learning institutions	To create personalized learning experiences for E-Assessment and E-Examination
3	Genesis	Aim to identify important services and assign one or more open standards and specifications.	Enable exams to be conducted distantly, e.g. at home.	Provide an Architecture for a generic and flexible assessment system that can be used across university campuses	Provide an overview of e-assessment practices required for a generalized E-assessment.	Aim to increase the effectiveness of schooling systems through analysis and use of data generated by E-Examination and E-Assessment.

4	Components	Categorized in five abstract layers: User and system, interface, assessment services, common services and infrastructure. Details include: Author, manage users, schedule, pre-delivery, deliver, mark, grade, analyze, feedback, certify, moderate, process data, process appeals, quality assurance, exchange, user management.	Categorized in four sections: Initiation, (FPA, VFKPS, KDA), Operations, violation and termination. The model is strong on authentication, however it lacks details on actual assessment and analysis	Categorized in four sections: User agents, application layer, middle layer, Application adoption, Details: same as SOFA, it offers more details in: authoring, schedule and delivery, reporting.	Categorized into four sections: pre-assessment, assessment and post assessment and assessment support Details: same as SOFA, but states more items including: policies, storage and transmission, support and maintenance, registration, plagiarism check.	Categorized into three functions: Assess, Analyze, Intervene. Details: same as SOFA, but has additional items in content development, delivery mode, intervention and reporting tiers.
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Venn diagram was used to compare and contrast the various implementation frameworks and to show the logical relationships of the elements of different sets of the framework.

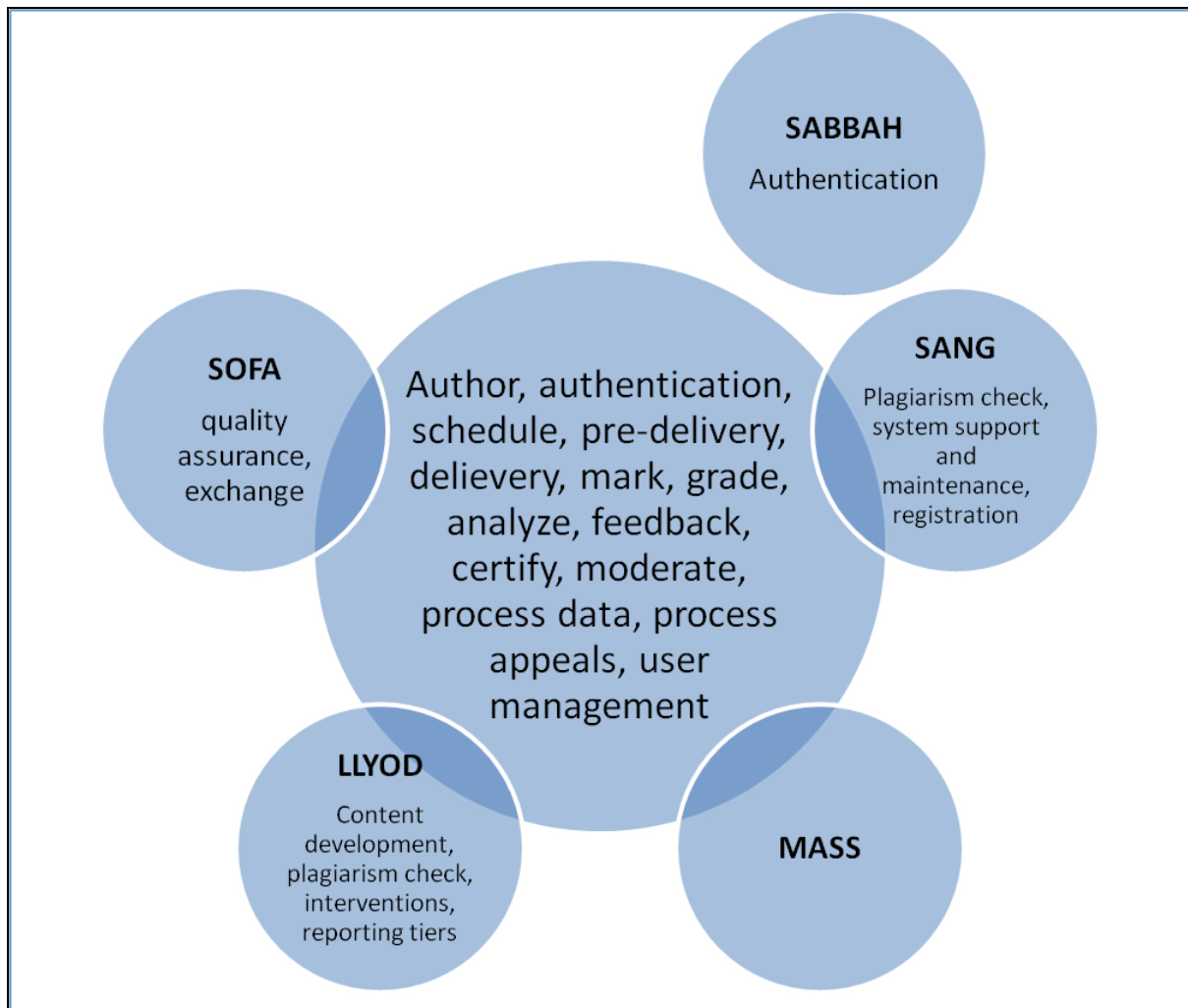


Figure 6: Radial Venn diagram, a comparison of online assessment implementation frameworks

By recording related components and using Lloyd as the basis framework (it is the most detailed framework), the extended Lloyd framework in figure 7 is proposed.

2.6 PROPOSED EXTENDED LLOYD FRAMEWORK

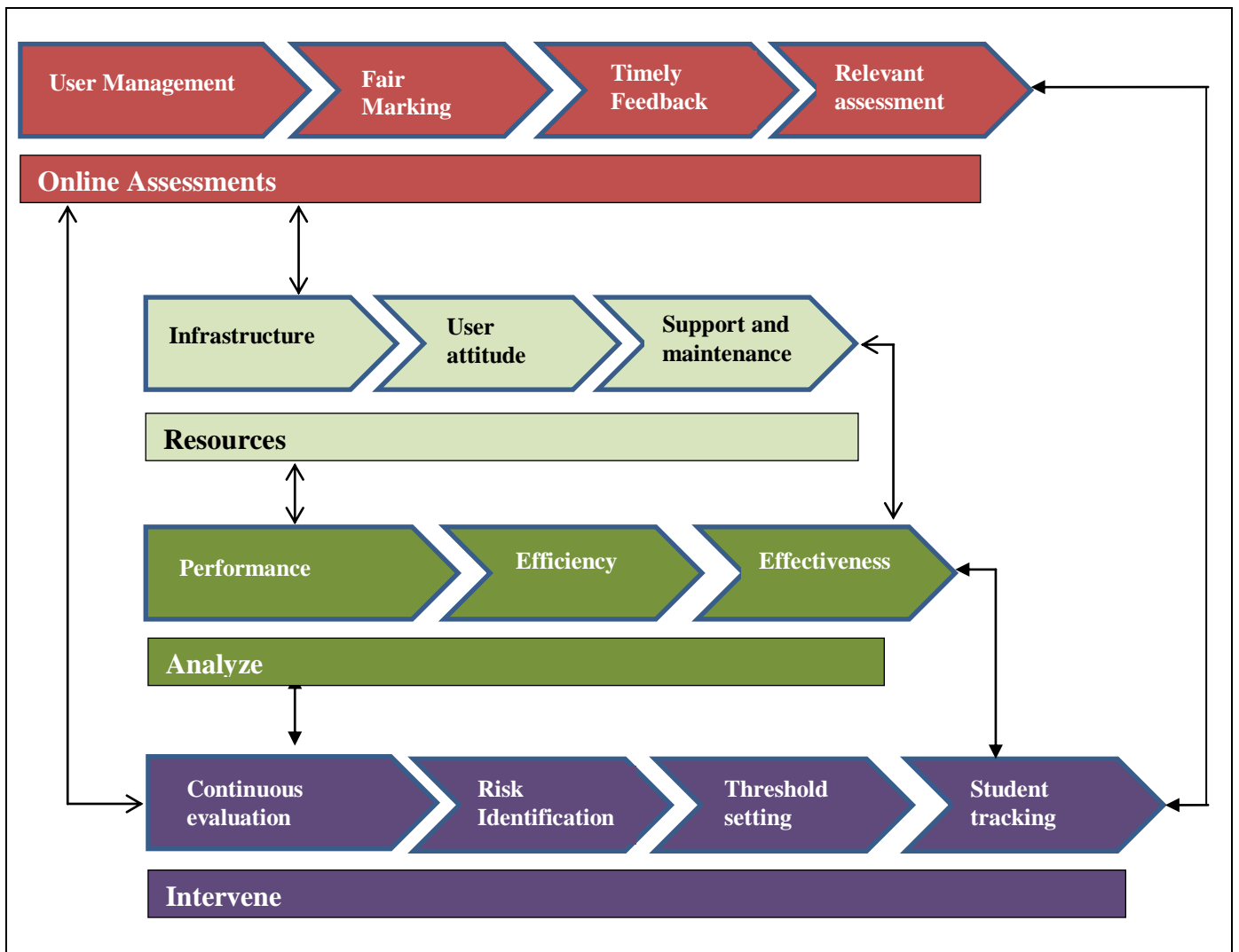


Figure 7: Proposed extended Lloyd framework

There exist several kinds of assessments. **Summative** assessment is a form of assessment that occur at the end of a set of learning activities and the results achieved by the student is registered as a final mark, **formative** is done at the beginning of a course to identify the knowledge background of the students. **Diagnostic** is a non-accredited assessment used to identify the learner's strengths and weaknesses with a view of providing appropriate learning program and **adaptive** is a form of assessment that changes as the assessment progresses based on student's response to earlier questions.

For a successful and relevant electronic assessment, Walker (2007) noted that the assessment items should:

- i. be aligned to the curriculum,
- ii. have clear and concise instructions and questions wording,
- iii. offer timely and meaningful feedback,
- iv. have fair marking schemes,
- v. accommodate students with special needs,
- vi. incorporate a range of question types,
- vii. include suitable distracters to minimize the potential of guessing especially for multiple choice questions,
- viii. be guided by the level of study,
- ix. offer realistic time frame to allow completion of the task, and
- x. not test student's information technology skills as key elements. To have relevant assessment, all the above factors must be observed.

The online assessment category has four sub-categories, user management, which provides scheduling of assessment, assigning the tests, authorization, security, data processing and accessibility functions. Fair marking entails items authoring, marking, moderating and grading. Feedback reports assessment results to students and other shareholders. To provide relevant assessment, it must be clear on what is to be assessed, how is it assessed, why is it assessed, when is it assessed, and who assesses it. Users management is aimed at ensuring access control, authentication, registration and plagiarism check during the administration of assessments. This is intended to produce fair marking and immediate feedback to the student, lecturer and the institution.

Data collected from online assessments is analyzed to help target students with tailored learning, and make decisions on performance, efficiency and effectiveness of the system. Data is analyzed to inform improvement plans and enable administrators to drive performance in academics, operational excellence, stakeholder satisfaction and a motivated workforce.

Efficiency considers the relationship of costs of assessment process of the institutions, instructors and learners, against the expected results. Analysis helps one to identify what contributes or detracts students' learning for operational effectiveness.

Independent Variables

Dependent Variables

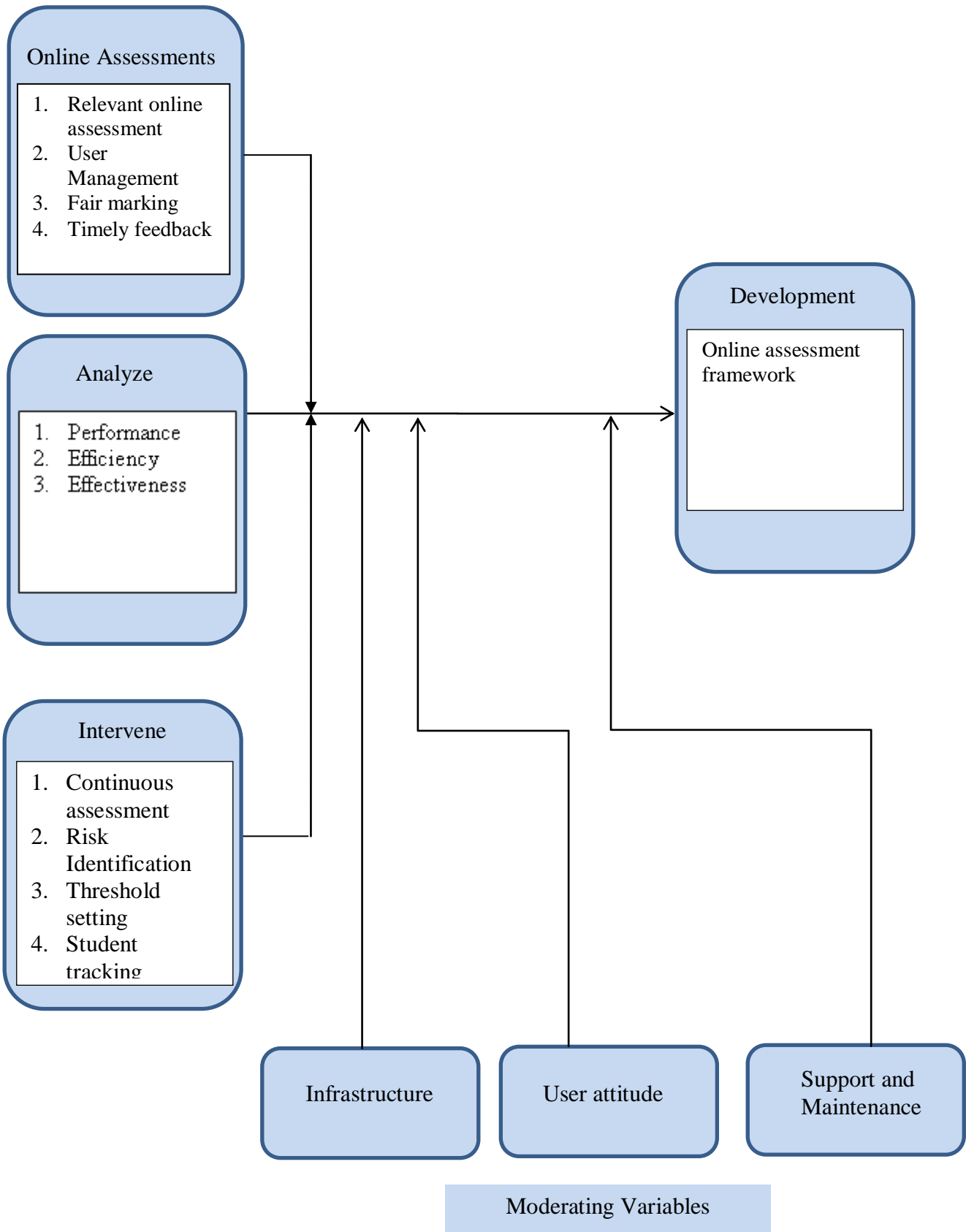


Figure 8: Conceptual framework for implementation of online assessments

The intervention plans are informed by a continuous evaluation of online assessment systems, risks are identified, threshold set and students' learning tracked. Intervention assists in identifying learning problems and put in appropriate measures to alleviate future problems. The availability of appropriate infrastructure e.g. software, hardware, positive user attitude and availability of support staff promotes online assessments.

According to Metz and Leah (2012), the implementation process is categorized into four functional levels; these are exploration, installation, initial and full implementation. Exploration stage examines the degree to which a particular model meets the users' needs and whether implementation is feasible. Installation stage comes after a decision to adopt the technology is made, appropriate changes are then made in order to initiate the new practices and ensure financial, human resources, equipment and technologies are in place. Initial Implementation stage involves strategies to promote continuous improvement and rapid cycle problem solving. Data is used to assess implementation in order to identify solutions and drive decision-making. Full Implementation stage occurs when the new system becomes integrated into the practice with processes and procedures that support the new way of work being in place. Financial sustainability ensures that the funding streams for the new practice are established, reliable, and adequate. Programmatic sustainability ensures that sustainable supports are in place to continue effective training, coaching, and performance assessment protocols.

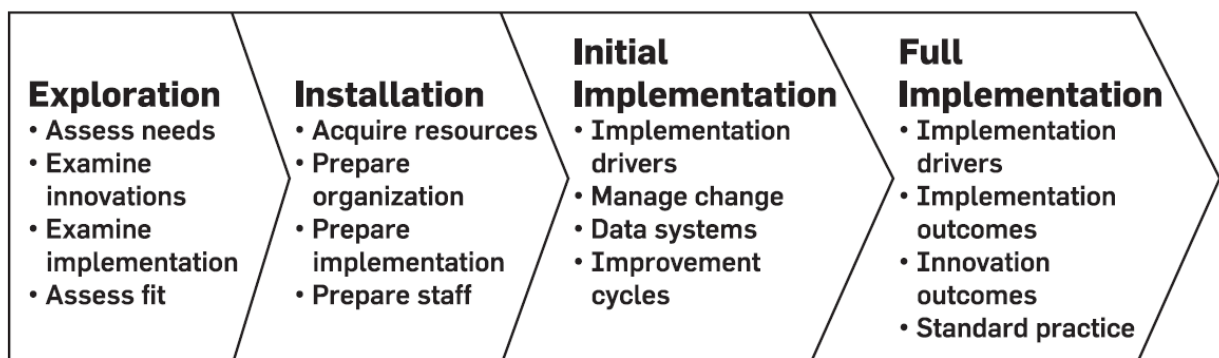


Figure 9: Implementation stages (Source: Zero to three, 2012)

3.0 RESEARCH METHODOLOGY

Kothari (2004) defined research as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in the procedure. It is a "blueprint" that defines research questions to study, which data is relevant, what to collect, and how to analyze the results, Wikimedia Foundation (2012).

In 2007, the e-learning Centre was established at Maseno University to spearhead the development of institutional policies and strategies for promoting the innovative use of information and communications technologies (ICTs) to benefit learning, teaching and research activities. There has been a steady growth in enrolment, as at September 2012, there were 134 students enrolled in Bachelor of Business Administration (With IT), 20 students in Bachelor of Science (Mathematical Sciences, With IT), 54 students in Master of Science in Research Methods and 19 students enrolled in Post Graduate Diploma in Education (PGDE) etc, there were a total of 304 students enrolled at the e-learning Centre, M. Ayere 2013, pers. comm. 23 February.

3.1 TARGET POPULATION AND SAMPLING TECHNIQUE

Primary data was collected from students at the e-campus and lecturers who were involved in the implementation of e-learning at Maseno University. Students under e-learning programme are required to complete online quizzes and tests as they go through their course. The CATs given are marked either by the computer or by the course lecturer.

Table 2: Number of student who had attempted online quizzes (Source: M. Ayere 2013, pers. comm. 27 February)

	Programmes	Number of students
1	Bachelor of Business Administration (BBA With IT)	64
2	Master of Science in Research Methods	22
3	Post Graduate Diploma in Education (PGDE)	7
4	Bachelor of Science (Mathematics and Business Studies With IT)	2
5	Bachelor of Science (Mathematical Sciences With IT)	9
6	Bachelor of Science (Mathematics and Business Studies With IT)	2
7	Bachelor of Science (Mathematical Sciences With IT)	2
8	Bachelor of Science (Mathematics and Business Studies With IT)	1
	Total	109

Students who had attempted online quizzes formed the sample of study; this is because it was believed that the students that had attempted online quizzes were in a better position to give meaningful responses. A request was made to Maseno University to help identify these students; a total of 109 students had attempted online assessments as summarized in table 2 above.

3.1.1 Sample

The number of students who had attempted online quizzes was established to be 109, the researcher targeted to collect data from these students. Through, non-probability sampling, the 109 students and 5 lecturers were selected to participate in the research work; the lecturers chosen were involved in the implementation of e-learning at Maseno University. Norman (2010) noted that parametric statistics could be used with Likert data, with small sample sizes, with unequal variances, and with non-normal distributions, with no fear of coming to the wrong conclusion.

3.1.2 Data Collection instruments

Data was collected through the use of questionnaires. Two sets of questionnaires were developed; the students' questionnaire had close-ended questions, the lecturers' questionnaires had both close and open-ended questions.

The study was piloted on 12 students and 5 (41.7%) responded. The pilot study was a replica and a rehearsal of the main survey and was intended to bring out the weaknesses of the questionnaires and the survey techniques, Kothari (2004). From the experience gained, improvement was effected before rolling out the research to the entire sample. The piloting helped the researcher to estimate time required to fill the questionnaire, assess language used and confirm expected answers, and how to apply them in the interpretation.

Table 3: Cronbach's alpha for piloted research

Research Question	Number of questions	Cronbach's alpha
Research Question 1	5	0.675
Research Question 2	6	0.729
Research Question 3	8	0.701
Research Question 4	2	0.611
Research Question 5	4	0.233
Research Question 6	2	0.642

The questions were reviewed in order to improve the reliability, the Cronbach's alpha were calculated for each research question and established as shown in table 3 above.

3.1.3 Testing the proposed framework

The testing of the proposed framework was done through data collected from students and lecturers. The open-ended questions were included in the questionnaire to facilitate discussions to allow for the interviewee to provide more information and a qualitative assessment of the proposed framework. More clarification was obtained by posing questions to the lecturers' responses. In the lecturers' questionnaire, the questions were organized in the structure of the proposed extended Lloyd framework. Tierney (n.d), samples in qualitative research tend to be small, this is because the aim of study is not to estimate the prevalence of a phenomenon but to provide an in-depth understanding of a topic, to develop explanations and to generate ideas or theories.

3.2 DATA ANALYSIS

From the data collected, the mean, standard deviation, frequencies were calculated. The two measures were calculated using Microsoft Excel and SPSS applications. The measure of internal consistency was determined by calculating the Cronbach's alpha; a value of 0.7 was taken as the threshold according to Tselios (2011), in all cases it was found to be within the acceptable limit.

4.0 PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Two sets of questionnaires shown in appendices 7.3.1 and 7.3.2 were sent to students and lecturers at Maseno University respectively. A total of 109 students and 5 lecturers were contacted. The feedback was checked for correctness and completeness. Out of 71 feedbacks received from students, 63 (57.8%) were rated as good and as such used in the analysis. Cronbach's alpha obtained for the six research questions ranged from 0.701 to 0.796, which showed that the data reliability was within the threshold.

Table 4: Cronbach's alpha for research work

Research Question	Number of questions	Cronbach's alpha
Research Question 1	5	0.701
Research Question 2	6	0.736
Research Question 3	8	0.733
Research Question 4	2	0.796
Research Question 5	4	0.762
Research Question 6	2	0.743

Table 5: Lecturers and students contacted and those who responded

	Respondents Targeted	No. contacted	No. responded	Percentage
1	Number of lecturers	5	3	60.00
2	Number of students	109	71	65.14

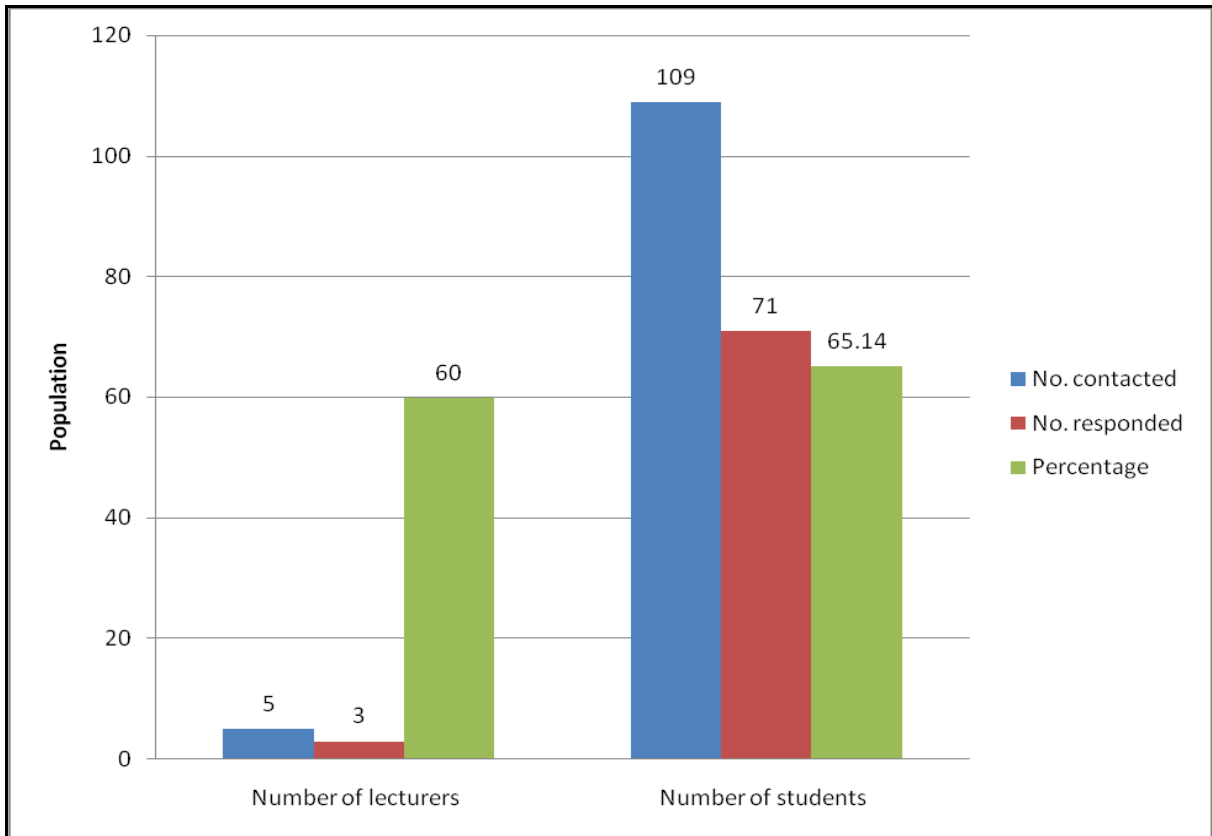


Figure 10: Number of lecturers and students who responded to the questionnaires

Respondents by course

Students enrolled in different courses responded to the questionnaire as shown in table 6. 70.31 % of students taking Bachelor of Business Administration (BBA With IT) who were contacted gave their feedback, 40% of students taking Bachelor of Science (Mathematics and Business Studies With IT) who were contacted gave their feedback, 36.36% of those taking BSc (Mathematical Sciences With IT) who were contacted gave their feedback, 72.7% of those taking Master of Science in Research Methods who were contacted gave their feedback and 57.1% of those taking Post Graduate Diploma in Education (PGDE) who were contacted gave their feedback. The overall response rate was 65.14%.

Table 6: Respondents by course

	Respondents	Target	Received	Percentage
1	Bachelor of Business Administration (BBA With IT)	64	45	70.31
2	Bachelor of Science (Mathematics and Business Studies With IT)	5	2	40.0
3	BSc (Mathematical Sciences With IT)	11	4	36.36
4	Master of Science in Research Methods	22	16	72.7
5	Post Graduate Diploma in Education (PGDE)	7	4	57.1
	Totals	109	71	65.14

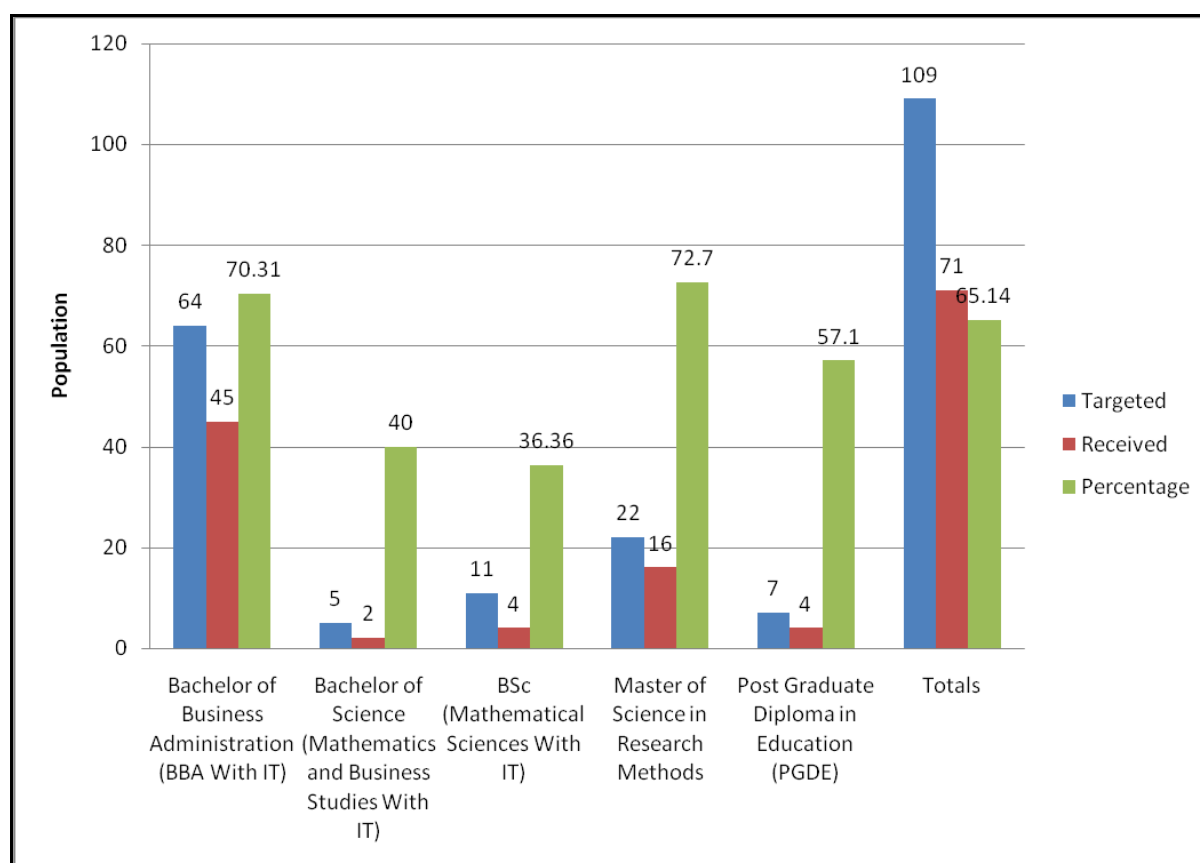


Figure 11: Students targeted and those that responded

4.2 DATA PRESENTATION AND ANALYSIS

From the results, 49 % of students strongly agree that assessment is never given at the beginning of a course, 30% agree with the same. 7 % of students were undecided, 9% disagree and 5% strongly disagree. 73 % of students strongly agree that assessments are

conducted at the end of a learning activity, 14 % of the students agree, 6.5 % were undecided and the same number strongly disagree. 71 % of students strongly agree that online assessments are never used for identifying learners' strength and weakness, 19 % agree, 6 % of students were undecided and 4% strongly disagree; 62 % of the students strongly agree that questions never get harder or easier depending on the previous answer given by the student, 30% agree with the same, 5 % of students were undecided and 1.5 % disagree and the same number strongly disagree. 60 % of the students strongly agree that online assessments are not widely used in public universities, 22 % of the students agree, 6 % were undecided, 1% disagree and 11% strongly disagree.

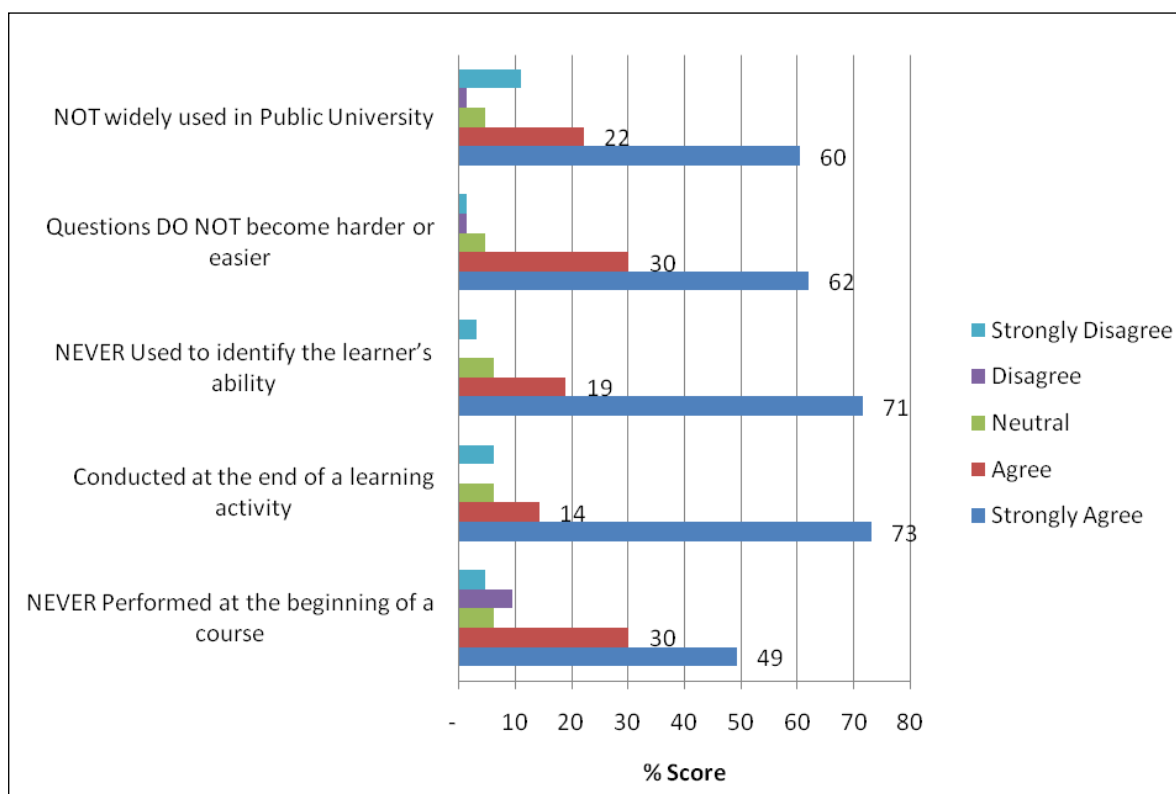


Figure 12: Responses on forms of online assessments used in public universities

44 % of students strongly agree that assessment was in line with the curriculum, 29 % of the students agree on the same, 14% are undecided, 5% disagree and 8% strongly disagree. 59 % of students strongly agree that instructions and questions were clear and concise while 22 % agree on the same, 13% are undecided and 6% strongly disagree, 51 % of students strongly agree that timely and meaningful feedback was given while 32 % agree on the same, 9% are undecided and 8% strongly disagree, 44 % students strongly agree that marking was fair and 35 % agree, 2% are undecided, 12% disagree and 7% strongly disagree. 56 % of the students

strongly agree that online assessments did not test ICT skills and 29 % agree with the same, 11% are undecided and 4% disagree. 48 % of students strongly agree that the online assessments had a range of questions to assess breadth and depth of student's knowledge while 21 % agree, 15% are undecided, 8% disagree and the same number strongly disagree.

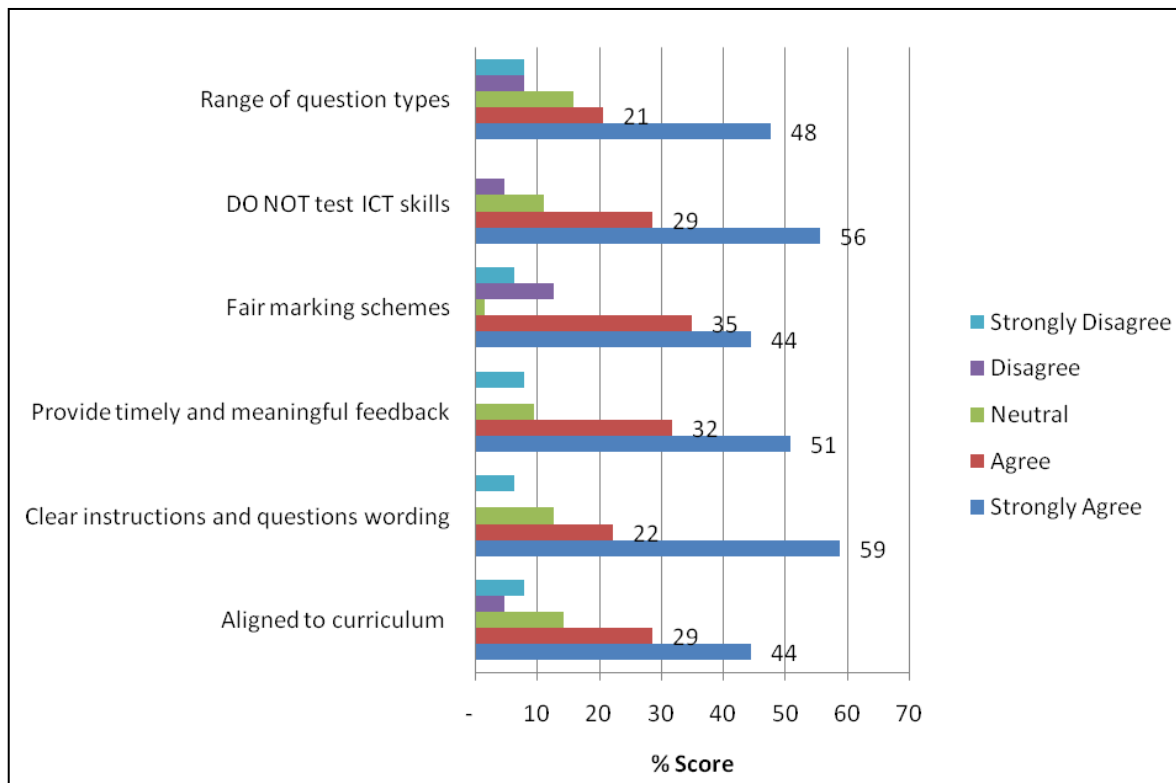


Figure 13: Relevance of online assessments to courses offered in public universities

52% of the students strongly agree that online assessments do not reflect competencies needed in real life while 29% agree, 3% are undecided and 16% strongly disagree. 52 % of the students strongly agree that online assessments do not reflect complexity of skills being measured while 32% agree, 6% are undecided, 8% disagree and 2% strongly disagree. 48 % of the students strongly agree that marking is accurate while 43% agree, 6% are undecided and 3 % disagree. 68 % of the students strongly agree that no regular maintenance and security reviews were done while 16 % agree, 9% are undecided and 7% disagree. 32 % of the students strongly agree that there was no suitable support for users, assessors and moderators while the same percentage agree, 15% are undecided and 21% disagree. 60 % of the students strongly agree that the cost of implementation of online assessments is high, 21% agree, 11% are undecided, 3% disagree and 5% strongly disagree. 62 % of the students strongly agree that there were limited skills in managing online assessment resources while 25% agree, 2% are undecided, 6% disagree and 5% strongly disagree.

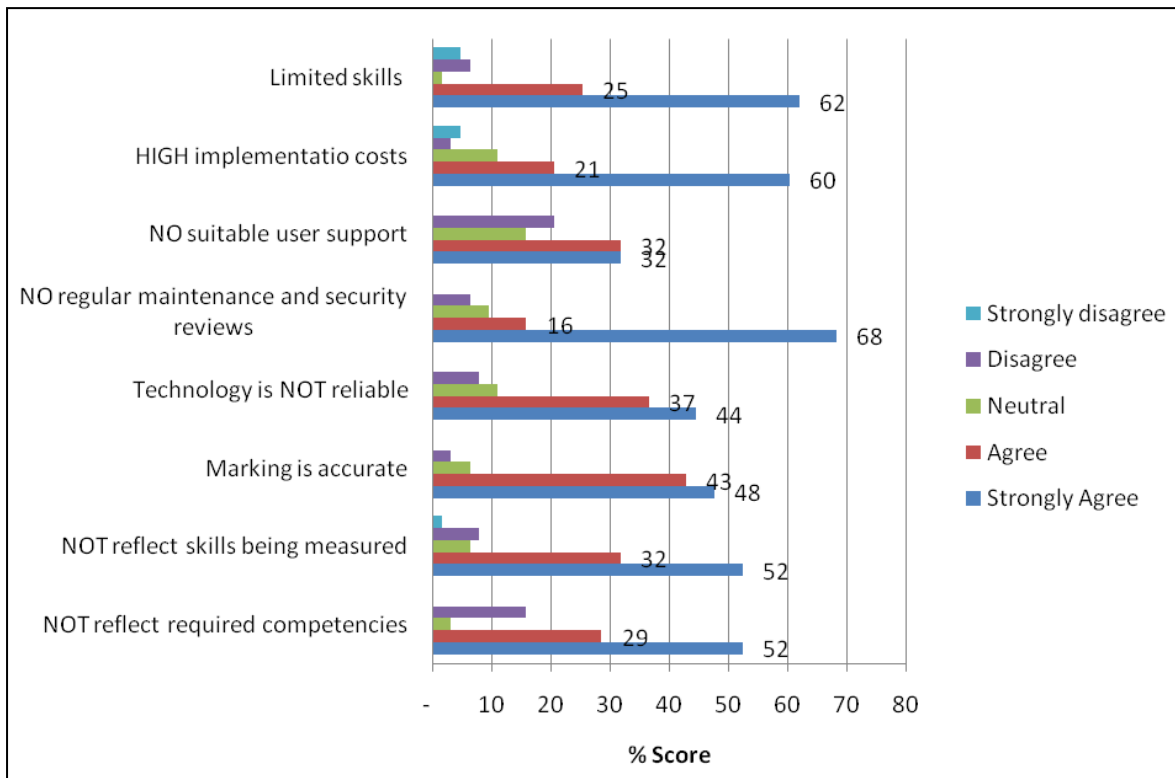


Figure 14: Responses on challenges that students, lecturers and institutions face

56 % of the students strongly agree that given a choice, they would take online assessment, while 21% agree, 11% are undecided, 5% disagree and 7% strongly disagree. 60 % of the students strongly agree that in the near future more people would be use online assessment while 17% agree, 13% are undecided, 5% each disagree and strongly disagree.

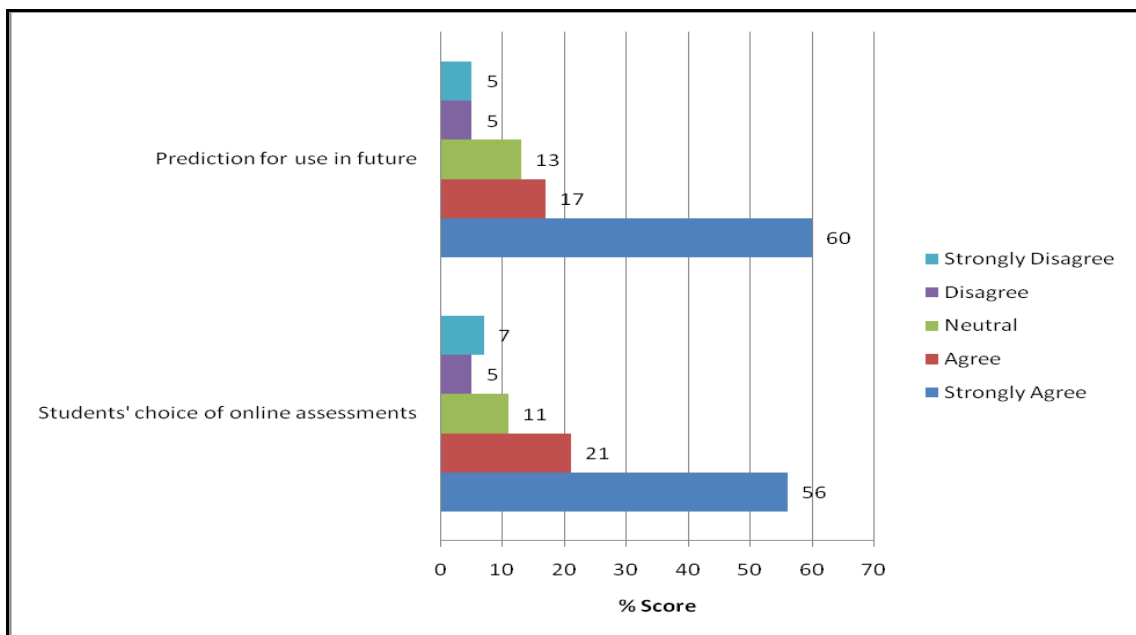


Figure 15: Students' willingness to use online assessments

59 % of the students strongly agree that online assessment platform installed is easy to use while 32% agree, 6% are undecided and 3% strongly disagree. 68 % of the students strongly agree that there is inadequate internet bandwidth to accommodate online assessment while 27% agree, 3% are undecided, and 2% disagree. 67 % of the students strongly agree that there were inadequate servers and computer hardware while 29 % agree, 3 % are undecided and 1% strongly disagree. 68 % of the students strongly agree that there was inadequate trained manpower to support students, lecturers and institutions, while 22 % agree, 8 % are undecided and 2% strongly disagree.

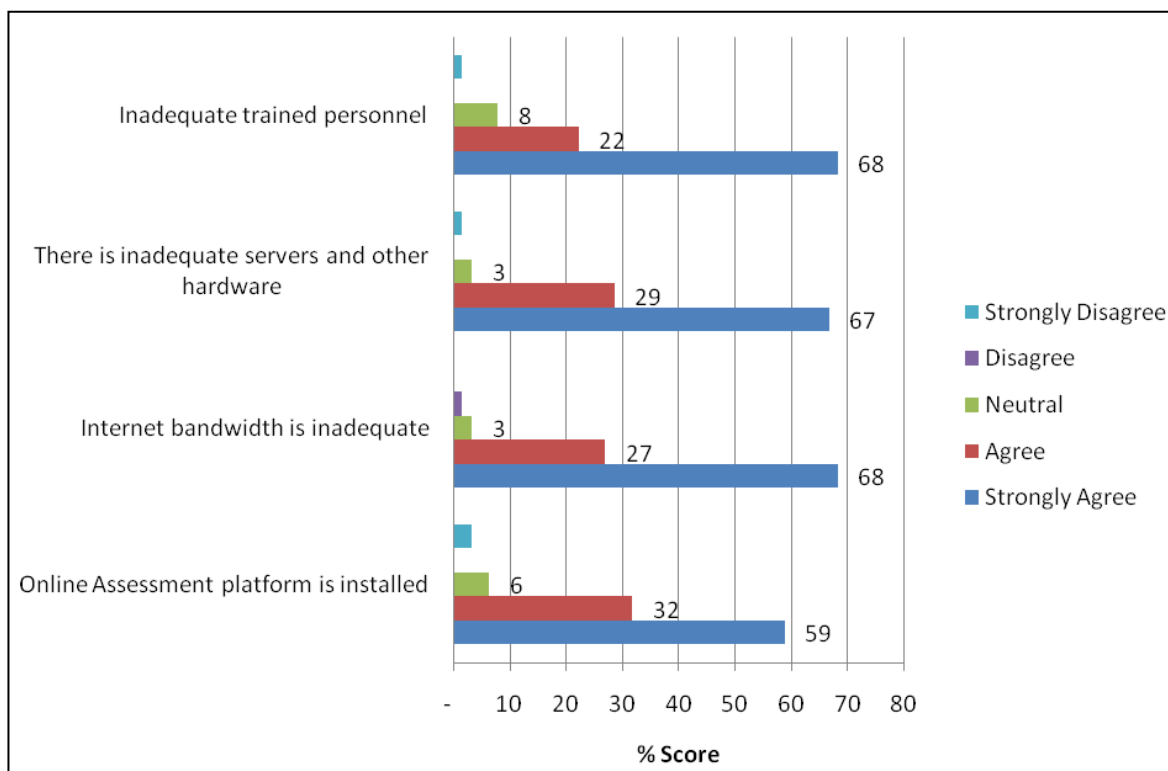


Figure 16: Responses on online assessment facilities available in public universities

56 % of the students strongly agree that online assessment facilities including internet, hardware, software and human capacity are not readily available while 35% agree, 8% disagree and 1 % strongly disagree. 71 % of the students strongly agree that online assessment systems have user-friendly interface and hence easy to learn and use while 13 % agree, 8% are undecided, 6 % disagree and 2% strongly disagree.

The online assessment software installed has a friendly user-interface; which does not limit users as even those without ICT background can comfortably use it. Other basic infrastructure: hardware, trained manpower and Internet connection is limited.

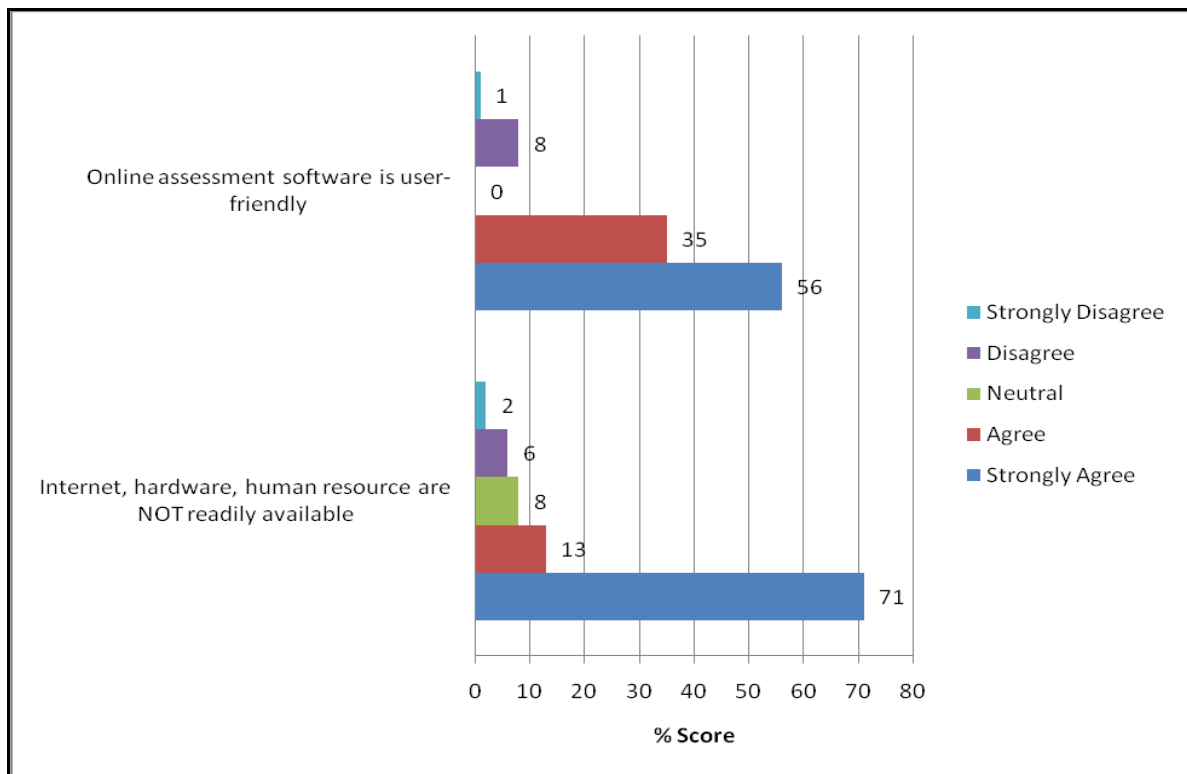


Figure 17: Responses on factors that hinder implementation of online assessments

4.2.5 Framework testing

This section discusses the extended Lloyd framework with a view of establishing its viability for adoption in implementing online assessments. The testing of elements in the framework was done through the data collected from lecturers at Maseno University. The questionnaire was structured according to the extended Lloyd framework. The findings confirmed elements of the conceptual framework, no new elements were identified and those that had no influence on the framework were removed.

The mean scores per question were calculated to establish the factors' contribution; the results are shown in figure 18. This form of data analysis was chosen since the data was not voluminous. The extended Lloyd framework was found to be largely suitable based on the responses on close-ended questions. Key points from the open-ended questions were used to further refine the framework.

All the means calculated apart from performance which was 1.40, the rest of the factors had a mean ranging from 3.2 to 4.2, this confirms that these factors had a contribution and had to be retained except performance, where consideration was made to drop it.

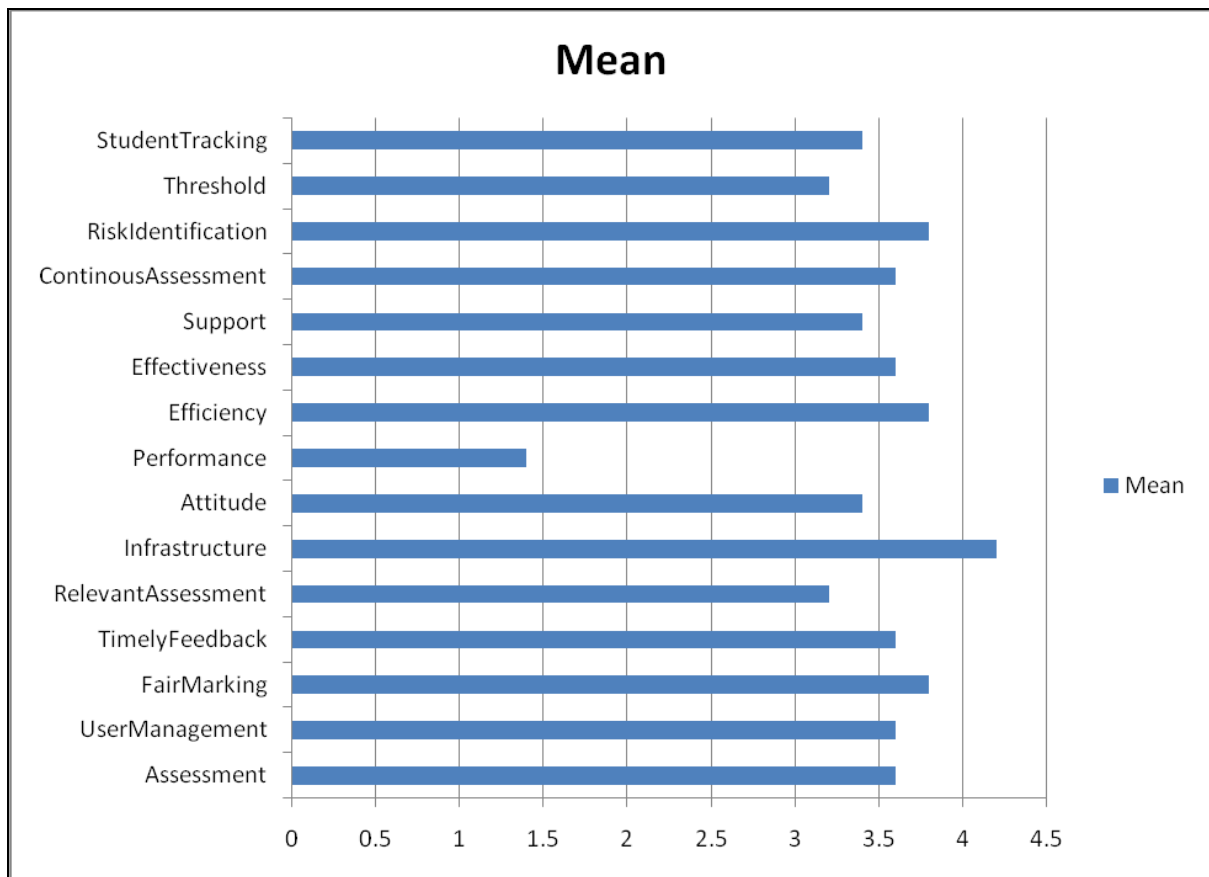


Figure 18: Means of factors of online assessments under investigation

To develop the implementation framework, it was important to investigate further the contribution of the factors identified to the implementation process. The variables under investigation were: user management, fair marking, timely feedback, relevant assessment, infrastructure, user attitude, performance, efficiency, effectiveness, user support, continuous assessment, risk identification, threshold setting and student tracking. The data was analyzed using SPSS software where factor analysis was done. From the factor analysis, the following was observed:

Descriptive statistics

Table 7 showed all the variables under investigation. The *mean*, *standard deviation* and *number of respondents* (N) that participated in the survey were given. *Infrastructure* with a mean of 4.2 was found to be the most important variable that influence the implementation of online assessments. *Performance* with a mean of 1.4 had the least contribution.

Table 7: Descriptive statistics showing mean and standard deviation of all factors assessed

	Mean	Std. Deviation	Analysis N	Missing N
Assessment	3.6000	1.67332	3	0
User Management	3.6000	1.14018	3	0
Fair Marking	3.8000	1.30384	3	0
Timely Feedback	3.6000	1.14018	3	0
Relevant Assessment	3.2000	1.48324	3	0
Infrastructure	4.2000	1.30384	3	0
Attitude	3.4000	1.51658	3	0
Performance	1.4000	.54772	3	0
Efficiency	3.8000	1.30384	3	0
Effectiveness	3.6000	1.67332	3	0
Support	3.4000	1.81659	3	0
Continuous Assessment	3.6000	1.14018	3	0
Risk Identification	3.8000	1.09545	3	0
Threshold	3.2000	1.48324	3	0
StudentTracking	3.4000	1.34164	3	0

The Correlation matrix

Table 8 which show the correlation matrix gave the correlation coefficients between a single variable and every other variable under investigation. The correlation coefficient between a variable and itself is 1 hence the principal diagonal of the correlation matrix contain 1s. The correlation coefficients above and below the principal diagonal were the same. The correlation matrix was used to check the pattern of relationships. Correlation coefficients were checked whether the values (considering the magnitudes) were greater than 0.05, and also looked for any values that were greater than 0.9. Majority of the values were found to be greater than 0.05 but less than 0.9, this therefore means that there was no risk of problems arising due to the singularity of data.

Table 8: Correlation matrix showing correlation coefficient between a single variable with other variables

	Assessment	User Management	Fair Marking	Timely Feedback	Relevant Assessment	Infrastructure	Attitude	Performance	Efficiency	Effectiveness	Support	Continuous Assessment	Risk Identification	Threshold	Student Tracking
Correlation Assessment	1.000	-.629	.069	.419	.342	.733	-.512	.764	-.733	-.518	.230	-.105	.627	.443	-.468
User management	-.629	1.000	.101	.423	-.532	.067	.839	-.881	.774	.157	-.024	.423	.120	-.532	.294
Fair marking	.069	.101	1.000	.269	-.362	.176	-.202	-.210	-.176	.413	.887	.942	.490	-.750	.629
Timely feedback	.419	.423	.269	1.000	-.089	.908	.260	-.080	-.067	-.498	.217	.423	.921	-.237	-.033
Relevant assessment	.342	-.532	-.362	-.089	1.000	-.026	-.711	.800	-.750	-.766	-.594	-.532	.031	.205	.075
Infrastructure	.733	.067	.176	.908	-.026	1.000	.076	.210	-.265	-.527	.274	.235	.910	.103	-.343
Attitude	-.512	.839	-.202	.260	-.711	.076	1.000	-.843	.936	.276	-.073	.116	-.090	-.044	-.221
Performance	.764	-.881	-.210	-.080	.800	.210	-.843	1.000	-.910	-.600	-.201	-.480	.167	.492	-.272
Efficiency	-.733	.774	-.176	-.067	-.750	-.265	.936	-.910	1.000	.527	-.063	.101	-.385	-.103	-.086
Effectiveness	-.518	.157	.413	-.498	-.766	-.527	.276	-.600	.527	1.000	.559	.419	-.464	-.262	.200
Support	.230	-.024	.887	.217	-.594	.274	-.073	-.201	-.063	.559	1.000	.821	.427	-.408	.226
Continuous assessment	-.105	.423	.942	.423	-.532	.235	.116	-.480	.101	.419	.821	1.000	.520	-.828	.621
Risk identification	.627	.120	.490	.921	.031	.910	-.090	.167	-.385	-.464	.427	.520	1.000	-.277	.068
Threshold	.443	-.532	-.750	-.237	.205	.103	-.044	.492	-.103	-.262	-.408	-.828	-.277	1.000	-.930
Student tracking	-.468	.294	.629	-.033	.075	-.343	-.221	-.272	-.086	.200	.226	.621	.068	-.930	1.000

a. Determinant = .000

b. This matrix is not positive definite.

Communalities

Communalities table 9 below, showed how much of the variance in the variables has been accounted for by the extracted factors. Principal components of analysis works on the assumption that all variance is common, therefore before extraction, the communalities are all 1. The communalities in the column labeled extraction reflect the common variance in the data structure, therefore, 100% of the variance associated with assessment is common, or shared variance. This was the case for all the factors under investigation.

Table 9: Communalities

	Initial	Extraction
Assessment	1.000	1.000
User management	1.000	1.000
Fair marking	1.000	1.000
Timely feedback	1.000	1.000
Relevant assessment	1.000	1.000
Infrastructure	1.000	1.000
Attitude	1.000	1.000
Performance	1.000	1.000
Efficiency	1.000	1.000
Effectiveness	1.000	1.000
Support	1.000	1.000
Continuous assessment	1.000	1.000
Risk identification	1.000	1.000
Threshold	1.000	1.000
Student tracking	1.000	1.000

Extraction Method: Principal Component Analysis.

Total Variance Explained

Total variance explained table 10 below, showed all the factors extractable from the analysis along with their eigenvalues, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. From the table, the first factor accounts for 38.758 % of the variance, the second factor accounts for 29.705%, the third

factor accounts for 19.413 %, the fourth factor accounted for 12.1234, the remaining factors were not significant.

Table 10: Total variance explained showing factors extractable with their eigenvalues

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.814	38.758	38.758	5.814	38.758	38.758	4.770	31.799	31.799
2	4.456	29.705	68.463	4.456	29.705	68.463	3.867	25.782	57.581
3	2.912	19.413	87.876	2.912	19.413	87.876	3.188	21.254	78.835
4	1.819	12.124	100.000	1.819	12.124	100.000	3.175	21.165	100.000
5	3.749E-16	2.499E-15	100.000						
6	2.354E-16	1.569E-15	100.000						
7	1.845E-16	1.230E-15	100.000						
8	9.289E-17	6.193E-16	100.000						
9	4.072E-17	2.715E-16	100.000						
10	-1.982E-17	-1.321E-16	100.000						
11	-1.189E-16	-7.928E-16	100.000						
12	-1.583E-16	-1.055E-15	100.000						
13	-2.579E-16	-1.719E-15	100.000						
14	-4.110E-16	-2.740E-15	100.000						
15	-6.347E-16	-4.232E-15	100.000						

Extraction method: principal component analysis.

Scree plot

Eigen value is the standardized variance associated with a particular factor. The sum of the eigenvalue cannot exceed the number of items in the analysis, since each item contributes one of the sums of the variances. The scree plot is a graph of eigenvalues against all factors; the graph is used to determine how many factors to retain. The point of interest is where the curve starts to flattens which in this case is at factor 5. From the plot, factor 5 has an eigenvalue of less than 1, so only four factors are retained.

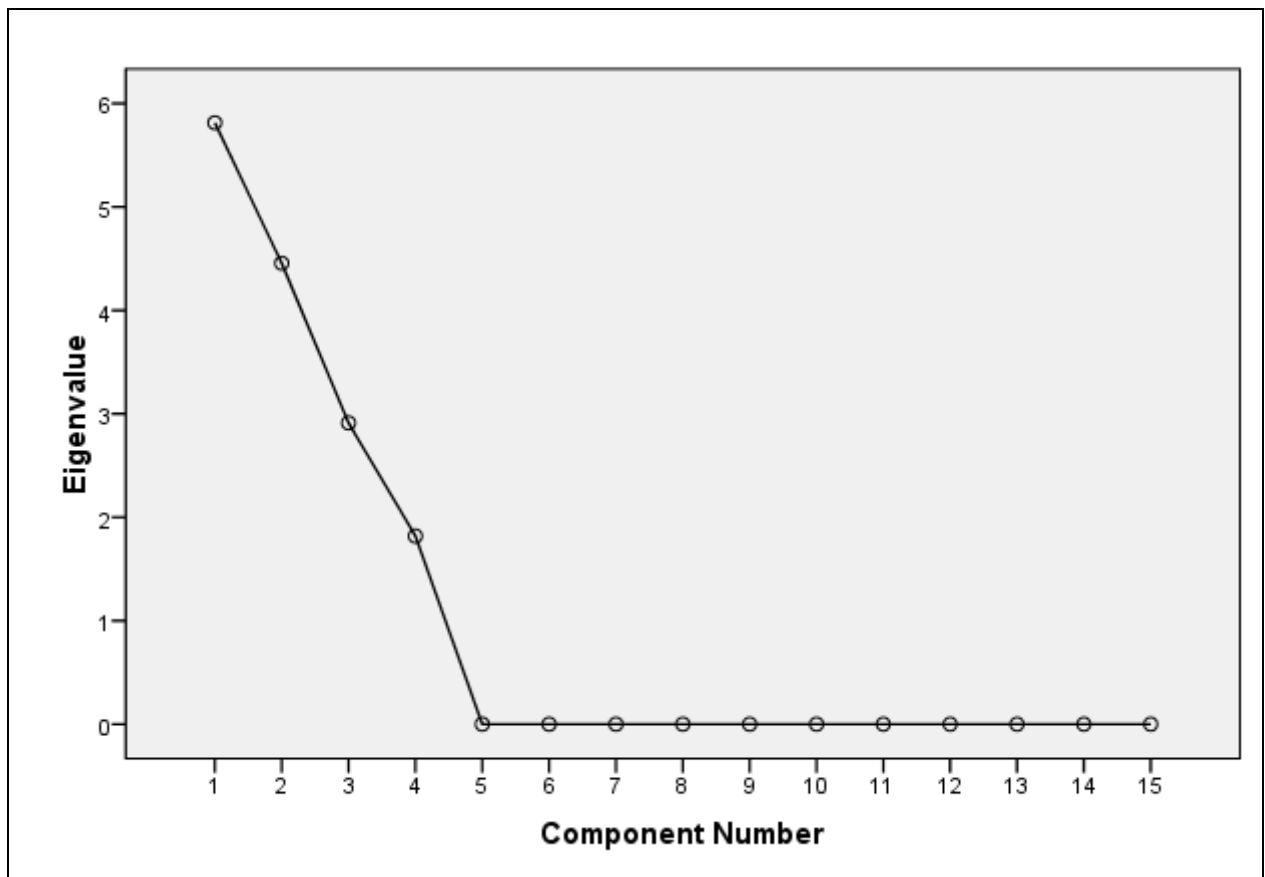


Figure 19: Scree plot showing eigenvalues against all factors

Component (factor matrix)

The component matrix, table 11 showed the loadings of the fifteen variables on the four factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. The gaps in the table represent loadings that are less than 0.5, these values were suppressed to make reading of the table easier. To make interpretation easier, the component matrix was rotated.

Table 11: Component matrix showing loadings of variables on four factors extracted

	Component			
	1	2	3	4
Assessment	-.702	.595		
User management	.790			
Fair marking		.737		
Timely feedback		.741	.625	
Relevant assessment	-.812			-.531
Infrastructure		.743	.630	
Attitude	.664		.687	
Performance	-.954			
Efficiency	.760			
Effectiveness	.700			.546
Support		.646		.570
Continuous assessment	.695	.687		
Risk identification		.934		
Threshold	-.669			
Student tracking			-.638	-.555

Extraction method: principal component analysis.

a. 4 components extracted.

Rotated component (factor) matrix

Rotation was done to reduce the number of factors on which the variables under investigation have high loadings; this was done in order to make interpretation easier. From table 12, fair marking, relevant assessment, effectiveness, support, continuous assessments were found to be substantially loaded on factor 4. Fair marking, continuous assessment, threshold and student tracking were found to be substantially loaded on factor 3. Assessment, timely feedback, infrastructure, effectiveness, risk identification were found to be substantially loaded on factor 2 while assessment, user management, relevant assessment, attitude, performance and efficiency were found to be substantially loaded on factor 1.

Table 12: Rotated component matrix

	Component			
	1	2	3	4
Assessment	-.656	.612		
User management	.897			
Fair marking			.601	.758
Timely feedback		.974		
Relevant assessment	-.713			-.691
Infrastructure		.971		
Attitude	.981			
Performance	-.921			
Efficiency	.964			
Effectiveness		-.588		.724
Support				.960
Continuous assessment			.628	.684
Risk identification		.949		
Threshold			-.944	
Student tracking			.983	

Extraction method: principal component analysis.

Rotation Method: Varimax with Kaiser

Normalization.

a. Rotation converged in 7 iterations.

4.2.6 Validated framework

The purpose of going out to collect data was to test the reliability and validity of the framework. The results supported the extended framework for implementation of online assessments. Based on the analysis in the preceding section, the updated framework shown in figure 20 below was derived. From the data analysis, performance was found insignificant due to small mean (1.4) obtained, as such it was discarded. The responses to open-ended questions also showed that performance was adequately covered in efficiency factor and hence it was not necessary to have it as a separate factor in the framework. Thus, information obtained from the survey validated the proposed framework shown in figure 20.

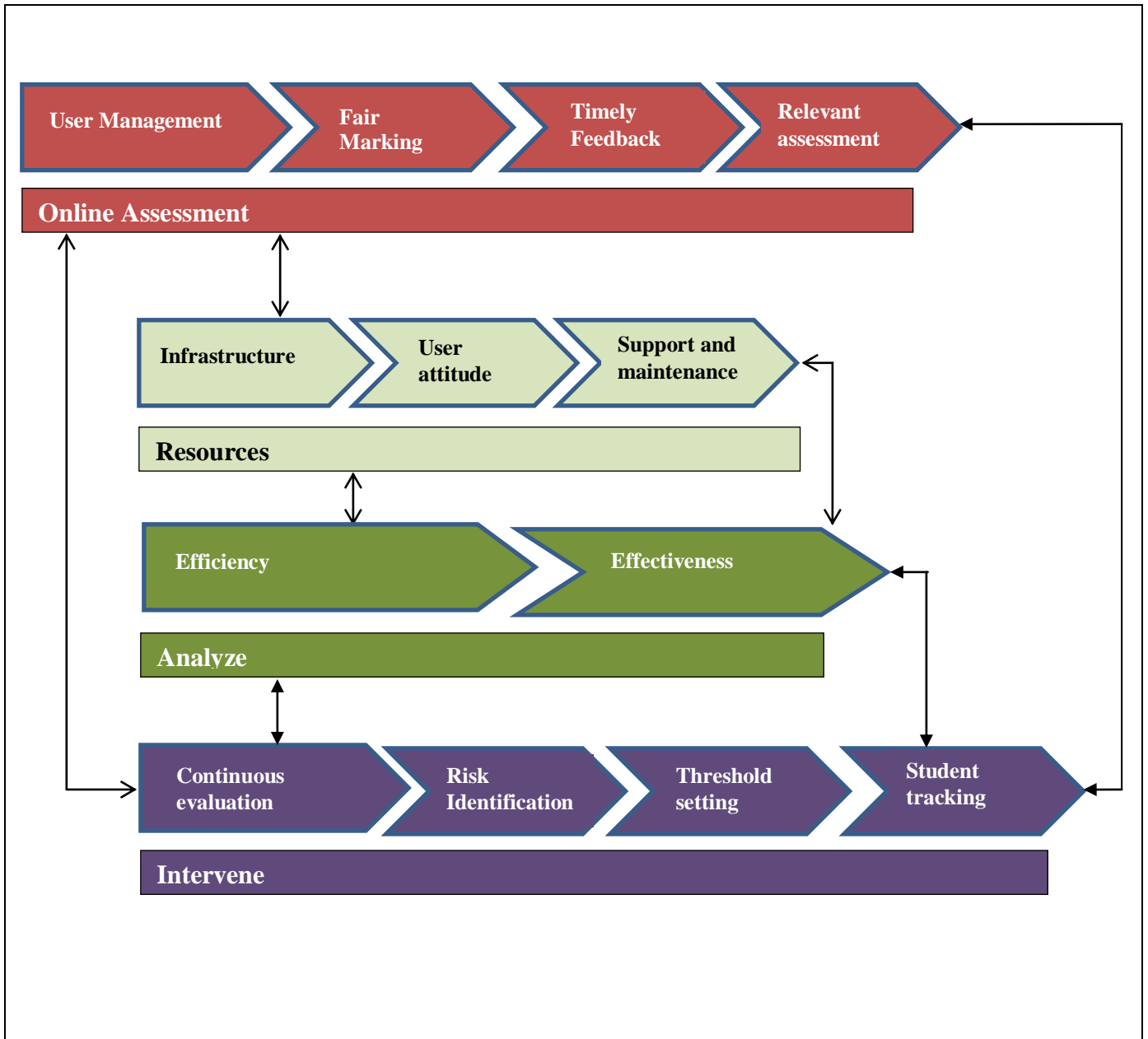


Figure 20: Validated extended online assessment implementation framework

Online assessment has four main components, user management, fair marking, timely feedback and relevant assessment. The above items are what make up online assessment. For the online assessment to be successful, analysis is done on the resources available to determine whether they increase efficiency and how effective they are. The resources checked will include infrastructure, user attitude, support and maintenance. Once installed, the online assessments are continuously evaluated to identify any risks. Thresholds set up determine the intervention mechanism to resolve a problem. The students' progress is tracked and monitored. These activities are done on a continuous basis.

5.0 FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter interprets figures from chapter four into descriptive statements and presents the overall conclusions of the study and implications for future research. It looks at the forms of online assessments used in public universities and how relevant they are to the learning outcomes, challenges that students, lecturers and institutions face in the use of online assessment. It establishes the extent to which students in public universities are willing to take online assessments, evaluate the online assessment facilities that exist in public universities, and factors that hinder implementation of online assessments in public universities. The study then compares and contrasts the online assessments implementation models that exist and develop an implementation models for online assessments in public universities.

5.1 SUMMARY FINDINGS

5.1.1 Review of online assessment in public universities

Forms of online assessments exist in universities

The form of online assessments used in public universities is mainly summative; these are assessments conducted at the end of a learning activity. Other forms of assessments which include adaptive, formative and diagnostic were not widely used in public universities. All these forms of assessments have a contribution; universities must adopt them as they will make a positive contribution to students' learning. The use of formative assessments offers an opportunity for lecturers to identify knowledge background of their students. Diagnostic assessments help lecturers to identify the learners' strength and weakness with a view of providing appropriate learning programs. Adaptive assessment which is a form of assessment that changes as the assessment progresses depending on students' response to earlier questions is effective in offering students with practice sessions.

How relevant are the online assessments offered

The online assessments offered in public universities were found to be relevant to the learning outcomes, by applying principles highlighted by Walker (2007), the assessments offered were relevant since they were aligned to the curriculum, had clear instructions and question wordings, gave timely and meaningful feedback, the marking is fair, the assessment

did not test ICT skills of the students and they offered a range of questions to assess the breadth and depth of students' knowledge.

5.1.2 Challenges facing adoption and use of online assessment in public universities

Challenges that tutors, students and institutions face

The use of online assessments in public universities faces numerous challenges in terms of human capacity, reliability of the technology and high costs of implementation. There is inadequate human capacity to support and use the systems. The online assessments in public universities face serious challenges, assessments offered did not reflect competencies needed in real life neither did they reflect complexity of skills being measured, this is the result of most of the assessments taking the form of multiple choice. Maintenance and review of security features of online assessment were not done regularly hence compromising on the authenticity of the assessments. There is no adequate support for users, assessors and moderators and the installation costs were high.

Students willingness to take online assessments

With the challenges highlighted above, online assessment is not widely used in public universities, from a total population of 8,000 students enrolled at Maseno University, Karani (2013), only 300 were exposed to e-learning, out of which only a half had attempted online quizzes, that is only 1.88 % of students had attempted these assessments. However, despite the many challenges, students are ready to embrace online assessment and most of them believe that it is a matter of time before the use of online assessment becomes a norm in public universities.

5.1.3 Extent to which online assessment can be implemented

Online assessment facilities that exist in public universities

The necessary infrastructure: hardware, trained manpower and internet connection is available in public universities but not in adequate measures. There is online assessment platform installed, this has a user-friendly interface.

Factor that hinder the implementation of online assessments

The implementation process of online assessments in public universities is hindered by limited trained personnel to support users, inadequate number of computers, servers and other relevant hardware and software, limited internet connectivity and frequent power blackouts.

5.1.4 Development of an online assessments implementation framework

The results of statistical analysis led to the restructuring of proposed framework to come up with a refined implementation framework presented in figure 20. The overall score of the framework is indicative that the framework is largely suitable. The implementation process should be done as a component of e-learning. Online assessments solution must provide user management function, fair marking, timely feedback and relevant assessment. The resources are evaluated for their effectiveness, the resources studied included infrastructure, user attitude and support and maintenance. The whole system is evaluated continuously in order to identify risks, set threshold and track students' performance.

5.2 LIMITATION AND FUTURE DIRECTIONS

The findings obtained in this research cannot adequately be generalized to all public universities in Kenya, in order to generalize; we would be required to collect data from a larger sample and from different universities, this was not possible due to limitation of time and other resources. In the future, related research should examine whether the findings obtained in this research are applicable to all the other public universities by widening the sample under study.

With regard to questionnaire findings, they would have been strengthened if they were supplemented using focus group discussions (FGD). This supporting tool was abandoned due to the limitations of time and other resources. The data collected within a short period of time only provided a snapshot, however focused interviews were conducted to take up the place of focused group discussion.

A further limitation is that research may not have examined some variables such as public universities' strategic plans, ICT policies and Government (stakeholder) influence which may directly or indirectly influence implementation process. To overcome this, future researchers should target to include the aforementioned variables and many more in their research.

5.3 CONCLUSIONS

Several key findings emerged from the study including the development of an implementation framework for online assessments in public universities. The research was done under conceptual framework developed based on existing models and literatures. The results of statistical analysis led to the restructuring of the proposed framework to come up with a validated framework.

Students are willing to take online examinations; public universities must provide necessary facilities to ensure that online assessments are implemented despite the many challenges hindering the installation currently. The validated framework provides a framework to assist in implementation of online assessments. The principles outlined in this study suggest that academicians are aware of the importance of aligning assessment with learning outcomes and recognize the potential of online assessments. There are potential obstacles in terms of user attitudes, infrastructure and support staff. These problems must be addressed while providing the necessary online assessment facilities to implement online assessments systems in order to harness the many advantages that come with it.

The selection of Maseno University was based on the fact that it had implemented e-learning and some of the quizzes were done online. The results support the existence of various components as highlighted in the framework, there was an overlap between these components. The validated framework provides a useful guidance for successful implementation of online assessments.

The underlying theme of this research is that online assessment should not be deployed simply for the opportunity to realize cost-savings or efficiency gains. The key drivers should align with the aims of assessments and ensure that the set objectives are met. This research adds variables studied to the Lloyd framework and explore the online assessments implementation process.

5.4 RECOMMENDATIONS

The study revealed several significant factors influencing adoption of online assessment in public universities. Public universities must create awareness, provide necessary facilities for online assessments, and train user support team to encourage use of online assessments.

The study presents an introductory research that explains the factors that promote or hinder the use of online assessments in public universities.

Further research in this area is crucial to enhance the credibility of online assessments practice and to aid institutions aiming to produce efficient online assessment tasks that assess skills in a manner that is valid and reliable and allows the learner to demonstrate their true potential. Determining whether online assessments is cost-effective, comparison requires attention to a host of factors, including the students served, the subject, budget and design factors. Such research would inform which combinations of technological options, subject domains, instructional and assessment approaches (U.S. Department of Education, 2012).

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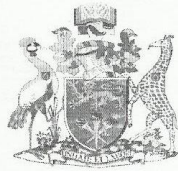
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7.0 APPENDIX

7.1 INTRODUCTION LETTER



UNIVERSITY OF NAIROBI
COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES
SCHOOL OF COMPUTING AND INFORMATICS

Telephone: 4447870/ 4444919/4446544
Telegrams: "Varsity" Nairobi
Email: director-sci@uonbi.ac.ke

P. O. Box 30197
00100 GPO
Nairobi, Kenya

Our Ref: UON/SCI/MS/IS/2011

01 August 2012

To Whom It May Concern

Dear Sir/Madam

ROBERT OMUNAMI MANAKA – REG. NO. P56/P/60222/2011

The above named is a bona fide student pursuing a Master of Science in Information Systems degree at the School of Computing and Informatics, University of Nairobi. As part of the course, students are required to undertake a research project. Hence, Mr. Manaka is currently carrying out his research on the project entitled: "An Implementation Framework for E-Learning in secondary Schools in Kenya".

We would be grateful if you could assist Mr. Manaka as he gathers data for his research. If you have any queries about the exercise please do not hesitate to contact us.

Yours faithfully

A handwritten signature in blue ink, appearing to be 'W. Okelo-Odongo'.

School of Computing & Informatics
University of NAIROBI
P. O. Box 30197
NAIROBI

PROF. W. OKELO-ODONGO
DIRECTOR
SCHOOL OF COMPUTING AND INFORMATICS

E:\D:\New 2\My docs\Research letter for Robert Omunani Manaka

7.2 A REQUEST TO COLLECT DATA

Robert Omulami Manaka
University of Nairobi
P. O BOX 30197, Nairobi
Mobile: 0727759130
rmanaka2001@yahoo.com

5th February 2013

Director of Research and Consultancy
Maseno University
P.O. Box 3275-40100, KISUMU, Kenya.

Dear Sir / Madam

Attention: Prof. Collins Ouma

RE: REQUEST TO COLLECT DATA FOR AN MSC INFORMATION SYSTEM PROJECT

I am a student at University of Nairobi pursuing a course in Master of Science in Information systems. As part of my course, I am required to undertake a research project; hence I am currently undertaking a project entitled **An Implementation Framework for online assessment in public universities in Kenya**. I am basing my research on Maseno University which has an eCampus that has worked to facilitate online delivery of high quality certificate, diploma and degree programmes to learners across the region.

For my research, I require to collect data from students and lecturers of Maseno University, therefore I kindly request for your assistance in;

1. Administering questionnaire to 35 students pursuing BBA, With IT. Preference is to those in their last or second last semesters.
2. Forming and conducting three (3) Focus Group Discussions:
 - i) Group 1 to be composed of seven (7) students pursuing BSc (Mathematical Sciences, With IT).
 - ii) Group 2 to be composed of seven (7) students pursuing MSc in Research Methods.
 - iii) Group 3 to be composed of seven (7) students, pursuing PGDE.
 - iv) Three (3) lecturers who are involved in e-learning programs, one lecturer will take part in one Group discussion.

I would be glad to collect the data between 4th to 8th February 2013. I take this opportunity to state that the data obtained will be held in confidence and used for the stated purpose only. Your assistance towards helping me realize this goal is highly appreciated.

Yours faithfully,



ROBERT OMULAMI MANAKA

7.3 PERMISSION TO COLLECT DATA



MASENO UNIVERSITY
OFFICE OF THE DEPUTY VICE CHANCELLOR
PLANNING, RESEARCH & EXTENSION SERVICES
(PRES)

Tel: 254-057-351622, 351620, 351008, 3511011
Fax: 254-057-351221, 351153
e-mail: dvcpres@maseno.ac.ke

Private Bag
MASENO
KENYA

Our Ref: MU/DVCPRES/RES/R8/(58)

Date: 11th February, 2013

Robert Omulami Manaka
University of Nairobi
P. O. Box 30197
NAIROBI

Dear Mr. Manaka,

REF: REQUEST TO CONDUCT RESEARCH

Reference is made to your letter dated 5th February, 2013 on the above subject matter

I am pleased to inform you that your request to conduct Research on **"An Implementation Framework for Online Assessment in Public Universities in Kenya"** in our institution has been approved.

For further arrangements please get in touch with the undersigned. Please note that upon completion of your research, you are expected to submit a copy of your research report to the University.

Thank you.

Prof. George M. Onyango
DEPUTY VICE CHANCELLOR (PLANNING, RESEARCH & EXTENSION SERVICES)

ISO 9001:2008 CERTIFIED



7.4 QUESTIONNAIRE

7.4.1 Questionnaire for students

My name is **Robert Omulami Manaka**, a student at University of Nairobi, school of computing and informatics, undertaking a project titled: **An implementation framework for online assessments in public universities: A case of Maseno University**. The focus of my study is to test validity of a framework construct. Your details or data provided will not be passed to any third party without your prior permission.

I request to take a moment of your time to answer questions below and email back to me through the address: rmanaka2001@yahoo.com, omulami@gmail.com

A. Fill in your personal details

Name: _____

Level of education: _____

Male [M]/Female [F]: _____

Course being undertaken: _____

Age Bracket: < 30 31-40 41-50 51-60 > 60

B. Indicate the level at which you agree with each of the statements below about the forms of online continuous assessment Tests (CATs) at Maseno University.

1. The assessment is given by lecturers at the beginning of a course to identify the knowledge background of the students Strongly agree Agree Neutral Disagree Strongly Disagree.
2. The assessment is conducted at the end of a set of a learning activity and the results achieved by the student are registered by the teacher as the final mark Strongly agree Agree Neutral Disagree Strongly Disagree.
3. The assessment is **ONLY** used to identify the learner's strengths and weaknesses with a view of providing appropriate learning program Strongly agree Agree Neutral Disagree Strongly Disagree.
4. The questions become harder or easier as the assessment progresses based on student's response to earlier questions Strongly agree Agree Neutral Disagree Strongly Disagree.

5. Online assessments are **NOT** widely used at Maseno University Strongly agree Agree Neutral Disagree Strongly Disagree.

C. Indicate the level at which you agree with each of the statements below about the relevance of online continuous assessment tests (CATs) at Maseno University:

6. They are aligned to the curriculum and are relevant to learning outcomes. Strongly agree Agree Neutral Disagree Strongly Disagree.
7. Instructions and questions wording is clear, concise and free from ambiguity? Strongly agree Agree Neutral Disagree Strongly Disagree.
8. They provide timely and meaningful feedback? Strongly agree Agree Neutral Disagree Strongly Disagree.
9. Marking schemes are fair and appropriately weighted? Strongly agree Agree Neutral Disagree Strongly Disagree.
10. They do **NOT** test student's information technology skills or their proficiency in using the online assessment tool? Strongly agree Agree Neutral Disagree Strongly Disagree.
11. They incorporate a range of question types to assess the breadth and depth of student knowledge? Strongly agree Agree Neutral Disagree Strongly Disagree.

D. Indicate the level at which you agree with each of the statements below on challenges students, tutors and institutions face with the use of online continuous assessment tests (CATs)

12. They do **NOT** reflect the competencies needed in real life? Strongly agree Agree Neutral Disagree Strongly Disagree.
13. The tasks given do **NOT** reflect the complexity of skills being measured? Strongly agree Agree Neutral Disagree Strongly Disagree.
14. The Marking is **NOT** accurate. Strongly agree Agree Neutral Disagree Strongly Disagree.
15. The technology used is **NOT** reliable. Strongly agree Agree Neutral Disagree Strongly Disagree.
16. Regular maintenance and review of the security is **NOT** done? Strongly agree Agree Neutral Disagree Strongly Disagree.
17. There is **NO** suitable support for system users, assessors and moderators. Strongly agree Agree Neutral Disagree Strongly Disagree.

18. The cost of implementation is **HIGH**? Strongly agree Agree Neutral Disagree Strongly Disagree.
19. There are limited skills in the use of online continuous assessment tests? Strongly agree Agree Neutral Disagree Strongly Disagree.

D. Indicate the level at which you agree with each of the statements below on your readiness to use Online Continuous Assessment Tests (CATs)

20. Given a choice, I would take online examinations? Strongly agree Agree Neutral Disagree Strongly Disagree.
21. More and more people will be using online assessment in two (2) years' time? Strongly agree Agree Neutral Disagree Strongly Disagree.

E. Indicate the level at which you agree with each of the statements below on your evaluation of facilities installed to support Online Continuous Assessment Tests (CATs)

22. The University has installed online assessment platform, Strongly agree Agree Neutral Disagree Strongly Disagree.
23. There is adequate **internet bandwidth**, Strongly agree Agree Neutral Disagree Strongly Disagree.
24. There are adequate **servers; computers** installed for online assessments, Strongly agree Agree Neutral Disagree Strongly Disagree.
25. There is adequate number of **trained personnel** to support students and lecturers with online assessment issues, Strongly agree Agree Neutral Disagree Strongly Disagree.

F. Indicate the level at which you agree with each of the statements below on factors that hinder implementation of online assessments in public universities

26. The necessary online assessment facilities are **NOT** readily accessible, Strongly agree Agree Neutral Disagree Strongly Disagree.
27. The online assessment software **HAS** a user-friendly interface Strongly agree Agree Neutral Disagree Strongly Disagree.

7.4.2 Questionnaire for Lecturers

My name is **Robert Manaka**, an MSc Information Systems student at University of Nairobi, school of computing and informatics, undertaking a project titled: **An implementation framework for online assessments in public universities: A case of Maseno University**. The focus of my study is to develop an implementation framework for online assessment. Your details or data provided will not be passed to any third party without your prior permission.

I request to take a moment of your time to answer questions below and email to me through the address given below: rmanaka2001@yahoo.com , omulami@gmail.com. I will also ask for one or two clarifications / questions on the responses given in questions 26 and 27.

Thank you.

Evaluating the relative importance of components in the proposed extended Lloyd framework

A. Fill in your personal details

1. Level of education: _____
2. Gender Male [M]/Female [F]: _____
3. Number of years you have taught at the University level 0 less than 5 6-10 11-15
 over 15
4. Have you ever used online assessment to deliver assessments to students Yes No
5. Were you part of the team that implemented e-learning at Maseno University or anywhere else in your career? Yes No

B. With regard to implementation of online assessment (or e-assessments) indicate the level at which you agree with each of the statements below.

6. The online assessment system should have automated polices and security procedures to handle students' authentication Strongly agree Agree Neutral Disagree Strongly Disagree.
7. Access control is an important component of online assessment system. Strongly agree Agree Neutral Disagree Strongly Disagree.

8. The online assessment system MUST handle students' registration and students' learning activities Strongly agree Agree Neutral Disagree Strongly Disagree.
9. The online assessments system MUST mark and grade submitted assignments Strongly agree Agree Neutral Disagree strongly Disagree.
10. The online assessment system should moderate the graded results Strongly agree Agree Neutral Disagree strongly Disagree.
11. The challenge of providing the right information (reports) to students and other stakeholders in a cost-effective way can be overcome by the use of online assessment Strongly agree Agree Neutral Disagree Strongly Disagree.
12. The need to AVOID lack of and late submission of feedback to students by lecturers is a driver of implementation of online assessments Strongly agree Agree Neutral Disagree Strongly Disagree.
13. The online assessments tests are set by the course lecturer Strongly agree Agree Neutral Disagree Strongly Disagree.
14. The reusable questions are stored in a central database Strongly agree Agree Neutral Disagree Strongly Disagree.
15. The online assessment system should have an in-built plagiarism checker Strongly agree Agree Neutral Disagree Strongly Disagree.
16. Servers and computers must be installed to run online assessment effectively Strongly agree Agree Neutral Disagree Strongly Disagree
17. The online assessments can be delivered through web-based, offline delivery or learners' management systems (LMS) Strongly agree Agree Neutral Disagree Strongly Disagree.
18. The maturing customer capability and confidence in the use of online assessment is a driver of implementation of online assessments Strongly agree Agree Neutral Disagree Strongly Disagree
19. The users of online assessment systems require support from competent personnel Strongly agree Agree Neutral Disagree Strongly Disagree
20. The online assessment system MUST analyze the data it generates to provide some insights to school administrators. Strongly agree Agree Neutral Disagree Strongly Disagree.
21. Analysis done by the online assessment systems should prompt corrective action to be taken before the problem occur Strongly agree Agree Neutral Disagree Strongly Disagree.

22. The analyzed results (reports) obtained from online assessment system are fundamental to planning for improvements of learning outcomes. Strongly agree Agree Neutral Disagree Strongly Disagree.
23. Increased demand for but decreasing availability of expert assessment personnel is a driver of implementation of online assessments Strongly agree Agree Neutral Disagree Strongly Disagree
24. The analysis of online assessment system should be done continuously in order to identify areas of improvements Strongly agree Agree Neutral Disagree Strongly Disagree
25. The pressure to improve reliability of assessment processes is a driver of implementation of online assessments Strongly agree Agree Neutral Disagree Strongly Disagree
26. The need to review and control overheads and running costs is a driver of implementation of online assessments Strongly agree Agree Neutral Disagree Strongly Disagree
27. Assessment of the students' learning outcomes is done on a continuous basis. Strongly agree Agree Neutral Disagree Strongly Disagree
28. The intervention plans must include identification of “risk factors” that may affect learning performance, and intervene through goal orientated actions. Strongly agree Agree Neutral Disagree Strongly Disagree
29. The thresholds above or below which to trigger an action is set. Strongly agree Agree Neutral Disagree Strongly Disagree
30. An intervention plan should take note of what may happen and make appropriate plan, budget, and forecast. Strongly agree Agree Neutral Disagree Strongly Disagree
31. In the proposed framework (see below), what are some of the items that in your view should be reviewed, added or deleted?

32. If this framework is applied at Maseno University, what are some of the challenges that may be encountered?

