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## **Usage and Security of Examination Modes of Assessment: A Survey of Two Universities in South Western Uganda**

Deborah Natumanya, Dr. Evarist Nabaasa, and Dr. Pius  
Ariho



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<sup>1</sup>Deborah Natumanya  
[deborahnatumanya@must.ac.ug](mailto:deborahnatumanya@must.ac.ug)

<sup>2</sup>Dr. Evarist Nabaasa  
[enabaasa@must.ac.ug](mailto:enabaasa@must.ac.ug)

<sup>3</sup>Dr. Pius Ariho  
[pariho@must.ac.ug](mailto:pariho@must.ac.ug)

<sup>1,2,3</sup> Mbarara University of Science and Technology

Corresponding Author's E-mail: [deborahnatumanya@must.ac.ug](mailto:deborahnatumanya@must.ac.ug)

### ABSTRACT

**Introduction:** Academic institutions are faced with challenges related to usage and security of existing modes of assessment. Security issues include confidentiality, integrity and availability while usage issues include complexity, compatibility, accessibility and flexibility.

**Methodology:** This study assessed three modes of assessment used in universities and these include electronic, paper-based and oral. A cross sectional survey was conducted where quantitative methods were used to determine the mode of assessment that is more secure and acceptable. Participants for the study were students and lecturers from Bishop Stuart University and Mbarara University of Science and Technology. The study population was 411 and a sample of 352 participants was obtained using the Krejcie and Morgan formula. A questionnaire tool was used for data collection and SPSS software was used for data analysis to generate descriptive statistics.

**Findings:** Results obtained from the study show that usage is ranked at 63.68% for paper based assessment, 68.76% for electronic and 60.28% for oral assessment. Analysis of security issues suggests that electronic assessment (67.72%) is more secure than paper based (63.0%) and oral assessment (62.32%). Although the paper based mode of assessment ranked best in usage, the method faces challenges such as poor computation of marks, poor storage of answer scripts and a slow feedback process. The results show that much as electronic mode of assessment ranked best using security parameters, the mode is not widely used because of its limited question types. Incorporation of various question types in the electronic mode of assessment will increase choice of questions and improve its adoption and usage in academic institutions.

**Unique contribution to theory, practice and policy:** This study established that, there is need for developing an electronic examinations framework that incorporates various question types, electronic free handwriting and electronic answer booklets to the current university examination process and procedures more robust and appropriate. The study contributes to the body of knowledge since it was found that, in the use of electronic learning technologies in the administration of examinations in Ugandan universities is not robust and appropriate for commonly used essay question types, also it was found out that, these technologies lack electronic free-handwriting, hence the need for a framework to address such gaps.

**Key words:** *Usage, Security, Electronic Assessment and modes of Assessment*

## 1.0 INTRODUCTION

Electronic learning refers to fields of online learning, web-based training, and technology-delivered instruction (Patel 2019). It is a learning that involves the Internet (Noesgaard and Ørngreen 2015); learning from a distance via the aid of the internet and/or other electronic gadgets (Sangrà, Vlachopoulos et al. 2012). E-learning is grouped into two categories, i.e. synchronous and asynchronous. Synchronous learning uses a model that initiates a classroom course, lecture or meeting using Internet technologies like google hangouts and zooms and is real-time in nature thus requiring live interactions. Asynchronous learning is a pause and resume kind of learning which does not require all the participants to be available at the same time. It offers activities like lessons, assignments, chats, instant messaging, blogging, and forums (Oye, Salleh et al. 2012).

Electronic learning offers a number of benefits to both students and lecturers, which include course delivery with limited financial resources (Stevanović 2019), and distance learning for example women who are unable to attend traditional educational programs because of household responsibilities or cultural constraints (McGowan 2015). It also improves the quality of instruction and offers a greater flexibility in the design and delivery of curriculum content than is normally associated with classroom teaching (Pandey 2013). E-learning enhances the ability to adapt the program to suit specific student needs or work requirements (Al-Azawei, Parslow et al. 2016). E-learning also adds the benefit of encouraging learners to take responsibility for their learning and build self-knowledge and self-confidence (Eke 2010).

Despite the benefits and opportunities brought about by e-learning in academic institutions, there are challenges it poses to both learners and lecturers (Liu and Geertshuis 2016; El Guemmat 2018). The challenges include access and availability of internet, isolation of learners and the cost of infrastructure required (Al-Hujran, Aloudat et al. 2013; Arinto 2016). Adjusting to e-learning is quite disturbing as learners have been used to the traditional teaching and thus find it difficult to acquaint themselves with the learning technology (Islam, Beer et al. 2015).

E-learning is comprised of two core components i.e. teaching and assessment (Pagram, Cooper et al. 2018; Eickholt, Jogiparthi et al. 2019). Teaching involves course management that stores course contents and allows learners to access it, while assessment is where tutors can share exercises, formative and summative examinations which help in evaluating the knowledge a student has acquired from a given course. The assessments currently offered include short answer, objectives and true or false (Fee 2013).

Universities are currently using three modes of assessment for continuous assessment and final examination (James 2016). The modes of assessment include oral examination, paper based examination and electronic examination. Universities are venturing into the transition from paper based to electronic based examinations, but due to a number of issues like lack of enough infrastructure to fully conduct electronic examinations, they are still majorly using paper based assessment (Ndunagu 2013; Kabarungi, Musiimenta et al. 2016). There is need for Ugandan universities to embrace e-examinations so that learning processes continue to run smoothly even with challenges like the Covid 19 pandemic which has destabilized the education system (UNESCO 2020). This pandemic has brought on board new operating procedures like social distancing and wearing of facial masks thus disregarding the normal operations of traditional

learning and examination (UNESCO 2020), and hence the need to embrace e-learning in academic institutions.

Electronic examination is a process of carrying out students' assessment and evaluation using ICT facilities, as opposed to the pen-on paper or print materials that are used traditionally. Some authors define e-examination as the conduct of examination through the web or the intranet (Ayo, Akinyemi et al. 2007). Electronic examination comes with a number of benefits (Candric, Katić et al. 2014) for example long run lower costs, ease of use, reliability, data management, automated evaluation and marking, but it is not yet fully utilized.

Some studies have shown that electronic examination is faced with a challenge of low usage and security (Adebayo and Abdulhamid 2014; Farzin 2016; Fayomi, Amodu et al. 2016). Most of the e-exam systems available are not secure enough which brings about examination malpractice, plagiarism (copy and paste) and the possibility of online impersonation (Farzin 2016). E-examinations are also faced with other challenges like limited examination question types as most of the current e-examination platforms do not cater for essay type of questions, yet they are commonly used in learning institutions.

The paper-based examination enables students to easily remember what to write down in the exam (Barros 2018) making it a good cognitive exercise that inspires creativity in a student and prevents students from being distracted as they do the exam. Traditional paper based assessment is still being used in universities (Ndunagu 2013) despite its numerous challenges like high cost of conducting the examinations, examination malpractice (Itaaga, Mugagga et al. 2013), examination leakages (A 2018), missing results, lack of flexibility of examinations, long period of retrieval of results sometimes leading to strikes (Amongin 2016; Mukhaye 2017), poor computation of marks, and missing answer scripts (Amongin 2016; Alruwais, Wills et al. 2018; Mukhaye 2017). These are largely manifested in the inadequacies in the supply of basic instructional materials, facilities, infrastructure, and students' over population (Makaula 2018; A 2018; UNESCO 2020). The aforementioned problems have brought the credibility of paper based examination to the lowest level in terms of security and long term costs. Therefore there is need to embrace technology in academic institutions in order to improve the examination process so that challenges of delayed feedback and poor computation of marks can be overcome thus making it possible to roll out e-examinations. Moreover (Tserendorj, Tudevtagva et al. 2013) and (Kassem, Falcone et al. 2015) confirmed in their works that e-examination will help provide solutions to the problems of pen-on paper examination.

The COVID-19 pandemic has brought tension and worry among people and academic institutions using traditional learning where students from different locations have to converge and meet in one classroom (Rose 2020). The closure of public places got academic institutions rethinking their ways of operation in terms of delivering teaching content to their students. In Uganda, academic institutions are adopting to electronic assessment following the guidelines issued by the government on embracing electronic learning and electronic assessment. Online platforms like radios, televisions and learning management platforms are being used to deliver content (UNESCO 2020), however there is still a challenge on how assessment will be done for both continuous and summative assessment (Burgess and Sievertsen 2020).

Oral examination is a traditional form of assessment in which one or more examiners direct questions at the candidate/student (Joughin 2010; Saefurrohman 2018). It typically takes the

form of an interview or discussion between the examiners and the candidate in an examination room (Kippers, Wolterinck et al. 2018). This form of examination is usually used when students are defending their research theses or coursework. The oral examination is meant to assess knowledge, and to probe depth of knowledge (Kippers, Wolterinck et al. 2018). Most institutions choose to use oral examinations because it is demanded by the learning outcomes and the same mode of assessment allows probing of the students' knowledge thereby improving the learning process (Joughin 2010). However the use of oral examinations in student assessments has been criticized for many years because of low reliability, validity and fairness (Memon, Joughin et al. 2010).

Institutions of higher learning have resorted to a rapid curriculum redevelopment so as to offer fully online programs where teaching and examinations can be done with the help of the e-learning and e-examination technology. As much as there is a number of e-learning platforms in use by different institutions, e-examination as an area has not yet been fully exploited because the available e-exam systems do not cater for all educational courses (Al-Hakeem and Abdulrahman 2017; Essel, Butakor et al. 2019). This study aims at understanding the usage and security of the three modes of assessment used in the students' assessment process in universities. Loopholes in these modes of assessment and their solutions for an improved electronic examination assessment are identified.

## **2.0 METHODS AND MATERIALS**

Design science theory was used which emphasizes development of new generalizable knowledge about design products and designed artifacts while solving organizational or community problems with new work practices based on Information Technology (IT) (Pirainen and Briggs 2011). The Design Science Methodology (DSM) was adopted for this study and results presented in this paper were only obtained from the first phase of the DSM which is awareness of the problem. Based on phase one of DSM, it was crucial to use multiple sources of data, analytical methods and modes of data presentation. These sources included socio demographics, the modes of assessments used in universities, security and usage of examinations.

This paper draws on a cross sectional study, conducted in one private and one public university in western region of Uganda. Mbarara University of Science and Technology (MUST) and Bishop Stuart University (BSU) were purposively selected because of their geographical location to reduce the costs involved in the research since the two universities are near each other. Further the two universities do not differ from the rest in-terms of the modes of assessment used following the university examinations guidelines of Uganda National Council for Higher Education (UNCHE), a body that governs the operations of higher institutions of learning. Data was obtained through a quantitative survey where a questionnaire tool was used to obtain students' views.

The computing faculties were chosen purposively since they are the only ones implementing e-learning in the two universities. The respondents were first and second year students pursuing a bachelor's degree in Computer Science and a bachelor's degree in Information Technology. These two years were selected for an easy follow up in the later stages of the broader research that aims at designing an electronic examination framework.

To get a better representation of participants from the two programs, stratified random sampling technique was used to determine the sample size. The total population was stratified into different strata according to the program and year of study as shown in table 2.1 below. The Krycie and Morgan formula was subjected to the population in each stratum to determine the sample size (Krejcie and Morgan 1970). The population in the two universities was 411 and a total sample of 352 students was obtained for the study basing on a 95.0% confidence level and a 0.05 margin of error.

Informed consent was obtained from the participants involved in the research and quantitative data was analyzed using SPSS v21 and graphs generated using MS excel. Usage was measured using variables such as flexibility, acceptability, accessibility, affordability and complexity while security was measured using confidentiality, integrity and availability.

**Table 2.1: Sample size per stratum**

Stratums		Number of people	Sample size
<b>MUST</b>	BIT 1	100	80
	BIT 2	85	70
	BCS 1	35	32
	BCS 2	28	26
	Lecturers	15	14
<b>BSU</b>	BIT 1	43	39
	BIT 2	81	67
	BCS 1	4	4
	BCS 2	8	8
	Lecturers	12	12
<b>Total</b>		411	352

The questionnaire instrument was designed in a way that the respondents' identity was kept anonymous and all information confidential. The instrument measured teachers' and students' perceptions on the usage and security of modes of assessment. To measure the respondents understanding and their responses on usage, the following parameters were considered; flexibility, acceptability, complexity, accessibility, and affordability while the three security parameter of confidentiality, integrity and availability were used to determine the security of the modes of assessment. The survey questionnaire guide consisted of three sections, section A asked about the respondents bio data, section B and C consisted of a total of eight questions which were intended in finding out the participants responses on their knowledge of the usage and security of modes of assessment. A 5 likert scale was used where 1 = low, 2 = fair, 3 = good, 4 = very good, 5 = excellent. This scale was used for flexibility, acceptability, accessibility, confidentiality, availability and integrity whereas for affordability and complexity 1 = very low, 2 = low, 3 = average, 4 =high and 5 = very high. The first part contained questions intended to produce demographic data of the lecturers and students participating in the survey. The second

part of the survey asked questions related to usage and the last part asked question related to security. Table 2.2 below shows the study respondents’.

**Table 2.2: Study Participants**

	Frequency	Percentage
Student	312	94.3
Lecturer	19	5.7
Total	331	100.0

### 3.0 RESULTS

From the survey, 352 participants were considered and of these only 331 respondents gave their views on the modes of assessments used in universities. Data were analyzed using SPSS (Statistical Package for Social Scientists), Version 21.0 and Microsoft Excel 2010. After data analysis, the following descriptive statistics were generated as shown in Tables 3.1 and 3.2. The mean provided the central tendency for each variable studied, while the standard deviations offered an available definition to explain potential variations for each distribution.

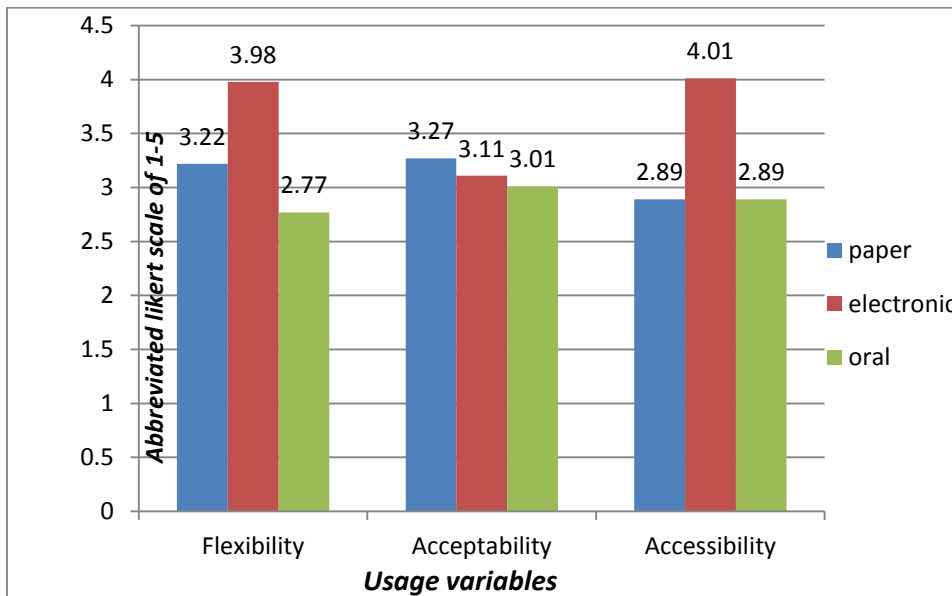
**Table 3.1: Descriptive statistics for usage variables**

		mean	median	mode	std dev	variance	min	max
<b>Flexibility</b>	paper	3.22	3	3	1.217	1.482	1	5
	electronic	3.98	4	3	0.822	0.675	3	5
	oral	2.77	3	3	1.326	1.759	1	5
<b>Acceptability</b>	paper	3.27	3	4	1.14	1.299	1	5
	electronic	3.11	3	3	1.272	1.618	1	5
	oral	3.01	3	3	1.264	1.597	1	5
<b>Accessibility</b>	paper	2.89	3	3	1.027	1.055	1	5
	electronic	4.01	4	4	0.813	0.661	3	5
	oral	2.89	3	3	1.267	1.606	1	5
<b>Affordability</b>	paper	3.61	4	3	0.976	0.953	2	5
	electronic	2.64	3	3	1.191	1.419	1	5
	oral	3.38	4	4	1.228	1.509	1	5
<b>Complexity</b>	paper	2.93	3	3	1.217	1.48	1	5
	electronic	3.45	3	3	0.908	0.824	2	5
	oral	3.02	3	3	1.223	1.497	1	5

**Table 3.2: Descriptive statistics for security variables**

		mean	median	mode	std dev	variance	min	max
<b>Confidentiality</b>	paper	3.16	3	3	1.185	1.404	1	5
	electronic	3.53	4	4	1.239	1.535	1	5
	oral	3	3	3	1.319	1.739	1	5
<b>Integrity</b>	paper	3.02	3	3	1.221	1.491	1	5
	electronic	3.31	3	3	1.247	1.554	1	5
	oral	3.19	3	3	1.273	1.619	1	5
<b>Availability</b>	paper	3.27	3	3	1.126	1.268	1	5
	electronic	3.32	3	3	1.209	1.462	1	5
	oral	3.16	3	4	1.288	1.66	1	5

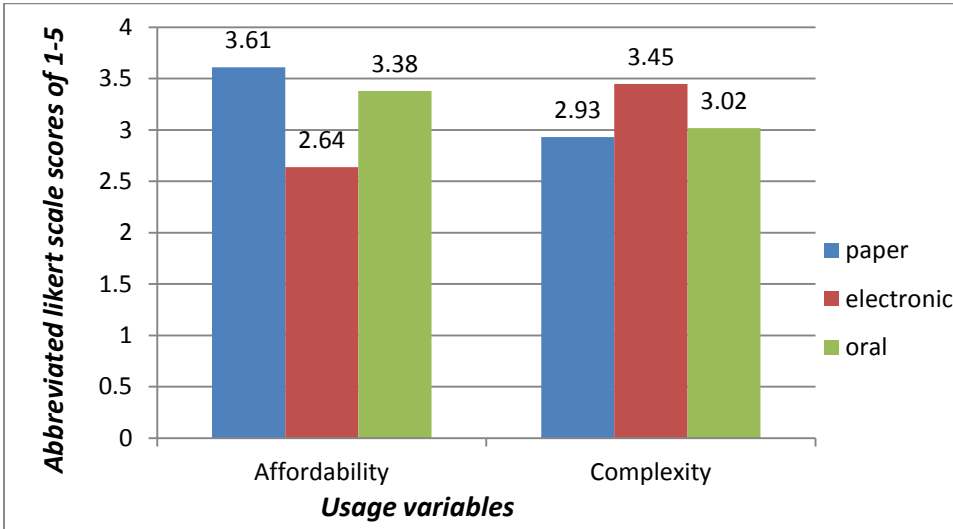
The study findings on usage indicate that electronic assessment is the most flexible mode of assessment with an average score of 3.98 (std 0.822) followed by paper based mode of assessment (3.22, std 1.127) and then oral based assessment (2.77, std 1.326). However the results show that paper based assessment was the most acceptable by the respondents; followed by electronic and then oral based assessment. Electronic assessment ranked highest on accessibility followed by paper and then lastly oral based assessment. See figure 1 below.



**Figure 1: Mean variations of the usage of modes of assessment.**

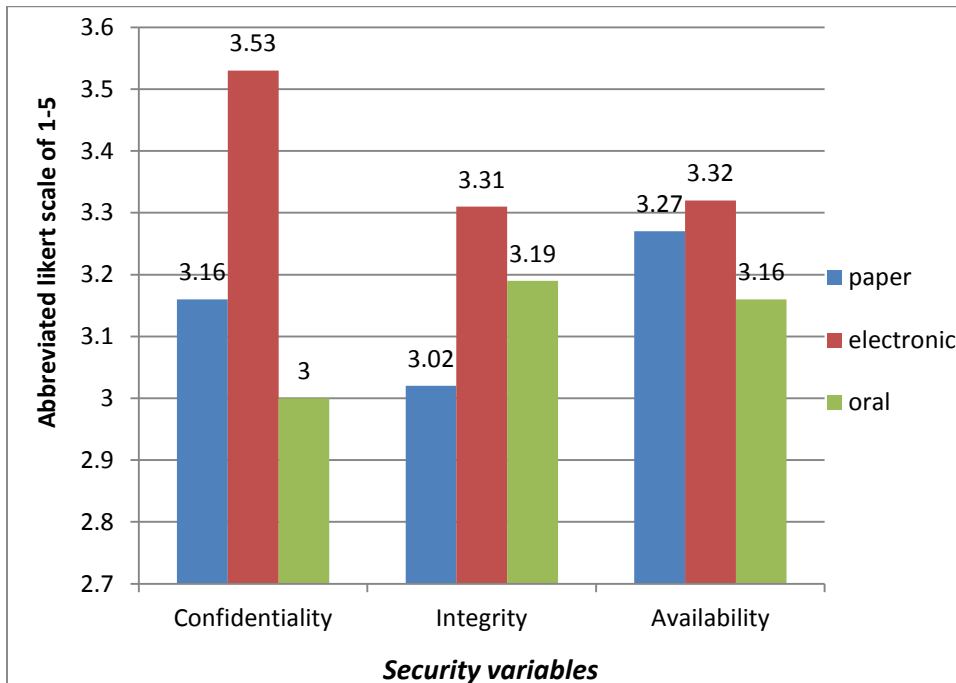


Figure 2 below shows that paper and oral based assessment are more affordable than the electronic assessment. It was also seen that electronic assessment is more complex compared to paper and oral based assessments.



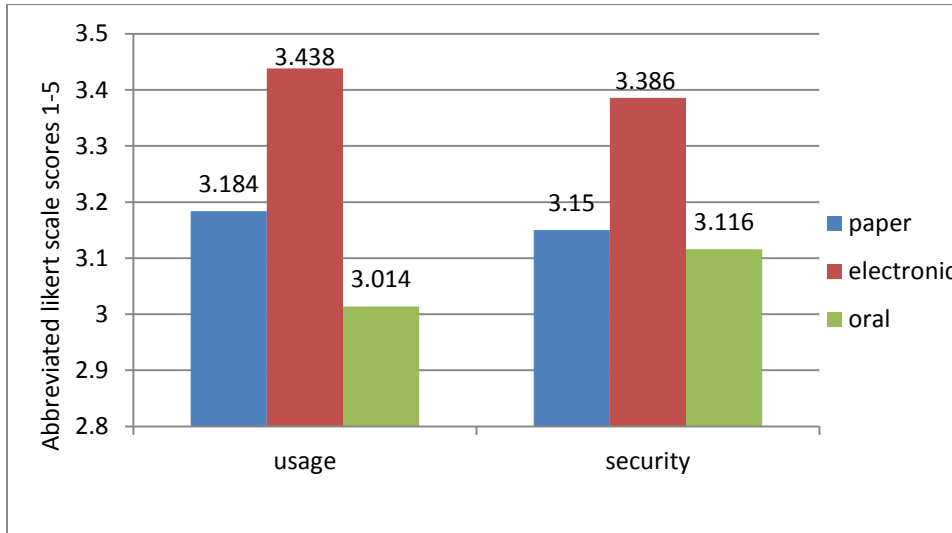
**Figure 2: Mean variations of modes of assessment**

The security of modes of assessment is very vital to any examination process. When measuring the security levels of the modes of assessment, the results indicated that electronic assessment is more secure than the other two modes of assessment as shown in figure 3 below. Electronic assessment was ranked higher in terms of its confidentiality, integrity and availability, followed by paper based assessment and lastly oral based assessment.



**Figure 3: Variations of the security of the modes of assessment.**

Further analysis focused on comparing averages of security and usage of individual modes of assessment. Results in the graph below show that electronic assessment was ranked highly in terms of usage and security compared to its counterparts. Paper based assessment was ranked second and lastly oral assessment.



**Figure 4: Modes of assessment in-terms of usage and security.**

## CONCLUSION

In conclusion, the analysis on the different modes of examinations used in universities was carried out to assess their usage and security. The results from the study indicate that electronic examinations provide more usability and security features to students as compared to paper based examinations. The study identified the challenges of paper based examinations as complexity, accessibility, flexibility, confidentiality and integrity which are as a result of poor computation of marks, delayed feedback, plagiarism among others; benefits of paper based examinations were also identified like acceptability and availability. Oral examinations were found to be similar to paper based examinations in terms of usage and security; however it was noticed that they are not flexible and require a lengthy time to examine each student. Electronic examination was found to support high levels of security features like confidentiality, integrity and availability, but it was noticed that this mode of assessment is not affordable. Since the paper based and oral examination modes are faced with the prior mentioned challenges like complexity, accessibility, flexibility, confidentiality and integrity, it is now clear that advances in electronic examinations will facilitate a smooth transition to the electronic mode of examinations in universities. These improvements include a comprehensive electronic examination framework, algorithms to incorporate the electronic free handwriting module, and support for more question type formats like essays to improve flexibility and complexity of electronic mode of assessment.

## RECOMMENDATIONS

An improved electronic examination framework that will emulate the current paper based examinations by providing more security and usage features through modules like electronic free handwriting, electronic answer booklet and electronic proctoring should be developed. The

framework to be developed should be more flexible by catering for various question types like essays, mathematical and diagrammatic which are not supported by the current frameworks.

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