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UNIVERSITY STUDENTS PERCEPTIONS ON THE EFFECTIVENESS OF OPEN-ENDED AND PROBLEM SOLVING QUESTIONS IN ONLINE EXAMS IN TANZANIA

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ABSTRACT

Studies propose the inclusion of open-ended (OE) and problem solving (PS) questions in online exams so as to improve effectiveness in assessing students' academic progress. However there is lack of research on perceptions of students on the effectiveness of OE and PS in online exams. This study was thus set out to investigate perceptions of university students on effectiveness of online exams with OE and PS questions. The study involved 60 students from the Moshi University College of Cooperative and Business Studies (MUCCoBS) and adopted the cross-sectional research design. Data collection instruments were questionnaires, interviews and review of existing documents. Study findings established that there is no formal online exam system implemented in the study area. However the study revealed an urgent need for online exams. This was so because the study area is experiencing increasing enrolment students as years go by. Such an increase is not proportional to the increase in number of academic staff, among other academic resources hence handling of exams (paper based), particularly invigilation and marking, is increasingly becoming difficult. Furthermore, although students demonstrated an understanding to online exams they declared a negative feeling towards implementation of OE and PS questions. Major reasons including ICT illiteracy among many students, unavailability of appropriate technologies required for attempting such kind of questions, generally poor ICT infrastructure, and the likely absence of fairness if such kind of questions will be marked electronically. The study recommends that online exams especially those used in universalities should contain both types of questions, there must be stakeholders' awareness creation on the importance of online exams consisting of both objective and subjective types of questions, and ICT infrastructure in higher learning institutions must be improved, among others.

Keywords: *ICT, online exam, objective questions, subjective questions, university students*

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1.0 INTRODUCTION

1.1 Background Information

The advancements in Information and Communication Technologies (ICTs) have provided vital impacts on the educational sector. According to Pelgrum (2001) these advancements have helped in creating conducive learning infrastructures, monitoring students' academic progress and in facilitation of staff (instructors) development. Swarts and Wachira (2010) add that the use of ICTs in education, such as electronic and mobile learning technologies, assist in addressing the key educational challenges and alternative delivery systems for accessing rich and interactive digital content to improve education quality. It is furthermore pointed out by Matto and Bwabo (2012) that ICTs has brought new opportunities like digital libraries which improve library resources management and services through improved information sharing, as well as wider access and preservation of library materials.

The role that ICTs play in the educational sector is also indicated in national policies and other documents. For example, the government of the United Republic of Tanzania [URT] (2007).Tanzania recognizes the importance of ICTs in improved access, equity, quality and education. The National ICT Policy also indicates that ICTs offer new opportunities to enhance education and to improve delivery of quality education thus represents a powerful tool with which to achieve educational and national development objectives (URT, 2003).

Studies across the region and beyond have shown that the uses of ICTs to enhance academic undertakings have been increasing, see for example Farrell and Isaacs (2007), Mostofa (2011) and Nwezeh (2010). Efforts have been established to enhance more utilization of ICTs in the education sector in Tanzania, as in many other countries. These efforts include formulation of national policies, such as the ICT Policy for Basic Education. References to ICTs are also prominent in policy documents that govern the education sector in the country. These documents are such as the Primary Education and Development Plan (PEDP I) 2002-2006 (URT, 2001), the Primary Education and Development Plan (PEDP II) 2007-2011 (URT, 2006) and the Secondary Education Development Plan (SEDP) 2004-2009 (URT, 2004).

Yizengaw (2008) studied challenges facing higher education in Africa. Among other findings he established that physical expansions of many institutions are not proportional with the increased number of enrolled students and thus managing examinations have never been easy. Such an increase of number students as well as the increased use of ICTs in educational institutions has prompted educators, testing experts and test developers to find ways of using ICTs to assess students' academic progress (Runté, 2010). According to Azim *et al*. (2009) this is observed by the transitions from paper- based exams to computer-based or online exams. Chicheb *et al*. (2011) contends that deploying exams electronically, apart from reaching out a big number of students at a time regardless of their physical locations, allows scores to be captured in an electronic form leading to automatic and accurate scoring and reporting more effectively and efficiently than the paper-based format.

Valiathan (2009) and Chiheb *et al*. (2011) argues that most of online exams are based on multiple choice questions (MCQs) and true/false questions (TFQs). Although studies like that of Espinosa and Gardeazabal, (2010), present a number of advantages of MCQs/ TFQs (such as easy to be marked electronically), the effectiveness of MCQs/TFQs as tools for assessing students' academic progress continue to be criticized. For example Piontek (2008) said that apart from the fact that they cannot measure complex human performance, the construction of challenging MCQs/TFQs requires special care and time- consuming and require special skills to construct Piontek (2008), Chieheb *et al*. (2011) and MCQS (2013). Runté (2010) furthermore alleged that another problem with such system of assessment is that students won't get a credit for a partially correct answer do not show the thinking process. It is in this line Dhokrat *et al*. (2012) proposed method which consider multiple answers to the same question in online exams. The authors also mention about consideration of answers with diagrams or equations.

1.2 Perception of students on the effectiveness of open ended question

Studies undertaken in several countries have encountered on the importance of online exams Dhokrat *et al*. (2012) despite the fact that they lacking a focus on open ended and problem solving questions. The studies do not also consider students perceptions on the quality and effectiveness of online exams in enabling them to

solve practical challenges in their livelihood. It is in this endeavor that this paper focuses on student's awareness of an online exams advantages and limitations of open ended and problem solving exams. This paper also identifies factors that facilitate the administration of online examinations in Tanzania.

2. Online examination systems

Online exams, sometimes referred as e-exams, are the examinations conducted through the internet or in an intranet (if within the Organization or Institution) for remote candidate(s). Most of the examinations issue results as the candidate finish the examination, when there is an answer processing module also included with the system. Candidate is given a limited time to answer the questions and after the time expiry the answer paper is disabled automatically and answers sent to the examiner. The examiner will evaluate answers, either through automated process or manually and the results will be sent to the candidate through email or made available in the web site (Softwarehouse, 2014).

Barak and English (2002) outlined several benefits of online exams. Some of them were administration convenience and cost savings in terms of labour and of supplies. Dhokrat *et al*. (2012) allege that the mission of online exam is to offer a quick and easy way for candidates to appear for the exam and it also provide the result immediately after the exam. According to Softwarehouse (2014) the main advantage of an online exam is that it can be conducted for remote candidates and evaluation of answers can be fully automated. Also an online examination can be conducted at any time and do not incur higher cost as traditional examination scenario as there is no paper work is involved.

Online examinations are however limited in several ways including applications of MCQS that could lead mostly testing superficial level of understanding need for a candidate and staff to have IT competence, need for IT security systems and high level of co-ordination.

Khuram (2006) mentioned two type of examinations; objective and subjective. Subjective type examination consists of such type of questions the answers to which are required to be given in descriptive form. And the objective type examination is usually in the format that asks questions and requires answers in the shape of fill in the blanks, multiple choice questions, differentiate between true and false statements etc. Consequently Dhokrat *et al*. (2012) said that there are two types of online examination systems; objective examination system and subjective examination system. According to the authors objective questions can be done through online exams systems without many complexities. But subjective examination systems have lots of complexity like, different ways of answering for same question, some question requires diagram or equation, or some questions require answers more than one word. It is because of this reason JICS(Joint Institute for Computational Science) Integrate Project Team (2010) pointed out that online exams are not good for subjective type of questions.

There are different software/systems for online examinations. According to JISC Integrate Project Team (2010) these includes WebCT, Assessment 21, Question Mark Perception and Kendata Scanner. The authors examined each of these systems and compared their effectiveness. The finding of their study is as shown in Table 1.

Table 1: Analysis of some available software tools for online exams

Software	Exam Invigilation	Exam Marking
WebCT	Careful invigilation needed to ensure students not using any other interface	MCQ and slot (fill in the blank) questions marked automatically
Assessment 21	An excellent invigilation system shows immediately if students stray outside the exam screen	MCQ and slot questions marked automatically
Question Mark Perception	Simple invigilation tools available for online exams.	Questions marked automatically apart from open answer and essay questions.
Kendata Scanner	Careful invigilation needed, plus teaching students how to complete answer papers	Large numbers of MCQs scanned and validated very rapidly

Source: JISC Integrate Project team (2010)

Unlike invigilation which can be done by some software like Assessment 21, all of these systems were found to not support open answers, essay questions or problem solving questions (subjective questions). This finding confirms assertions by Dhokrat *et al*. (2012) who said that subjective examinations have lots of complexity to be done online.

3. METHODOLOGY

A cross-sectional research design was used in this study. The reason for using it was as asserted by Bryman and Bell (2007) that unlike other research designs, cross-sectional is resource effective and has the potential of helping the researcher to come out with best results. This research was conducted at the Moshi University College of Cooperative and Business Studies (MUCCoBS), in Tanzania's Kilimanjaro Region.

A total of 60 students were involved in the study; 15 of them were doing Diploma in Business ICT, 30 were doing Bachelor of Business ICT and 15 were from other degree programmes. Most of our respondents were from ICT programmes because of two reasons; they indicated to have done some academic assignments online, and they had more knowledge as far as the topic under study was concerned. However respondents from other programmes, although few in number, ware also involved in the study to help in providing balanced responses. Simple random sampling method was used to get a representative sample from a population of ICT and non ICT students (stratums). The equal chance of representatives to be involved in the study.

Both primary and secondary data were collected during this study. Primary data was collected through questionnaires and interviews while secondary data was collected through a survey of existing documents and internet search including surveying the MUCCoBS website. The study used descriptive statistics technique to analyze the collected data. Data were coded and analyzed using Statistical Package for Social Science (SPSS) and Microsoft excel. By using these data analysis tools descriptive statistics such as frequencies and percentages were determined where the implications of the results led to recommendations.

4.0 FINDINGS

4.1 Demographics of the Respondents

A total of 60 bachelor and diploma students were involved in this study. These respondents were both males and females where 60% of them were males while 40% were females. Out of them 45 were doing bachelor studies and 15 were doing diploma studies. It was established that 2 (3.3%) respondents were aged below 18 years, 36 (60%) were aged from 18 to 25 years, 18 (30%) were from 26 to 35 years and 4 (6.7%) were aged from 36 to 45 years. None of the respondents were above 45years. Table 2 summarizes these demographic data of respondents.

Table 2: Demographics of respondents

Variable	Category	Frequency	Percentage
Sex	Male	36	60.0
	Female	24	40.0
	Total	**60**	**100.0**
Study Programme	Bachelor Degree	45	75.0
	Diploma	15	25.0
	Total	**60**	**100.0**
Age (Years)	Below 18	02	3.3
	18 – 25	36	60.0
	26 – 35	18	30.0
	36 – 45	04	6.7
	Above 45	0	0.0
	Total	**60**	**100.0**

4.2 Students Enrolment Trends

Runté (2010) alleged that one of the driving factors towards the move to online exams in academic institutions is the increasing number of enrolled students. This study thus investigated the trend of students' enrolments in the study area. We examined the said trend in nine consecutive academic years from 2004/05 to 2012/13 and observed and the availability of academic staff (among other resources as far as exams conducting is concerned) in the same nine academic years. As seen in Figure 1, we found that the number of academic staff is also increasing, but at a low rate as compared to the rate of students' increase, which confirms findings by Yizengaw (2008). This tells that, if the same trends will persist for the next few years it will consequently be very difficult for academic staff to handle efficiently paper-based exams (invigilation and marking); hence the need for online exams will be more visible.

Table 3: Trends of students' enrollment and number of academics staff in nine consecutive academic years

YEAR	STUDENTS	ACADEMIC STAFF
2004/05	342	95
2005/06	540	76
2006/07	785	83
2007/08	1429	89
2008/09	2186	108
2009/10	2713	136
2010/11	3785	144
2011/12	4211	148
2012/13	4611	151

4.3 Online Exams

4.3.1 Respondents' awareness to online exams

The study attempted to explore respondents' awareness on online exams. To do so a question was set out to capture their understanding of the term 'online exam'. As it is seen in Table 4, although they slightly differed in their definitions most of respondents defined online exam, more or less, as an exam which is done through the use of internet or through online access. This entails that most of respondents had a general understanding or awareness to what an online exam is. However 5 (8.3%) respondents were either unfamiliar with the term or they provided no response.

Table 4: Definition of online exam by respondents (N=60)

Definitions of 'Online Exam' by respondents	Responses	
	Frequency	Percentage
Is the exam which is supposed to be done in an exam room but is done through computer	7	11.7
Is the completion and submission of assignment tasks through the internet	15	25.0
An exam which is done via the internet, there is minimum or no invigilation	12	20.0
Service on the web that allows students to do their exams and get immediate feedback	03	5.0
Electronic equivalency of traditional exams that allows students to do the exam at their own places	05	8.3
Online access to examination which takes place through computers and where all who are taking that exam must be online at the same time	01	1.7
A virtual exam room where the exam is conducted electronically	04	6.7
An exam which is conducted through the use of electronic means such as internet	08	13.3
No response	05	8.3
TOTAL	**60**	**100**

The captured definitions are relatively similar to the definitions of online assessment provided by respondents in a study by TAFE Frontier (2002). According to the author respondents defined online assessment as: using online technologies to support, wholly or in part, summative and formative assessment; assessment where the assessor has not met the assessee; where participants have the opportunity to submit assessments through online channels, providing a more flexible approach to submitting work; computer marked short quizzes to assess knowledge; online facilitator-marked assessments; and to be able to determine the learner's ability to understand the material using the internet, just to select few definitions.

4.3.2 Advantages of Online Exams

A question was set to tap respondents' perceptions on the advantages of online exams as compared to paper-based exams. It was found that a large portion of the respondents declared a positive attitude towards online exams. In capturing the specific advantages of online exams a multiple response question, which allowed respondents to indicate more than one advantage, was used and the following were found; 36 respondents said that marking is precise with online exams, they provide quick feedback (34 responses), they are convenient to students as they can be taken at students' convenient time and place (30 responses), they are ecologically friendly because no paper is used, and resource effective (18 responses each), and the exam can reach out a big number of students at minimum or no additional costs (10 responses). Four responses were provided to indicate that online exams are cost effective to institutions and to students. Table 5 summarizes these findings.

Table 5: Advantages of online testing

ADVANTAGE	FREQUENCY	PERCENTAGE (%)
They are cost effective	4	6
Convenient to students	30	50
It is ecologically friendly	18	30
Provide quick feedback on results	34	56
Marking is precise	36	60
It is resource effective	18	30
Exams can reach out many students	10	16

4.4 Open ended (OE) and Problem solving (PS) questions in online exams

4.4.1 Importance of including OE and PS questions in online exams

The study attempted to establish respondents' opinions on whether it is important for OE and PS questions to be included in online exams. Findings revealed that 53 respondents (equivalent to 88.3%) said that it is important for online exams, as in paper-based exams, to include also OE and PS questions, 5 respondents (equivalent to 8.3%) said that it is not important, while 2 respondents (equivalent to 3.3%) did not provide any response, as seen in Table 6.

Table 6: The importance of including OE and PS question in online exams

RESPONSES	FREQUENCY	PERCENTAGE
No response	2	3.3
It is not important	5	8.32
It is important	53	88.3

For those respondents who said that it is important to include OE and PS question in online exams, the study further investigated on why they held so. To achieve this, a multiple response question was set out and respondents were asked to indicate on what they believe to be pros of inclusion of OE and PS questions in online exams. Table 7 summarizes the subsequent findings on this. The finding tell that if online exams are to be used then it is necessary for exam developers to make sure that both objective and subjective types of questions are included.

Table 7: The importance of OE and PS questions in online exams (N=53)

Importance of OE and PS questions in online exams	Responses		Percent of Cases
	Frequency	Percent	
They can be used to measure higher level cognitive skills	35	20.6%	66.0%
Marking are fair because even the partially correct answer can get marks	17	10.0%	32.1%
They discourage guessing	28	16.5%	52.8%
They allow students to demonstrate creativity	41	24.1%	77.4%
Mathematical calculations and formula derivations can be tested	7	4.1%	13.2%
Ability to organize and express ideas can be measured	32	18.8%	60.4%
They can be used as testing tool in all types of subjects	10	5.9%	18.9%
TOTAL		**100.0%**	

4.4.2 Possibility of implementing OE and PS questions in online exams

Apart from just indicating the importance of the inclusion of OE and PS questions in online exams, respondents were asked to indicate if they real believe that such kind of questions can be effectively implemented in online exams. Findings showed that most of respondents were suspicious. This was divulged by a big portion of respondents who alleged that such kind of questions cannot be effectively implemented in online exams (34 respondents, (56.67%)) as compared to those who believed they can be effectively implemented (26 respondents,(43.33%)). Two respondents did not provide any response to the question; they were placed into a pessimistic part.

The study then went further to ask those respondents with pessimistic feeling as to why they were suspicious on the effective implementation of online exams with OE and PS questions. According to the findings it was so because of three reasons. First, respondents were worried about students' competences in using ICTs. One respondent when interviewed, for example, provided the following; *"...problem solving questions sometimes require me to show some drawings which are also marked... currently when I'm typing it takes me lots of time to finish one page, what about drawings? I think when these questions are included in online exams students will spend much of their time struggling with technology than attempting exam questions..."* This finding is similar to what Jamil et al. (2012) pointed out that to attempt an online exam, students should have a basic understanding of ICT competencies. A second reason was availability of appropriate technologies necessary for doing such kind of exams. *"...suppose I'm attempting a trial balance question in financial accounting, how can I write all the required steps by using* Finance. JICS Integrate Project Team (2010) also pointed out that online testing is not good for structured sentences/paragraphs, essay writing or situations where students are required to construct an argument or develop ideas. A third reason was that they were worried that if technology is used to mark such kind of questions it may not be sufficiently fair. In supporting this one of the interviewed respondents said; *"...what if I did not get the final answer correctly but I have done some other calculations reasonably well, will computer give me scores on that?!, I don't think so...".*

The study established that, apart from personal initiatives of some lecturers to require their students to access assignments and submit answers online, there is absence of formal online examination system/software in the study area. The study then wanted to know respondents views on the factors that may be impeding online

exams implementation in their institution. To achieve this, a four points Likert scale, “strongly”, “strong”, “weak” and “very weak”, was used on different factors that were presented to respondents. Figure 1 summarizes the findings.

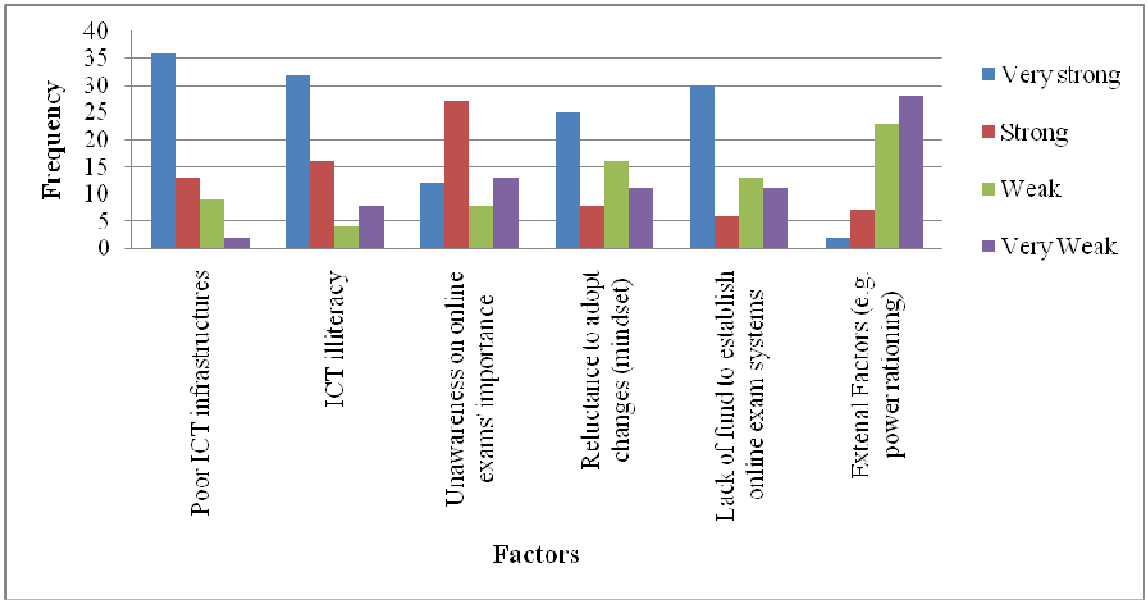

Figure 1: Factors impeding the use of online exams (N=60)

As it is seen in Figure 1 most of respondents alleged that poor ICT infrastructures, ICT illiteracy, lack of fund to establish and run online exams, reluctance to adopt changes and lack of awareness on the importance of online exams are the leading very strong factors. External factors, like power rationing, were mentioned to be a weak factor impeding online exams implementation.

Summary

The study undertaken shows the need the establishment of a formal online examination system in the study area, although the findings show that there are a number of issues to be settled prior to formalized online examinations.

5.0 CONCLUSION AND RECOMMENDATIONS

This is necessitated by the constant increasing number of students enrolled in the study area as years go by. Such an increase is observed to be disproportionate to the increase in number of academic staff, among other academic assets, hence handling of paper based observed that most students in the study area demonstrated an understanding to online exams. They also indicated the importance of OE and PS questions inclusion in online exams. However most of them declared a negative feeling towards implementation of OE and PS questions in online exams. The main reasons for that were ICT illiteracy among many students, unavailability of appropriate technologies required for attempting such kind of questions, generally poor ICT infrastructures, and the likely absence of fairness if such kind of questions will be marked electronically. Findings show factors that facilitate online exams implementations in the study area include ICT infrastructures, ICT illiteracy, funding to establish and run online exams, willingness to adopt changes and awareness on the importance of online exams.

This paper recommends that:

- Deliberate efforts should be put in place for awareness creation to all academic stakeholders on the importance of online exams, especially those with open- ended and problem solving questions.
- Online exams, especially those used in universities, must consist of both types of questions; objective (MCQs, TFQs, etc.) and subjective (OE and PS questions). But as a short time measures, a same exam can be made with two parts, first part comprising of objective questions and be administered online, and the second part with subjective questions and can be administered through traditional paper- based system.
- ICT infrastructures in higher learning institutions should be improved, the improvements of which will eventually facilitate smooth implementations of online exams with OE and PS questions.
- Putting in place appropriate country-wide and institutional-wide policies which will govern the creation, installation and use of online exams with both objective and subjective type of questions. These policies should include security policy for ensuring security, integrity and quality of exams.

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