

Adoption of e-Assessment in Strathmore University

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Abstract: ICT can contribute to the development and efficiency of education management and administration. Efforts to introduce ICT in teaching, learning and assessment aim to help meet a wide variety of goals in the education sector. This paper is based on a research project that was carried out in Strathmore University by @iLabAfrica, funded by the Kenya Education Network (KENET). The research was driven by challenges facing traditional assessment of large classes. It aimed at identifying e-assessment tools, evaluating if differences existed between performances of students examined with traditional assessment and those examined with e-assessment and investigating the feasibility of implementing e-assessment to complement eLearning in the University. Findings revealed that a variety of tools existed and that e-assessment was better than traditional assessment in terms of students' performance, management of large classes, flexibility and cost effectiveness.

Keywords: ICT in education, e-assessment, Moodle, eLearning, assessment of large classes, eLearning Centre.

1. Introduction

E-assessment is described as the use of computers in assessment, that is, the setting, delivery, marking and reporting of assessments [1]. Assessing learning in an electronic environment is being used by lecturers and institutions worldwide at an increasing rate [2]. Several e-assessment tools have been developed, tested and used as plugins or embedded in Learning Management Systems (LMS). Students' enrolments are increasing. Consequently, time spent by the lecturers to assess students learning is also increasing. Therefore, a step towards e-solutions becomes a real need to reduce time and an effort spent on students' assessment and a strong rationale to use the e-assessment technology [3].

For instance, Strathmore University has been carrying out assessments using the traditional method based on pen and paper. Lecturers would then mark the assessment scripts. This can be so cumbersome for larger classes of over 60 students; there is wasted time and effort as lecturers struggle to finish marking the scripts instead of spending the same time and effort improving the learning content. Sometimes there is little relevant and specific feedback or none at all concerning what areas students need to revisit to help them improve their learning. Paper booklets for assessments can be expensive in the long run. Each paper booklet for assessment costs Kshs 16 and on average students sit for two assessments per semester which totals to about Kshs 1,000,000 that the University spends every semester. In terms of four years, that is a lot of money that could be invested in other projects.

This paper addresses the use of ICT in assessment of large classes (60 students and above), the benefits and challenges associated with it and the feasibility of its adoption. Challenges facing traditional assessment of large classes drove to the research with a

purpose to identify e-assessment tools, critically assess if differences existed between students' performance depending on the mode of examination, perception of the students and lecturers towards e-assessment and infrastructure needed to support its practice.

2. Theoretical Framework

2.1. Implementation of e-Assessment in Institutions of Higher Learning

Reference [4] presented a case of the University of Ilorin which adopted the use of computers to make assessments better. The University used e-assessment in the conduct of its examinations for courses with large population of students of 500 and above. The e-assessment method represented a great deal of improvement over the former pen and paper method given the many advantages it came with, which include standardized examination questions, elimination of incidence of malpractices, missing results and manipulations, quick release of results, unbiased test administration and scoring, faster decision making and reduction in cases of impersonation.

Reference [5] presented the University of Central Florida where large classes of 250 or more students presented particular challenges which made administering and grading paper-based exams difficult and time-consuming. The University adopted the use of WebCT/Blackboard and an e-assessment tool inherent in the LMS. An overwhelming majority of students who responded (86.2%) indicated that they were satisfied with e-assessment. Over a period of time, computer-based exams were offering significant cost savings over paper-based exams. Since the adoption of e-assessment, the University estimated a savings of between \$135,000 and \$163,000 in the cost of paper.

Edinburgh's Telford College embedded the use of e-assessment across the College through the development of a dedicated e-assessment Centre, e-assessment authoring tools and delivery platforms [6]. Evidence from students is that they enjoyed using the Centre and e-assessment. They liked getting instant feedback/immediate results and also believe it is a more environmentally friendly option as it saves on paper. The lecturers have been pleased by the accessibility benefits of e-assessment. The institution has also realized reductions in the use of paper, printing costs and offsite storage.

According to a case study done in Farnborough Sixth Form College in England, along with e-assessment, software Invigilator Pro was used. It took regular screen shots of the candidates' screens as well as recorded all network traffic and logged every keystroke during examinations. The students also sat around oval shaped tables instead of sitting in rows in order to prevent cheating [7].

Reference [8] argues that it is important to 'construct a pedagogically driven model for e-assessment that can incorporate e-assessment and e-Feedback into a holistic dialogic learning framework, which recognises the importance of students reflecting and taking control of their own learning'.

A number of papers highlight the challenges of e-assessment including: the question to what extent e-assessment enhances student learning [9]; enhancement of feedback in dissertation supervision [10]; e-portfolios promoting active engagement in student-centred learning groups [11].

Reference [12]; [13]; [14], summarise benefits of e-Feedback such as legibility of electronic feedback, the use of hyperlinks and attachments in virtual communication which enable lecturers and students to easily suggest additional relevant resources, copying others into a communication and joint feedback in specific areas.

3. Methodology

3.1. Introduction

Desktop research and questionnaires were employed to collect data. The sample size for the study was determined largely by three factors: (i) the estimated prevalence of the variable of interest – e-assessment adoption in this case, (ii) the desired level of confidence and (iii) the acceptable margin of error. The confidence level was set at 95% with an error margin of 5%. Prediction of proportion of the study was that 75% of the responses will be in favor of e-assessment. This resulted in a sample population of 373 students drawn from a total population of 4,600 students.

3.2. Desktop Research and Surveys

Desktop research was used to collect data related to the practice of e-assessment; mainly tools, platforms and processes. Surveys were also conducted after students and lecturers have had an experience using e-assessment to find out what their views were. The results were analyzed using the Moodle Questionnaire module. The students' and lecturers' questionnaires were administered to all students and lecturers who used e-assessment in order to obtain feedback on their experiences and their general perceptions towards e-assessment.

3.3. Testing e-Assessment

Eight different classes were used for testing. A variety of course units were chosen for the experiment; it included Information Technology related units such as computer security and cryptography, networking and data communication. Others were Humanities such as anthropology and philosophy. The lecturers divided their classes into two groups for the experiment; the control group which was tested using traditional assessment and the test group that was examined using e-assessment. Question types mostly used were multiple choices, true or false, matching and short answers. For security purposes to minimize cheating, Safe Exam Browser (www.safeexambrowser.org) was used. A comparison was done between the test scores of the two groups. T-test analysis [15] was used to analyze and interpret those results.

4. Technology Description

The use of computers in assessment has become increasingly important in modern education. The integration of an e-assessment module with a learning management system brings about several advantages to students, lecturers and the institution as a whole. The advantages include richer assessment experience, peer assessment, instant and timely feedback, reduced administrative burden, cheaper in the long term, increased flexibility with regard to location and timing, greater reliability than human marking, greater storage efficiency and Increased accessibility among others.

However, there are also challenges to the institution such as developing an e-assessment strategy that incorporates pedagogic and technical aims, investment up front to establish the materials/content, introducing sustainable ways of supporting computer-based assessments, setting up a viable physical and Information Technology (IT) infrastructure to support e-assessment to the required scale, instituting policies and procedures to ensure the validity of e-assessments, plagiarism management and careful design of questions to enable the testing of higher order skills

To practitioners, challenges are such as allocating time for e-assessment-related skills development, ensuring the accessibility of e-assessments for a diversity of learners, achieving a best fit between e-assessment design, course objectives and the needs of

learners, developing confidence and expertise in a full range of e-assessment approaches and assimilating changes in working practices.

5. Results

5.1. E-assessment Tools and Platforms

Various platforms and tool that support e-assessment were identified. Among the tools were Hot Potatoes (www.hotpot.uvic.ca), Respondus (www.respondus.com), Question Mark Perception (www.questionmark.com) and Moodle Quiz (www.moodle.org) while the platforms were: Moodle (www.moodle.org), Angel (www.angellearning.com), Blackboard (www.blackboard.com) and Desire2Learn (www.desire2learn.com). A comparison of these tools was undertaken in terms of cost effectiveness, question types offered and platforms that support them. Moodle Quiz Engine, an open source plugin for Moodle was selected as the most suitable and cost effective tool for the study.

5.2. Students' Performance

Analysis of Tests Scores/Performance was done with T-Test. Average performance of each class for the two groups: control group and test group were recorded. Using t-test analysis, the mean, deviation and variance were computed. The results came out to be that $t = 4.5254$. Using the critical values of 'T' table with a probability level/alpha level = **.05** and a Degree of Freedom = **14**, t must be at least **2.145**. In this study case $t = 4.5254$, so the difference in performance **was statistically significant**.

Interpretations and Recommendations of Hypotheses Testing were done:

H₁: "There is significant difference in performance between the students who are examined using e-assessment and those who are examined using traditional assessment".

This hypothesis was confirmed to be true based on the results that $t = 4.5254 > 2.145$. This is evidence that if e-assessment was to be implemented in the University, then students' performance would gradually be improved.

H₂: "The difference in terms of average marks/scores is 5 marks and above".

This hypothesis was not confirmed based on the results that the difference in average scores for all tested classes was **1.53** which is less than **5**. The difference was found to be small; however, it kept changing after every round of test which means that the results could change if observations were made over a considerable period of time.

5.3. Feasibility and Readiness factors for e-Assessment Adoption

Students' Responses from the e-Assessment Survey:

- Main challenges faced by students: 22% identified Interruption of power supply during exams as the main issue, 19% were confused by the multiple choice questions. 'Unfamiliarity' of the process and 'Not easy' were other setbacks as stated by 16% and 14% respectively. 10% complained that e-assessment was not interactive while 19% had no challenge at all.
- 83% of the students scored higher with e-assessment while 17% scored lower.
- Main benefits identified by students: convenience (17%), flexibility (15%), instant feedback (15%), reliability of marks (15%), less stressful (27%) and 11% were happy with the variety of question types making the experience enjoyable.
- 85% of the students prefer using e-assessment over traditional assessment while 15% still prefer traditional assessment.

Lecturers' Responses from the e-Assessment Survey:

- 90% of the lecturers felt that the e-assessment tool would be beneficial to them and to the students; therefore, they prefer e-assessment over traditional assessment, while 10% were dissatisfied with the fact that essay questions had to be marked manually and the e-assessment tool version at that time could not handle complex mathematical formulae as well as computer programming notations.
- Some of the features/benefits lecturers were attracted to include: setting questions creatively, instant marking of assessments, and quick feedback to students, faster and easy analysis of students' performance, easy generated reports and a variety of question types. Lecturers also confirmed that among their students, those who were examined using e-assessment performed better than those examined using the traditional method of pen and paper.

Safe Exam Browser (SEB) was used to reduce chances of cheating. It locked down all other applications denying users access to the Internet or other applications, but there was need for invigilators to prevent students from using mobile phones or consulting each other during tests.

Each paper booklet costs the University Kshs 16. Students sit for at least two assessments per unit per semester and every semester has at least 7 units. The total number of students estimated at 4,600. This translates to about Kshs 2,000,000 (USD 24,000) being spent by the University in a year on paper only.

The variables that contributed to the readiness factors for the adoption of e-assessment were users' perceived usefulness, their perceived ease of use, availability of ICT infrastructure and management support. The conducted surveys established that there was perceived usefulness and ease of use by students and lecturers. In terms of infrastructure, the survey indicated that 61% of the students owned laptops and that there is a computer capacity of 280 Desktop computers available for use in the student's laboratories. Management also supported the project and understood the benefits of e-assessment practice.

6. Discussion of Findings

Moodle Quiz Engine was selected as the most suitable e-assessment tool for the study because it offers a range of question types, is free and open source hence cost effective and it is compatible with the Moodle e-Learning system that has been supporting teaching and learning in Strathmore since 2005. For research or implementation considerations, an institution would choose the tools and platforms that fall within their learning and assessment requirements and most importantly their budget.

The performance of students was found to be better with e-assessment. The difference in average scores between e-assessment and traditional assessment was not considerably big though. However, this difference was seen to increasingly change as observations are made over a significant period of time and students familiarize with e-assessment.

Students chose e-assessment over traditional assessment because it offered them a rich assessment experience, is flexible, reliable, convenient, provides quick feedback and their performance improved. They however experienced some challenges including unfamiliarity of the process and lack of practice sessions before examination. Furthermore, Internet was not stable and power outages were experienced causing frustrations to both the students and the lecturers. Lecturers also chose e-assessment over traditional assessment because they were able to set a variety of questions, enjoyed the tool's instant marking and e-feedback to students and they could easily analyze the class performance and generate reports. They were certain that with the e-assessment tool which offers e-feedback and test scores instantly, students learnt easily achieving the primary objective of the education system.

Lecturers also faced some challenges in that they had to mark essay questions manually and could not use mathematical and computer programming functions with the e-assessment tool version used at that time hence they requested an upgrade to a higher version if it existed.

The e-assessment readiness survey indicated that all parties involved in the practice perceived the usefulness of e-assessment and its great impact on learning and assessment. The availability of ICT infrastructure in the University in terms of the number of desktops and laptops and the already deployed network on the campus was another potential indicator that e-assessment could be adopted in the University. Based on the positive results of this research, the eLearning Support Centre was launched in the University. However, one cannot overlook the fact that if an institution resolves to implement e-assessment, there is need for electronic equipment e.g. computers, reliable software, reliable source of power, bandwidth, manpower, training and the time involved in developing test questions.

By adopting the e-assessment practice, the institution could see a significant reduction in the cost of assessment. In the short to medium term, e-assessment implementation can be expensive as it involves the cost of acquiring or upgrading the equipment and resources discussed earlier. Once implemented, however, e-assessment practice becomes less expensive, being easy to operate and reuse over time.

7. Conclusions and Recommendations

Based on the findings of the research carried out in Strathmore University, it is evident that the use of ICT in assessment would be a great tool to manage assessments of large classes. It is time-consuming in the beginning to set up a question bank but it is beneficial in the long run as it can be easily updated and reused. The study identified a number of e-assessment tools and platforms that support them. Moodle Quiz Engine, embedded in Moodle learning environment offered great learning and assessment outcomes, supported with the right infrastructure such as computer capacity, network bandwidth, the Internet and reliable source of power.

The research also established that the performance of students examined with e-assessment is better than that of students examined with traditional assessment, despite the challenges that they faced at some point during the experiment.

Although Lecturers and students experienced some challenges with e-assessment, they chose to embrace e-assessment given its many benefits to educational effectiveness. The institution was seen to be ready for the adoption of e-assessment based on the opinion and interest shown by management, lecturers and students and also the infrastructure capacity readily available and still growing at the campus. The initial cost of setting up an e-assessment system was found to be expensive; however, e-assessment could be a long term solution to minimize traditional assessment expenses because of its flexibility to update and reuse.

The study recommends an extensive exploration of the security measures to ensure authentication, privacy and security of e-assessments. Safe Exam Browser was tested in the Windows environment but more advanced or combined practices could be studied to achieve best results. Future work could also look into how e-assessment could be useful beyond written assessments, by incorporating testing of presentations and better handle essay questions.

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