Establishing the current extent and nature of usage of Online Assessment Tools in Computing-related Departments at South African Tertiary Institutions

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ABSTRACT
The use of online assessment and computer-based testing is on the increase. A survey was conducted to investigate the extent and nature of use of online assessment tools in Computer Science, Information Systems, and Information Technology academic units in South African tertiary institutions, as well as satisfaction on the part of academics who are users. This was done to set the context for future research to determine the requirements for online assessment tools and systems, and criteria for evaluating them. The extent of usage was found to be low, but on the increase. There were 36 respondents from 9 institutions; 16 of whom are regular users of online assessment, mainly using multiple-choice questions. The systems are employed more for formative than summative assessment. Most usage is for large first-level classes. The benefits and barriers mentioned by respondents correspond closely with those identified in a literature study on use internationally.

Categories and Subject Descriptors

K.3.1 [**Computers and Education**]: Computer Uses in Education – *computer-assisted instruction (CAI); Distance learning;*

General Terms

Computer-aided assessment (CAA), computer-based testing, e-learning, online assessment tools, online testing.

Keywords
Computer-aided assessment (CAA), e-learning, electronic assessment, online testing,

1. INTRODUCTION AND BACKGROUND
The aim of this study was to establish the current extent and nature of usage of online assessment tools within Computing-related academic departments/schools at South African tertiary institutions, as well as the satisfaction on the part of academics with the use of such tools. The study was conducted to set the context for future research on requirements for, and evaluation of, online assessment systems and tools.

The time and location independent nature of Information and Communication Technology (ICT) can provide 'decongestion of overcrowded education facilities, support for students and educators, and a valuable opportunity for specific groups of students, if the learning material is accessible to them' (Ardito et al, 2006, pg 12). This statement applies not only to instruction and learning via e-learning, but is also relevant to assessment supplemented by ICT technologies. Many universities internationally use online assessment for at least some portion of their assessment programs. Research has indicated that many tools and systems can create, deliver, score, report and analyze both summative and formative assessments, and provide various other customised online and paper-based testing and reporting services (Harrington and Saxon, 2005).

As first-level Information Systems coordinator for seven years at the University of KwaZulu Natal, the primary author faced a major challenge in efforts to implement a software tool for online assessment. Due to the large number of students, approximately 1600, distributed over two campuses, the method of assessment adopted in the School of Information Systems and Technology (IS&T) for its entry-level learners was primarily multiple choice questions (MCQs). Since 2003, the researcher has investigated various online assessment tools for judgement of MCQs, including: SAM, Hot Potatoes, ExamView, EzTests and CourseCompass. These tools were selected as they were made freely available to the primary researcher by the creators of the software, for testing purposes. Various problems were encountered during the testing of these software tools, for implementation purposes, two of the major issues being:

- tool interfaces were not easy for students to understand;
- the administration associated with implementing the tools was laborious, hence did not provide motivation for the academic administrator to implement these technologies.

Following this failure to implement an online assessment application in the School of IS&T at the University of KwaZulu Natal, yet taking cognizance of recent advances in educational technologies, the researchers set out to investigate the current extent and nature of usage of online assessment tools within Computing-related academic departments at South African tertiary institutions, and to determine the levels of satisfaction or dissatisfaction of academics using these technologies. To this end, research was undertaken in Information Systems (IS), Information Technology (IT) and Computer Science (CS) departments, aiming to answer the research questions:

What is the current extent and nature of use of electronic assessment in computing-related departments at South African universities?

How satisfied are the academic users with the online assessment tools they employ?

The first question is quantitative in nature, while the second requires qualitative answers. These research questions were developed by:

- the primary researcher's personal interest in the area of study;
- motivation for the knowledge outcomes to be achieved; and
- suggestions from the literature of areas where further research is required (Oates, 2008, pg 34).

Disclaimer: This research is situated in the sub-discipline of MCQ-related assessment. The authors acknowledge the sub-discipline of automated assessment whereby essay-style questions are judged using sophisticated techniques of pattern matching, natural language processing, and artificial intelligence. However, these assessment forms are outside the scope of the present study.

2. LITERATURE SURVEY

The subsections that follow, overview the concepts of e-learning, assessment in general, and online assessment in particular.

2.1 e-Learning and associated terminology

e-Learning, web-based learning, and online learning are terms often used interchangeably yet, according to Tsai and Machado, (2002), they represent concepts with subtle, yet consequential differences. Turban (2010, pg 68) supports this view, stating that 'e-Learning is broader than the term online learning, which generally refers to purely web-based learning'. Tsai and Machado further differentiate web-based learning as learning materials delivered in a Web browser; however, their definition includes materials packaged on CD-ROM or other media. They refer to content readily accessible on a computer via the Web or the Internet, or simply installed on a CD-ROM or the computer hard disk, as online learning, not e-learning.

Clark and Mayer (2003, pg 13), cited in de Villiers (2005, pg 346) define e-learning broadly as 'instruction delivered on a computer by way of CD-ROM, the Internet, or an Intranet, which:

- includes content relevant to the learning objective
- uses instructional methods such as examples and practice to help learning
- uses elements such as words and pictures to deliver content and methods
- builds new knowledge and skills linked to individual learning goals or to improve organizational performance'.

In a highly current publication, Turban (2010) extends the concept of e-learning to include online delivery of information not only for formal education, but also for training or general knowledge management. Such systems are usually web-based, making knowledge accessible to those who need it, when they need it, anywhere, anytime. However, formats can vary, ranging from virtual classrooms through to mobile learning (m-learning) applications, by which material is delivered wirelessly to learners via mobile phones or PDAs (Turban, 2010).

In this paper, an all-encompassing definition of e-learning is adopted, which incorporates a broad range of educational technologies and types of learning/instruction. e-Learning is viewed as including interactive institution-wide learning management systems, web-based teaching materials and hypermedia, multimedia CD-ROMs, e-learning tutorials, simulations, games, and computer-aided assessment (Alessi & Trollip, 2001; de Villiers 2005). In the realms of Web 2.0 and e-Learning 2.0 (Ebner, 2007), where learners are not only consumers of content, but also contributors, there is a major role for collaborative software technologies on the Internet such as discussion boards, e-mail, blogs, wikis, chat rooms, and educational animations (Ebner, 2007; Turban, 2010).

2.2 Assessment

Assessment is 'an integral, ongoing aspect of teaching and learning… the process of gathering, describing, or quantifying information about learner performance' (Rovai, 2000, pg 142). Assessment is intended to measure the effectiveness of learning. It is seldom an end in itself, but is an important element of courses (Horton and Horton, 2003). According to Anderson et al (1975, pg 27) in their classic encyclopedia, 'assessment, as opposed to simple one-dimensional measurement, is frequently described as multitrait-multimethod; it focuses on a number of variables judged to be important and utilizes a number of multisource/multijudge techniques to assay them'.

Traditional assessment techniques usually require the learners of a single class to be tested through a single standardized procedure at a single controlled location or simultaneously at various locations. These forms of testing have the advantages of being reliable and consistent. Nevertheless, current trends involve moving away from traditional methods of assessment, to focus more on 'student-centered active learning and performance' assessments, which frequently involve some elements of online assessment. However, the assessment principles that guide student assessments in a traditional learning environment remain unchanged in an online learning environment (Rovai, 2000).

2.3 Computer-aided assessment (CAA)

Computer-aided assessment (CAA) (Fielding and Bingham, 2003; Lambert, 2004; Weerakoon, 2001) is a common term used for online assessment, although there are synonyms such as computerized tests (Alessi & Trollip, 2001), online testing (Maurice and Day, 2004), computer-assisted assessment (Conole and Warburton, 2005), online examinations (Khare and Lam, 2008), electronic assessment (Sangi, 2008), online evaluation (Nelson, 1998), computer-administered tests (Waring et al, 1999), and computer-based testing (participants in this research). The term of preference in the present study is online assessment (Horton and Horton, 2003; Lambert, 2004; Fielding and Bingham, 2003; Maurice & Day 2004). Students are presented with a variety of questions online to which they respond and which are marked electronically. The results are sent to a database where they can be stored and accessed by lecturers, and/or presented back to the student immediately. Facilities such as detailed feedback and the ability to take a test a number of times are available in some systems (Maurice & Day 2004).

CAA supports some of the following question types (Lambert, 2004; Maurice & Day 2004; Horton and Horton, 2003; Fielding and Bingham, 2003; Alessi and Trollip, 2001; Sim 2004):

- *Multiple choice questions (MCQs):* these display a list of answers from which learners choose by
  - picking one option – only one alternative from the list provided;
  - picking multiple options – one, some, all, or none of the alternatives can be selected from the list.
- *Fill in the blank questions*: learners submit the missing word(s) in a sentence/paragraph or missing items in a table.
- *Short answer questions:* these require the learner to type in the answer to a question, typically short answers to very specific questions.
- *True/False questions*: learners decide between two alternatives stating whether a statement is true or false.
- *Hotspot questions:* the learner is asked to select an object or an area in a graphic by using the mouse.
- *Drag and drop questions (also called move-object questions):* these questions test the ability of learners to assign items to the correct category or to arrange parts of a system into a whole by moving icons, images, or textual labels to specific locations on the screen.
- *Matching list questions:* learners are required to specify which items in a list correspond with items in another list. These lists may include text or graphics.
- *Simulation questions:* these require the users to perform a highly interactive task.

The literature reveals advantages and disadvantages of CAA, and discusses various constraints that users should note. These are addressed under the three italicized subheaders following.

Advantages CAA holds certain advantages over manual assessment (Alessi & Trollip, 2001; Lambert, 2004; Maurice & Day 2004; Horton, 2000):

- Online assessments are available on demand.
- Marking (grading) of assessments for large numbers of students is more efficient when done by automated means.
- Feedback to students can be delivered instantly.
- A large variety of questions can be developed over time to form a question bank. Questions can be randomly generated per assessment, using a generalised algorithm.
- Online assessments can be integrated with other online media resources.
- The computer cannot be judgemental, so learners need not fear subjective human criticism.
- There is wide variety in the kinds of questions that can be offered in a single assessment.

Disadvantages It must be acknowledged that there are certain disadvantages associated with the implementation of CAA (Lambert, 2004; Maurice & Day 2004):

- Some types of questions cannot be marked automatically.
- Data security is problematic; in some cases, the identity of the test taker cannot be determined with certainty.
- Students with poor IT skills or who dislike the delivery method, may be disadvantaged.
- Students need facilities where they can access the technology to take the assessment. This is not a problem in contact-learning, where institutions have computer laboratories, but can be a factor in the case of isolated learners doing distance-education.
- Accessibility for the physically challenged must be considered, since many online assessment tools have limited features for the disabled.
- Testing programs should be user-friendly and have a high level of usability. If learners struggle with the mechanics of the software, they will be distracted from concentrating on their responses.
- For the educator, it is time-consuming and difficult to write MCQ questions that assess higher-level thinking.

Constraints: In implementing online assessment, the educator and/or the administrator must consider certain constraints, as outlined below (Khan, 1997; Alessi and Trollip, 2001; Horton, 2000):

- Security is a concern in some environments.
- Assessment material must be available timeously; it must relate to current learning material to enable learners to prepare appropriately for the assessment; and the environment must be easily usable by the target learners.
- Ideally, feedback should be provided at the end of a test. Piecemeal feedback makes tests longer in duration and can frustrate knowledgeable learners.
- Immediate feedback, question-by-question, can make it difficult for learners to answer a series of closely related questions.
- If the test has a time limit and intermediate feedback is provided, time must be allowed for the learner to read and comprehend the feedback.
- Course outlines should be provided that clearly state module outcomes, so learners can map the relationship between their learning and the associated assessments.
- Each item in a test should assess stated objectives, so that learners can perceive the value of the assessment.
- The purpose and content areas of the assessment must be clearly specified.
- Questions must be presented in such a way that learners can focus on their actual response to each item, and not spend time deciphering in what way they are expected to answer the questions.

2.4 Online Assessment Tools

Online assessment tools mentioned in the literature include (Horton and Horton, 2003; Lambert, 2004; Fielding and Bingham, 2003; Pretorius et al, 2007):

- Perception by Questionmark
- Coursebuilder for Dreamweaver by Macromedia
- Hot Potatoes by Half-Baked Software
- Quick Rocket by LearningWare
- Random Test Generator Pro by Hirtle Software
- Test Generator by Fain & Company
- TestLinc for LearnInc by Mentergy
- HoestedTest.com by HostedTest.com
- Unit-Exam.Com by Unit-Exam.com
- Umfundi by FullMarks

Perception by Questionmark is a popular computer-aided assessment tool developed in 1988 and widely adopted in USA, UK and Japan since its inception, but it comes at a relatively high price.

Irrespective of the tool selected, the deployment of online assessment tools follows a common cycle of developing, conducting and reporting assessments. This six step cycle is depicted in Figure 1 below.

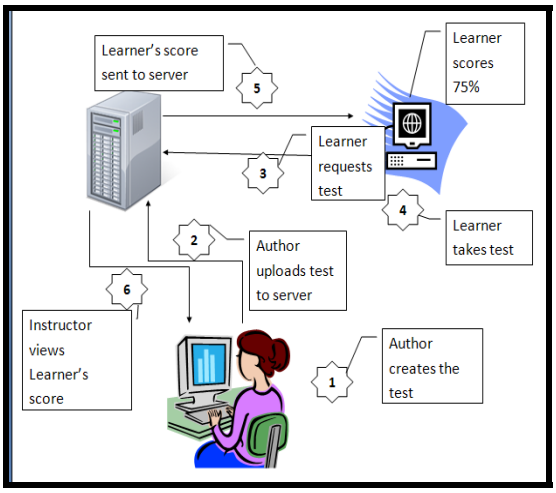

Figure 1: The cycle of developing, conducting and reporting tests (Adapted from Horton, 2003, p 328)

The process is initiated by the test author, who creates the test with an assessment tool (1 in Figure 1). The assessment is then uploaded to the server (2) where students access it at a stipulated date, time and locality (3, 4). Learners' results are displayed at the completion of the assessment and returned to the server (5). The progress of the learners is monitored by the assessor, who can check the results on the server (6) (Horton and Horton, 2003).

There are other tools that require authors to set a bank of questions and store them in a database. Test items are then randomly generated by the system, subject to predefined parameters such as the number of questions from a particular section of the learning material and the number of questions from each level of difficulty.

3. RESEARCH METHODOLOGY

3.1 Research design

The design adopted in this research involved, firstly, a literature study to obtain a conceptual background of the research area. This provided the secondary data. The literature study also assisted the researchers in deciding 'upon a viable research question that has not been fully addressed' by current literature sources (Oates, 2008, pg 34). As stated in Section 1, this study relates particularly to the South African context and no prior South African study could be identified.

A review of the literature is essential, because through this process, an understanding is developed of the most 'recent and authoritative theorising about the subject' (Mouton, 2003, pg 87) and duplication of previous studies is avoided. According to Mouton, literature supports researchers in understanding the generally accepted empirical findings and in ascertaining the most widely accepted definitions of key concepts.

This was followed by an empirical study in the form of a user-based survey, which is described in Section 3.2. The targeted users were the educators/academics at computing schools who were assumed to be the most likely early adopters of online assessment tools. The results of this survey comprise the primary data for the study, providing the researchers with data for analysis and interpretation. The purpose of this kind of research is to 'add to what is known about the specialist subject' (Oates, 2008: pg 17, 23), by supplementing the literature-based survey with original research on online assessment in South Africa.

3.2 Research methodology

The primary data was obtained by a questionnaire survey which investigated the current situation with regard to online assessment in CS/IS/IT departments at tertiary institutions in South Africa. The survey aimed to identify the nature and extent of use of online assessment tools in the participating departments. The questionnaire consists of a pre-defined set of questions, with alternative sections to be completed depending on the participants' level of usage of online assessment. Items for the questionnaire were developed from concepts encountered in the literature. In addition to the questions that require quantitative answers, there are open-ended questions where respondents could provide qualitative information.

Requests for Gatekeeper consent were made to the relevant departments/schools in all the tertiary academic institutions in South Africa. The questionnaire was then distributed to the departments where consent was provided, as explained in the next subsection. Details of the participants are provided in Section 4.1.

Note: The questionnaire is too lengthy to be included in this paper, but an abridged version follows as Appendix A. The full version can be acquired by request from the authors.

3.3 Ethical considerations

The first step in the survey process was to obtain ethical clearance for the study from the College Research and Ethics Committee (CREC) of the College of Science, Engineering and Technology at UNISA, where the primary researcher is registered for doctoral studies. Gatekeeper consent was then sought from the appropriate Heads of Schools/Departments at 22 South African tertiary institutions, of which nine responded, granting clearance. The questionnaire compiled for the survey was distributed to the IS, IT

and CS academic departments in those nine institutions and volunteers were invited to participate. Each participant was given an informed consent document to complete prior to filling out the questionnaire. The document indicated the purpose of the study and stated that there would be no monetary gain for participants. Furthermore, it was explained that participation was voluntary and that confidentiality and anonymity of records would be ensured.

4. DATA COLLECTION AND ANALYSIS

4.1 Participation: by Faculty and Department

Questionnaires were e-mailed to the IS, IT and CS academic departments at the nine tertiary education institutions where Gatekeeper consent had been obtained. Figure 2 below summarizes the distribution of respondents in terms of Institution, Faculty and School/Department. Schools were categorized as follows:

- SET – Science, Engineering and Technology
- ACM – Accounting and Management Studies
- NAS – Natural and Allied Sciences
- HS – Health Sciences
- HED – Higher Education Department

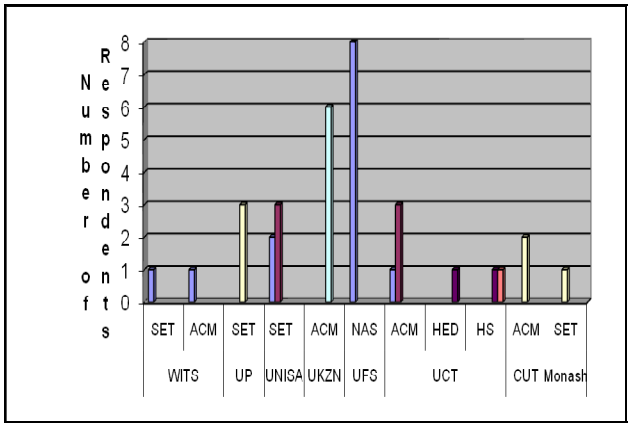

Figure 2: Distribution by Institution, Faculty and School/Department

Figure 2 shows that the largest number of respondents came from CS (13), while IS and IT had an equal representation of six respondents each.

4.2 Participation: by University

Figure 2 also indicates that, in total, a sample of 36 South African tertiary academics volunteered to participate in this study. Sixteen (44%) of them were current users of online assessment systems while 20 (56%) were potential or future users. Of the 16 respondents who indicated that they do currently make use of these tools, 2 are from UP, 2 from UNISA, 3 from UFS, 7 from UCT, 1 from CPUT and 1 from Monash. These 16 current users represent 6 different teaching units. This is a very small number and indicates low-level usage of online assessment tools by South African CS, IS and IT academics.

4.3 Findings

4.3.1 Quantitative Usage of Online Assessment Software

Figure 3 presents the various online assessment tools and systems currently being used by South African academics in CS, IS, and IT, as reported by the 16 respondents who are users.

Very few of the tools outlined in Figure 3 below correspond with those adopted internationally, as identified in the literature (Section 2.4)

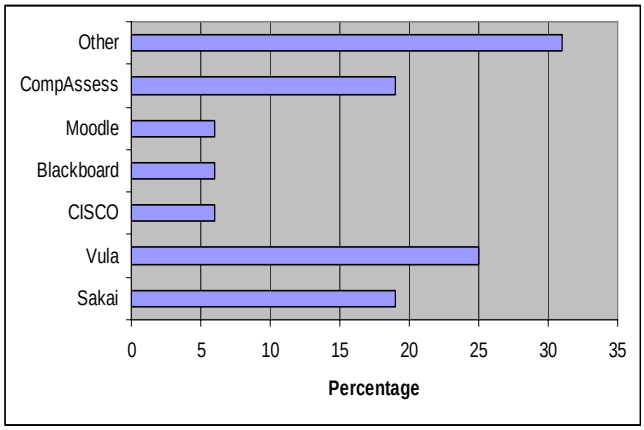

Figure 3: Tools currently being used

Analysis of these tools with school/departmental classification shows that significantly more than expected (p=.042) IS departments use Vula.

Some of these tools were formerly housed on external media and used as computer-aided assessment but now run on intranets and web based environments. Others however are newly developed for web-based learning environments, eg. Umfundi.

'Other' tools mentioned include 'Self Assessment My UNISA'; 'Home-grown automated marking systems'; 'Umfundi and Click UP'; 'Tests, quizzes and examinations' or testing tools that are part of 'learning management systems'.

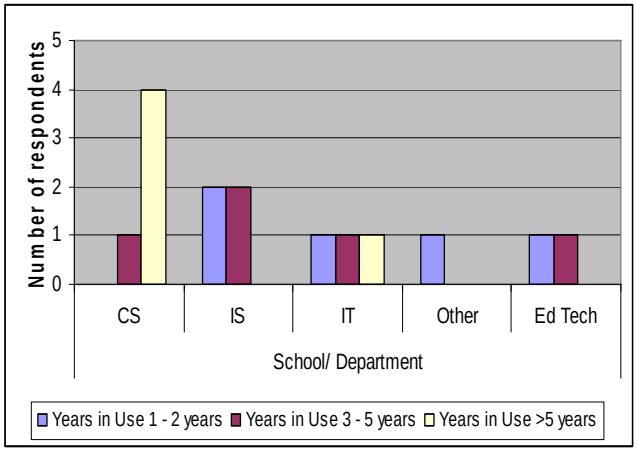

Figure 4: Analysis of usage by school/department classification

Figure 4 above indicates that five of the teaching units surveyed have used online assessment tools for more than five years; a further five units have done so for three to five years; and six units

are new users who have employed these tools during the past one to two years.

Although Figure 4 shows that more of the CS departments have used the tools for more than five years, this relationship is not significant.

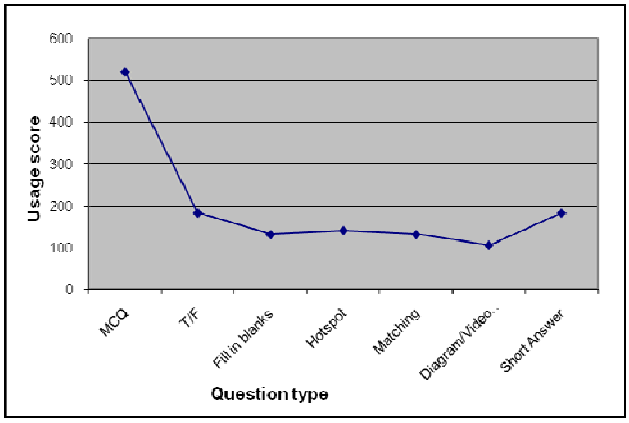

Figure 5: Types of questions supported and their use

The tools currently being used incorporate questions and items in forms such as basic Multiple choice, True/False, Fill-in-the-blank, Hotspot, Matching, Diagram/Video clips, and Short answer questions. This covers most of the types outlined in the literature in Section 2.3. Figure 5 above shows that Multiple-choice and True/False type questions are the most supported and used by these tools.

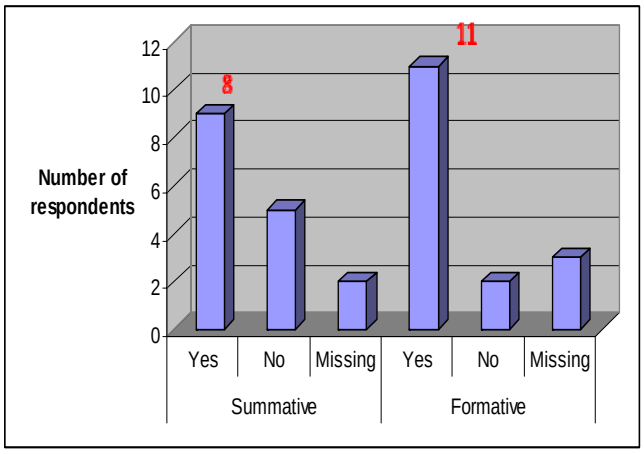

Figure 6: Tools currently being used

Significantly more of the respondents than expected (p=.010) responded affirmatively to using online testing for formative assessment, as depicted in Figure 6. Eleven of the users reported employing it for formative assessment and eight for summative.

YEAR OF STUDY	USAGE PERCENTAGE	AVERAGE CLASS SIZE	RANGE OF CLASS SIZES
FIRST YEAR	**81**	1492	50-5000
SECOND YEAR	**31**	505	120-800
THIRD YEAR	**25**	215	50-600
POSTGRADUATE	**13**	13	10-15

Table1: Levels at which online assessment is being used

Table 1 indicates that the highest usage of online assessment tools is occurring at the entry level, among first-year students, where student numbers are at their highest. Eighty one percent (81%) of the users employed online assessment for their first level, in contrast to only 31% at second level and 25% at third level, with little use at postgraduate levels.

4.3.2 Qualitative Aspects of Online Assessment

The questionnaire investigated benefits and disadvantages associated with online assessments. The results corresponded closely with the secondary data from the literature (Section 2.3). Qualitative results from responses to open-ended questions are presented below:

Confirmed users stated their belief that online assessment is more effective than traditional forms of assessment. Eighty one percent of the current users fell into this category and indicated that:

- feedback is available immediately to students;
- automated testing allows for better management and control of large classes;
- online assessment serves as a time-saving tool;
- the marking/grading process is faster, more accurate, and always consistent;
- the approach provides easier administration of formative and summative testing and other results.

Respondents outlined the following direct *benefits*:

- for students –
  - feedback is available immediately;
  - access to more tests with a wider variety of questions (due in part to question banks synthesized by the educators);
  - convenient and easy access to assessments;
  - the facility to work in a simulated environment;
  - there is uniformity and consistency in marking.
- for educators –
  - economy of scale, in that less time has to be spent on marking, allowing more time for other academic activities;
  - assists in minimising cheating through random generation of questions
  - allows for easier management of large classes;
  - provides more opportunities to assess students;
  - reduces the major administration associated with managing student records;
  - provides better analysis of student performance

Barriers identified to the adoption of online assessment tools include:

- It is time consuming to build a comprehensive set of good questions;
- Technical issues versus ethical challenges, e.g. student test submissions lost deliberately or unintentionally. Infrastructure issues:
  - technology flaws and bandwidth problems,
  - insufficient availability of computers,
  - requirement for a highly competent systems administrator;
- Online assessment is a limiting approach, since it does not test insight into learning content.

These barriers outlined by the respondents show a close correspondence with the constraints identified in the secondary data from the literature (Section 2.3).

Eighty eight percent (88%) of the respondents indicated that they find Web-based online assessment tools more useful than Non-Web-Based tools because:

- they give distance-learners (distance education is increasingly common) equal opportunity to access a greater pool of questions on a regular basis;
- they provide better management of large classes, yet utilise less resources;
- students feel more comfortable in an e-environment;
- they support educators in setting exams for different groups of learners at different times. Inter-learner communication is limited, because the learners cannot take question papers away;
- examiners can present high quality pictures and diagrams by means of colour screenshots;
- they enable a distributed (anytime, anywhere) approach to support additional teaching, communication and assessment.

4.3.3 Non-Users of Online Assessment Software

A variety of reasons for non-usage of online assessment software were given by the 20 (56%) respondents who are non-users. These reasons are depicted in Figure 7.

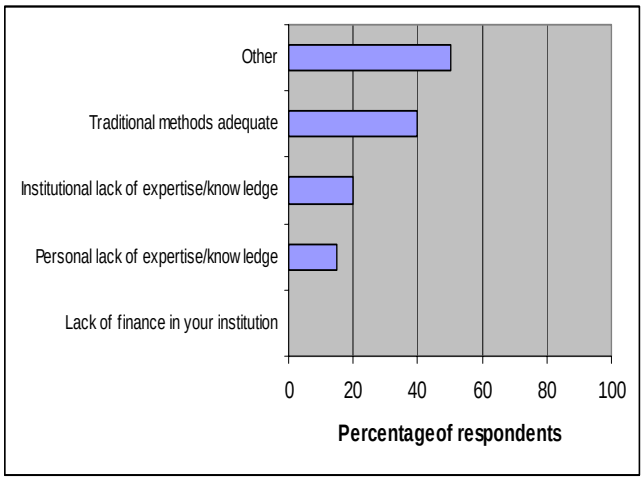

Figure 7: Reasons for non-usage

The greatest category of reasons for non-usage was 'Other', which included issues such as:

- insufficient time provided for academics to learn the software and lack of training on the available software;
- not all students have adequate access to the Internet; many encounter bandwidth problems;
- inadequate infrastructure at testing centres;
- lack of financial resources for pursuing online assessments;
- management decisions prevent academics from adopting online assessment tools;
- online tools inadequate for individual academic's requirements;
- online assessment systems unavailable in the university or in the department.

5. CONCLUSIONS AND FUTURE RESEARCH

Prior to this study, the researchers had limited knowledge of the extent of usage of online assessment tools at tertiary institutions in South Africa, as well as little understanding of the nature of this use with regard to the types of questions and items tested, the level at which such tests were used, etc. Hence this study, which is the first in an envisaged set of three, aimed to establish a broad context as the foundation for subsequent research.

We now re-visit the two research questions and summarise the findings:

1. *What is the current nature and extent of use of electronic assessment in computing-related departments at South African universities?*

According to survey responses, usage appears to be concentrated in six tertiary institutions: UCT, UFS, UNISA, UP, CUT and Monash, with more users being Computer Science academics, who tended to adopt these tools earlier than Information Systems and Information Technology users. In some CS academic units, the tools and systems have been deployed for more than five years. Although the actual extent of usage is low, it is on the increase. There were 36 respondents from 9 institutions, of whom 16 were regular users of online assessment and testing, while 20 were potential users. The systems were used more for formative than for summative assessment. Most usage occurred in cases of high student numbers, i.e. first-level classes with numbers ranging from 50-5000. Questions most frequently used in assessment were multiple choice questions, and true-or-false questions.

Deployment of tools is either limited, or supported by, institution-wide policies. Although a number of academics make ad-hoc use of online assessment and CBT, certain institutions have official policies and procedures, and promote established practices. In such cases there are dedicated laboratories for computer-based testing and administrators to manage testing sessions. The results of summative assessment in the form of tests and exams are recorded automatically on students' academic records, as well as on class records.

Despite the small number of users. a variety of tools was adopted, including Sakai, Vula, CISCO, Blackboard, Moodle, and CompAssess. Assessment was also conducted using Self Assessment on the myUnisa learning management system (LMS);

Umfundi and Click UP, which are custom-developed automated marking systems; and tests/quizzes on various LMSs.

2. *How satisfied are the academic users with the online assessment tools they employ?*

To determine satisfaction, the questionnaire probed the 16 established users on their perceptions of benefits and disadvantages. The qualitative open-ended responses (Section 4.3.2) are mainly in line with the secondary data from the literature study. Though few in number, these established users are, in the main, convinced users. Eighty one percent (81%) of them believe that online assessment is more effective than traditional forms, and motivated this by giving their reasons. They expressed satisfaction with the concept of online assessment, and pointed out advantages for both educators and learners. They also addressed disadvantages and barriers resulting from the use of such tools.

Standpoint of the researchers: Despite their belief that online assessment of MCQ-related questions has many strengths and benefits, the authors acknowledge the drawbacks and concur with the reservations. In particular they take cognizance of the issue identified in the literature and raised again in the survey, namely that questions from the MCQ family, whether online or paper-based, are not appropriate to test all forms of knowledge and learning. Moreover, it is very difficult to design questions that assess insight and higher-order thinking skills.

The study undertaken and the way forward: This study has served to establish the nature and extent of usage of electronic assessment tools in CS, IS, and IT academic units at South African tertiary education institutions, and has investigated the satisfaction of the users of such tools. It has set the context for future research aimed at determining the requirements for electronic assessment tools by this target group of academics, as well as criteria for the evaluation of online assessment tools. Future work will be conducted both by surveying the literature and by conducting further empirical research in South Africa. Participants in this research will be learners as well as academics.

Prior to this new research, efforts will be made to incorporate further African users and non-users as participants in an extension to the present survey, targeting in particular the institutions that did not grant gatekeeper consent in the present study.

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