Student Perceptions of the Implementation of an Indigenous e-Assessment System at a South African University

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ABSTRACT

Identifying a gap in the literature, with respect to student perceptions, on the implementation of e-assessment, as an alternate assessment method, the researcher investigated the students' views, on the implementation of an indigenous e-assessment system, within the discipline of Information Systems and Technology, at the University of Kwa Zulu-Natal. This article focuses specifically on the student perceptions of this form of assessment. The findings clearly indicate student acceptance of this form of assessment, as well as enthusiasm for e-assessment to be made more prominent in other modules they take. This highlights the importance of experimenting with and applying new forms of technology within an academic context, to make the entire learning process more exciting, for both the student, and the academic. Ultimately, this study shows that the implementation of e-assessment was widely accepted by these students, as a novel approach to assessment.

KEYWORDS

electronic assessment (e-assessment), student perceptions, multiple choice questions (MCQs) assessment, higher order thinking skills.

1. INTRODUCTION

The adoption of electronic assessment (e-assessment) in higher education is rapidly increasing especially since e-assessment offers a solution to those institutions looking to address the logistical issues associated with the larger number of students entering higher education [1]. Thus, several e-assessment software that can 'create, deliver, mark, analyse and provide customised reporting facilities' have been developed [2]. Since e-assessment has the potential to motivate student learning, increase the provision of feedback to learners and remove concerns associated with marking, by ensuring consistency [3], some academics have adopted e-assessment for at least some aspect of the assessment of the modules taught [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14]. Commonly adopted e-assessment tools, both internationally and in South Africa, include Coursebuilder for Dreamweaver by Macromedia; HostedTest by HostedTest.com; Hot Potatoes by Half-Baked Software; MarkIt; Perception by Questionmark; Quick Rocket by LearningWare; Random Test Generator Pro by Hirtle Software; Test Generator by Fain & Company; TestLinc for LearnInc by Mentergy; Umfundi by FullMarks; Unit-Exam by Unit-Exam.com, Virtual Assessor [30], and Quizzes in Moodle.

The e-assessment system adopted in this study, called Riddel, is a South African-developed and supported e-assessment tool, that supports various types of Multiple Choice Questions (MCQs), marks all MCQs automatically, offers extensive statistical reporting facilities, as well as includes features that allow questions to be re-marked or excluded, while automatically updating student marks. In addition, Riddel allows for the setting of short answer and essay type questions which can be marked

electronically utilising the built-in on-screen marking tool.
This study specifically focuses on the students experiences with the Riddel e-assessment system and, as such, will contribute to the body of literature on student perceptions of e-assessment, which is an area that is under-researched [15], [16], [17].

2. LITERATURE REVIEW

The worldwide increase in the adoption of online education has expanded the range of options available to academics in terms of the teaching and learning strategies they choose to adopt. Many institutions are using more online delivery of courses, and as a result, e-assessment has increased for both formative and summative assessment purposes.

According to [18], there are two 'drivers' of e-assessment namely, business efficiency – where e-assessment will utilise technologies to support pen-and-paper based assessments using multiple-choice and short answer items; and educational transformation – which adopts various forms of e-assessment, aligned with the module outcomes to be assessed. [19] refer to e-assessment as assessment that is 'stored, delivered, answered and often fully marked automatically, using some form of technology'. Similarly, [20] highlight that e-assessment is considered as a rapid and accurate tool for the assessment of students' learning.

[9] states that e-assessment presents 'a new way of harnessing the power of computers to the field of education'. He believes that e-assessment can support both educators and students in the method of delivering assignments and examinations; creating marking memorandums; using analytical tools for diagnosing and correcting the work submitted by students; and generating automated reports and consolidating students results [9].

Although e-assessment is now the most common term used for all forms of online or automated assessment methods adopted in both e-learning and traditional class-based learning, various synonyms identified in the literature [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [21], [17], [22], [16], [23], [24], [25], [26], [18], [15] associated with e-assessment, are depicted in Figure 1.

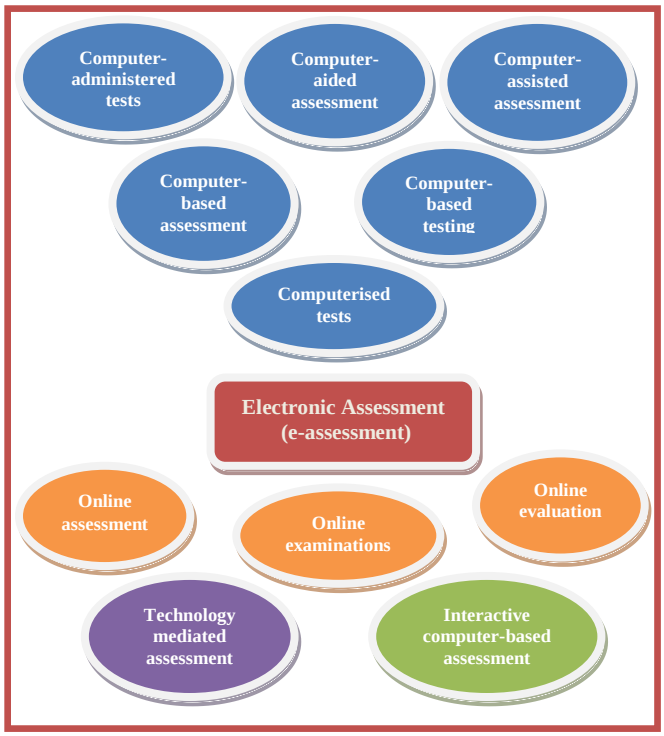

Figure 1: Synonyms associated with e-assessment

For this paper the term of preference is e-assessment – as it encompasses the use of technology to deliver, administer and assess assignments and examinations.

While assessment is a fundamental aspect of a student's learning experience, assessment, and its associated feedback form a substantial part of an academics' workload. Especially with increased student numbers, coupled with declining budgets, e-assessment tools can assist higher education institutions grappling with

these increasing class sizes and the associated demands on educator time and resources [27].

Furthermore, e-assessment can provide detailed, individualised and instant feedback to large numbers of students without additional pressure on the academic [28].

Thus, as outlined in Table 1, and discussed below, e-assessment can bring benefits to both students and academics [21], [17], [22], [16], [23], [24], [25], [26], [18], [15].

Table 1: Synonyms associated with e-assessment

Benefits to academics	Benefits to Students
Time saving	Provides immediate feedback
Enhanced resource use	Offers flexibility
Accurate record keeping	Reinforces student understanding
Convenience and reliability	Innovative method of assessing
Environment friendly	Supports individual learning
Lower long-term costs	Facilitates improved learning
More question variety	Forces students to think systematically
Better engagement with material	Enhances inherent technological skills
Ability to monitor student progress regularly	Gap between actual and desired performance narrows
Implement corrective action	

Learning benefits provided by e-assessments are derived when students reinforce their understanding of core concepts through repetition of material, or by taking a variety of assessments on the subject matter [21], [17], [16], [23], [24], [25], [26], [15].

Features such as detailed feedback and the ability to repeat an assessment are present in most e-assessment systems [12]. Prompt feedback is usually a characteristic of e-assessment. Rapid feedback can help to guide students about the educator's expectations at an early stage of learning [9]. Through the provision of timely feedback that indicates their mistakes, students are able to close the gap between actual and desired performance levels [29], [1].

Besides providing feedback, e-assessment provides an attractive option for higher-education institutions facing the logistical problems associated with the increase in student numbers [24], [25], [26], [18], [15].

The consistency provided by electronic marking reduces concerns associated with subjective manual marking by the human assessor [3], [15], [24].

e-Assessment, through the use of self-assessments, forces students to engage more with the subject material, thus helping them to focus more in the class and also encouraging them to read the textbook. This results in them becoming motivated and ultimately achieving better marks in both summative and formative assessments [24], [25], [18].
e-Assessment can offer a variety of question types for adoption [15], [18], [21], [25]. These questions may also include multimedia elements making the questions more stimulating for the student [21].

Successful adoption of e-assessment systems encourages the educator to focus on the actual assessment process, rather than the potential of the technology alone [17], [21].

Statistical analysis gleaned from the e-assessment system can assist educators in improving assessment questions, as well as provide feedback to educators about gaps in students' understanding of the material taught [17]

It must be acknowledged that, despite the advantages associated with the adoption of e-assessment, that were highlighted above, there are also disadvantages associated with its implementation, which include issues related to

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security, venues, use and usability, and HOTS (higher order thinking skills), discussed below.

Data security can be problematic [21], [18], [15], [26]. The test taker's identity cannot always be accurately determined, which makes it possible for a substitute to take a student's place [2], [8]. Moreover, management problems and logistical errors can occur, such as students forgetting their passwords, and the Internet not being available [2].

Computing facilities where students can access the technology to take the assessment are required. This can prove problematic for students undertaking distance-learning. However, in the context of this research, contact-learning institutions usually have computer laboratories which can be utilised [21], [18], [15], [26]. Accessibility to these venues for the physically challenged must also be considered [30]. Programs that present tests and examinations to students should be user-friendly and have a high level of usability [1], [21], [25].

If students struggle with the mechanics of the software, they will be distracted from concentrating on their responses. In addition, if interfaces are complicated and unfriendly, students with poor IT skills or who dislike the delivery method, may be disadvantaged [30], [18], [15]. Some e-assessment tools have limited features for the disabled [30].

The creation of MCQ questions that assess higher-level thinking can prove to be time-consuming and difficult for the educator [30]. Most often, adoption of e-assessment is simply to measure students' knowledge, skills, and aptitudes and to rank students – thus mainly adopting objective questions [19]. However, e-assessment can encourage guessing, as a student may answer a question correctly not because he or she knows the answer, but simply because he or she has guessed the correct answer from the options provided. Research has shown that in an assessment consisting of 100 multiple choice questions with five options per question, a student who has not attended any lectures and has not studied any of the material may get 20% of the answers correct simply by guessing [30]. Applying negative marking in an assessment can help to discourage guessing [19].

Essentially, e-assessment raises concerns about its capacity to assess higher-order learning [31], [32]. Developing good MCQs is a skill and it takes time to develop valid test items. Students tend to use low-level cognitive skills, such as memorising facts and identifying correct answers from the options provided, rather than showing critical thinking and reasoning in their responses. They do this because they are expected to 'converge upon the right answer and not to diverge on a range of possibilities which a question may open up' [30], [25], [18]. Students may then become comfortable in narrowly reproducing the material taught, rather than developing higher-order cognition abilities of synthesis and evaluation.

Although e-assessment is a valuable tool for both formative and summative assessment, especially if the educator develops a large question bank which facilitates the random selection of questions per assessment, the questions created must be of a high quality so that they can be reused. It is often a time-consuming task to develop good quality questions [19], [30].

Locally, in South Africa, [24], undertook research to determine the perceptions of first-year business management students in their experiences of online self-assessment exercises as a learning tool at an open and distance learning (ODL) tertiary institution. The results of their study indicated that students had an overall positive experience in using the e-assessment tool. Furthermore, the older groups (aged 30+) used the e-assessment tool for self-assessments, more frequently than the

younger age groups. They also found that race did not influence the use of the e-assessment tool. Encouragingly, better academic performance was noted in those students who completed the self-assessment via the e-assessment tool. Thus this research, as presented by other researchers [21], [25], [15], suggests that online self-assessment that provides feedback could enhance meaningful learning and aid students in their preparation for their summative assessment (examinations).

Similarly, in research on e-assessment in Singapore, [23] show that students as 'digital natives' can provide very insightful feedback on technology initiatives; the outcomes have implications for test development, student preparation and the design of the computer-based interface. Despite only half the students having experience of computer-based testing, the majority found it easy to start and navigate through e-assessment, as well as how to respond to the computer-based item types. It is interesting to note that although the on-screen mode is seen positively by a majority of students, some students viewed computer-based assessment as negative. Similarly, some students felt that the onscreen mode made the test easier and some felt it made it more difficult. Thus, as with [15], [16], 25] the overall experience of these students with e-assessment, was positive.

3. RESEARCH DESIGN AND METHODOLOGY

[33] defines research as a systematic process where the researcher learns about a phenomenon or an object, and results in the researcher knowing more than he/she did before engaging in the research process. She presents four ways in which researchers can engage in the research process, that is by 'contributing to the knowledge base in a field (pure research), or improving the practice of a discipline (applied research), assessing the value of something (evaluative research), or addressing a particular problem (action research)' [33]. The present research primarily involves the second form as it attempts to improve the practice of assessment through the implementation of e-assessment.

The implementation of e-assessment, through the adoption of Riddle, at UKZN, was not immediately conceived as a possible research project. Over time, especially after exploratory research was conducted on a set of participants, the experience gained during the implementation of this e-assessment tool was deemed invaluable. Thus, the aim of investigating the implementation situation that the researcher knew very little about, grew into a research project on the implementation of e-assessment in the context of higher education. Ethical clearance was sought and obtained from the University of Kwa-Zulu Natal.

From the above, the idea of researching the implementation evolved more theoretical ideas related to research in the field of e-assessment. In doing this research we adopted a qualitative approach underpinned by the interpretivist paradigm. Qualitative research approaches use non-numerical data, which include words, images, diagrams, and audio, generated from interview transcripts; researchers' notes; published and unpublished documents; memorandums; emails and faxes; and websites as artefacts. Qualitative modes of analysis typically comprise textual analysis of verbal or written data [34].

Interpretive theories aim at understanding the phenomenon being studied [34]. In interpretive studies, data can be collected through interviews and observations, and is inductively analysed to identify the underlying themes and patterns [33].

Thus this research possessed the classical characteristics of qualitative research being subjective and unstructured in nature; involved no manipulation of subjects; took a great deal of time to conduct, and was situated in a domain where there was little distance between the researcher and the subject under investigation.

The next step was to identify possible participants in the study. These participants were all from the University of Kwa-Zulu Natal and included fourteen (14) third year students enrolled in an exit level module in the discipline of Information Systems. The participants were selected using a combination of convenient and purposive sampling methods. A purposive sample is one that is selected based on the knowledge of a population and the purpose of the study.

A convenience sample is where the researcher uses participants that are available to participate in the research study [34]. Students were selected using a combination of convenience and purposive sampling as they were easily available being registered in the module being taught.

The research methods underpinning the research methodology was qualitative data analysis. Qualitative research 'abstracts from the research data, the verbal, visual or aural themes and patterns' that the researcher deems relevant for the study [33]. [34] states that the creation of themes and patterns is also referred to as 'coding'. Coding is accomplished through labelling each piece of text that signifies a specific thought or idea. This facilitates the researcher finding similar patterns among the varying pieces of textual data that have been collected. Sometimes, a single piece of text may contribute to more than one theme and thus maybe assigned more than one code. Coding can be undertaken manually or electronically.

In this research, data collection occurred through an observation of students' interaction with the tool, as well as student experience with tool through a feedback survey. The data was extracted using multiple methods. Students were observed as they interacted with the system. Following the e-assessment students recorded their experience with tool in a brief feedback survey. The data in this research, was analysed and manually coded, using common themes, that were generated in the findings, and thereafter written up in detail.

4. DISCUSSION ON THE IMPLEMENTATION OF RIDDEL

Following a demonstration of the Riddel tool by the developer to the School of MIG (Management, Information Technology and Governance) at the University of Kwa Zulu- Natal (UKZN), the researcher was tasked by the Dean of the School of MIG with implementing this tool at UKZN. During a review of the Riddel system it was noticed that it offers more than just your standard MCQs (questions, with 4/5 distractors), and a matching answer). Some of these question types include, matching questions, fill in the blank questions, hotspot questions, diagram and video based questions, drag and drop questions, and short answer questions. This ability to offer students a variety of question formats in a single assessment that would be marked automatically, was attractive.

The Riddel e-assessment tool was adopted to conduct a summative assessment for a third year exit level module in the Discipline of Information Systems at UKZN. Fourteen (14) students were enrolled in this module, which was based on the concepts of Green Computing – which is defined as the 'study and practice of designing, manufacturing and using computers, servers, monitors, printers, storage devices, networking and communication systems efficiently and effectively, with zero or minimal impact on the environment' [35]. The

summative assessment conducted using Riddel contributed 40% towards the student's final mark for the module.

These students were using Riddel for the first time. To ensure that all University specified procedures were followed for the assessment, two (2) independent invigilators were employed to conduct both the administration and invigilation of the test.
Each machine was pre-logged in using the ICS Exam Logins, before students arrived. The Riddel tool was also opened on each machine prior to the students arriving. Thereafter students were seated, and they were given the password for the test to enable them to login to the assessment. The assessment password was used as a double security measure, as they also had to input their student number to give them access to the test. It was noted that the speed of the logging in procedures for students was much faster than during the Pilot session.

The assessment was designed to include three (3) MCQs and four (4) Short Answer questions as presented in Table 2.

Table 2: Question type breakdown

Question type	Marks
MCQ: Complete a diagram	8
MCQ: Fill in the blanks	5
MCQ: Drop-down list	3
Short Answer	28
TOTALS	16

The MCQ component, which utilised varying MCQ types, comprised 36.3% of the marks, while the Short Answer questions comprised 63.6% of the marks, adding up to an unconventional total of 44 marks (100%) for the assessment. e-Assessment makes this concept of 'unconventional' total marks more feasible as there is less work involved in calculating 'odd' marks (marks not totalling to the typical round figures academics are used to).

In addition to answering the questions online, students were given a page on which their details, unique code generated by the tool had to be entered. The code generated can be converted to a mark in case the results are lost (as part of a backup). For example, if a student does the assessment off-campus (in the case of formative assessments) the student can send the code back to the examiner, where it can be decoded to determine the student's mark. If the mark is not shown, the student cannot decode the code by him/herself. The code generated is unique to each assessment and to each student (each student gets a different code for the same mark), so the assessment that generated the code must be used to decode the code. During a summative assessment, it also serves as proof that the student completed the assessment during the test session itself, while being present.

At the end of the test session, the two sections had to be extracted separately, with the MCQ component being marked instantly by Riddel itself and its related statistical analysis provided immediately. The written component was stored in a different file. The on-screen marking facility in Riddel proved efficient and effective, allowing for partial marks to be allocated as well as individual comments to be added in by the marker. The marker found the grading of these Short Answer questions to be effortless. The only shortcoming faced by the examiner was that the grades for two sections had to be exported to Excel and then 'married' to provide the student's total score. However the overall time saving was impressive (approximately 1/3 of the usual manual marking time was taken to complete the marking and grading of all fourteen (14) scripts).

5. STUDENT PERCEPTIONS ON THE RIDDEL E-ASSESSMENT SYSTEM

A short survey of student opinions on this form of assessment indicated that all fourteen students (100%) were pleased with the use of

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the Riddel tool. Their positive comments are summarised and illustrated in Figure 2.

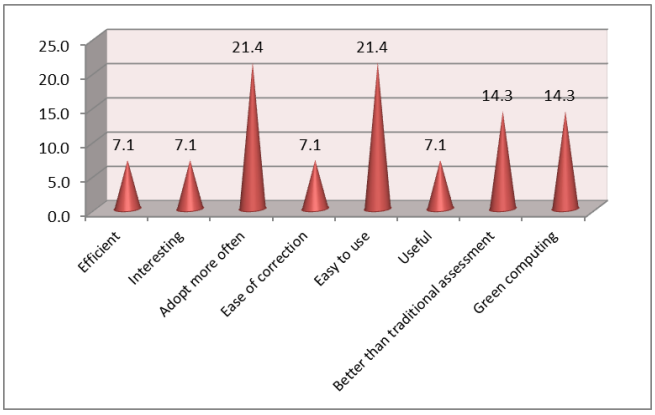

Figure 2: Student opinions of the Riddel e-assessment tool

Student1 (S1) stated that Riddel was "efficient…especially for diagram based questions". S3 found Riddel "interesting". Both S3 and S4 requested that it be "used more often" while S9 indicated that he "wouldn't mind using it again". S6 appreciated the ease at which changes to answers could be made online stating that "it was easy for me to erase my work, and it still looks tidy". Despite not being exposed to Riddel, S7 and S13 commented that "it was easy to use", with S7 adding that after "spending a few minutes getting used to the interface" it became intuitive, "with no complications" S14, which is a "benefit to both IT and non-IT students" (S13). This was supported by S9 who found the "overall tool to be user friendly, with an easy to use format". S13 added that Riddel was useful to testing his "understanding of the content material". S11 preferred the electronic format to the manual format of assessments "… much better than writing with pen and paper". S1 and S14 stated adopting e-assessment followed the principles being taught in this module titled Green Computing stating that Riddel is "green" (S1), there is "no wasting paper and ink" (S14).

A few students provided suggestions on improvements to Riddel's functionality and usability. These comments are briefly summarised in Table 3.

Table 3: Suggestion from students to improve Riddel

Suggestions themes
Additional features
Instructions and messages
Navigational flexibility
Power failure backup

Additional features - S1 and S5 suggested the inclusion of spelling and grammar check facilities, especially with the Short Answer questions where students are "typing so fast that they type the wrong words". The inclusion of an on-screen timer facility, letting students know automatically how much time they have left as well as how many questions remaining, to ensure that they complete the assessment timeously, was requested by S2, S3, S4, S5, S6, S9 and S14. This could also serve to record the total time taken by the student to complete the test. S10 suggested the addition of a 'clear page' button, will allow the student to clear the entire page and re-commence with his answer, following a change in thought in his mind.

Instructions and messages - S4 said that the instructions provided at the start of the assessment should be more specific. A message informing the student that "the assessment has been submitted successfully" (S9) is an imperative feature which is clearly lacking in Riddel.

Navigational flexibility - S9, S10, S11 and S12 added that the student should also be allowed the flexibility to "visit a section again, once it has been completed" to allow them to revisit their answers, prior to submission.

Power failure backup - A pertinent query was made by S6 "what would the lecturer do if the electricity was cut-off in the middle of the test?", suggesting that some facility should be available within Riddel to backup the assessment in the event of a power failure –

thus allowing students to resume the assessment when electricity is re-connected.

6. CONCLUSION AND RECOMMENDATIONS

The findings of this research will be useful to various stakeholders: academics at higher education institutions who wish to implement e-assessment software; students who will benefit from new educational technologies as a supplement to traditional assessment; and educational institutions due to increased productivity of their academics who will be able to save time formerly spent on manual assessments.

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