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Solving the 'Riddel' of e-Assessment: Student Perceptions

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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, named Riddel, within the discipline of Information Systems and Technology, at the University of Kwa Zulu-Natal. The Riddel e-assessment system is briefly introduced before the student perceptions of this form of assessment is presented. 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, indigenous systems.

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], academics internationally have adopted e-assessment for at least some aspect of the assessment of the modules they teach [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14]. Commonly adopted e-assessment tools, both internationally and in South Africa, include Hot Potatoes by Half-Baked Software; MarkIt; Perception by Questionmark; Random Test Generator Pro by Hirtle Software; Test Generator by Fain & Company; 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 provides various types of Multiple Choice Questions (MCQs). Key features of Riddel include automatic marking of MCQs, extensive statistical reporting facilities, as well as facilities to re-mark or exclude questions, while automatically updating student marks. Additionally, 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 presents students' perceptions of 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.

Reference [19] refers to e-assessment as assessment that is 'stored, delivered, answered and often fully marked automatically, using some form of technology'. According to reference [18], there are two 'drivers' of e-assessment, namely, business efficiency – where e-assessment utilises 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.

Similarly reference [9] states that e-assessment presents 'a new way of harnessing the power of computers in 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].

Reference [20] highlights that e-assessment is considered as a rapid and accurate tool for the assessment of students' learning.

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 associated with e-assessment, include computer-administered tests, computer-aided assessment, computer-assisted assessment, computer-based assessment, computer-based testing, computerised tests, online assessment, online examinations, online evaluation, technology mediated-assessment, and interactive computer-based assessment [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [21], [17], [22], [16], [23], [24], [25], [26], [18], [15].

The term of preference adopted in this paper 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. Increased student numbers, coupled with declining budgets, have resulted in placing greater demands on educator time and resources [27].e-Assessment tools have easily been adopted in these institutions [36].

e-Assessment tools can assist higher education institutions to reduce these demands by incorporating features that provide detailed, individualised and instant feedback to large numbers of students, without additional pressure on the academic [28].

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: Benefits associated with adopting 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	

Carefully designed multiple choice quesions, lend themselves to e-assessment, since these tools facilitate the accurate of measure knowledge, comprehension and application of learning outcomes [37]. Features such as detailed and prompt 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].

Prompt feedback is usually a characteristic of e-assessment. This rapid feedback can help to guide students about the educator's expectations, at an early stage of learning [9].

Besides providing feedback, e-assessment provides an attractive option for higher-education institutions grappling with the logistical problems associated with the increase in student numbers by supporting enhanced utilisation of resources [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].

The ability to repeat a test, which is present in most e-assessment systems, promotes active engagement by the learner [12,38]. Thus, e-assessment systems allow educators to assess the students both with formative and summative objectives [31]. 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].

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 an 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 security, venue availability, use and usability, power disruptions, and HOTS (higher order thinking skills), as 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].

Management problems and logistical errors can occur, especially when students forget their passwords, or the Internet/network is not 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]. Furthermore, Some e-assessment tools have limited features for the disabled [30].

e-Assessment often raises concerns about its capacity to assess higher-order learning [31], [32]. 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], which some academics are unwilling to invest in. Most often, educators prefer to adopt e-assessment simply to measure students' knowledge, skills, and to rank students – thus mainly adopting objective questions [19].

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, if MCQs are not developed to stimulate HOTS.

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].

Locally, in South Africa, 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 was undertaken [24]. The results of the study indicated, by the students, an overall positive experience in using the e-assessment tool. Interestingly, the older students (aged 30+) used the e-assessment tool for self-assessments, more frequently than the younger age groups. Better academic performance was recorded 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, students, who are regarded as 'digital natives', provided insightful feedback on technology initiatives adopted in assessment [23]. Despite only half the students having experience of e-assessment, 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. However, as with references [15], [16] and [25], the overall experience of these students with e-assessment, was positive. These postitive student perceptions of e-assessment have implications for test development, student preparation and the design of future e-assessment systems.

e-Assessment tools were typically designed to assist educators in reducing the burden associated with administrative tasks. In recent times, these tools have evolved to become valuable ways of fostering self-directed learning. More especially, if these tools are readily available for students to use in their own time, the support and assistance provided by the automated feedback facilities, can offer great support for learner engagement and self-learning. Many higher education institutions are currently adopting e-assessment tools either for marking students' assessments or for providing feedback to students, in an attempt to enhance the student's learning experience [36]. Reference [38] suggests that as students spend time increasing their knowledge and redoing formative e-assessments, until they get a good mark, they are actively participating with the module content, thus increasing student engagement levels. This, in turn, helps them to focus more in the class and also encourages them to read the textbook, to better understand the content they are having difficulty comprehending. Furthermore, they become motivated, following the feedback from the e-assessment tool, on their actual understanding of the material taught, and ultimately achieve better marks in summative assessments [39].

Although there are many e-assessment tools available [30], the deployment of e-assessment tools follows a similar cycle of developing, conducting and reporting assessments.

The six step cycle, suggested by reference [40], is depicted in Figure 1.

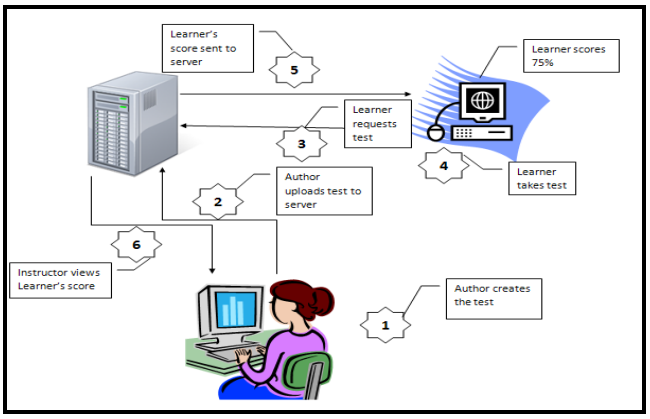

Figure 1: The cycle of developing, conducting and reporting tests
(Adapted from [40]: 328)

The process suggested, involves the following:

- initiation of the test – the academic creates the test with the e-assessment tool (1 in Figure 1),
- uploading of the e-assessment to the server (2) where it can be accessed by students at a specified date, time and locality (3, 4),

- displaying and storing of the students' results after the assessment is completed (5), and
- monitoring the progress of the students by the academic (6) [40].

In similar research, five processes usually followed in e-assessment are presented. These include:

- presenting the scenario or question to the student,
- obtaining a response entered by the student on the computer,
- evaluating the student's response,
- providing a mark or score to the student, and
- providing feedback to the student [9].

All the above processes require that the underlying system be reliable.

Generally, any e-assessment system includes the following procedures:

- access to the system by running the executable file or via the web link,
- authentication of students through the use of log-in details which are also used to map feedback to each individual student,
- presentation of the assessment, both the instructions and the questions,
- responses entered by the student to the questions presented,
- recording of student's responses to the questions presented,
- marking of the student's responses, automatically, and
- feedback presented to students either in the form of marks gained, correct responses to questions highlighted, or sending of feedback to the individual student in a personalised manner [41].

3. RESEARCH DESIGN AND METHODOLOGY

Reference [33] defines research as a systematic process, where the researcher learns about a phenomenon or an object. Four ways in which researchers can engage in the research process, include 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 third form as it evaluates the implementation of e-assessment, from students' perspectives.

The implementation of e-assessment, through the adoption of Riddel, 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 by students 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. Hence retrospective ethical clearance was sought and obtained from the University of Kwa-Zulu Natal.

A qualitative approach, underpinned by the interpretivist paradigm, was adopted in this research. 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 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. The participants in this study, 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.

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

In this research, data collection occurred using multiple methods. Firstly, students were observed as they interacted with the system. Thereafter, following the e-assessment students recorded their experience nt with the e-assessment tool, in a brief feedback survey.

As stated previously, qualitative research 'abstracts from the research data, the verbal, visual or aural themes and patterns' that the researcher deems relevant for the study [33]. Reference [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.

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. OVERVIEW OF THE RIDDEL E-ASSESSMENT SYSTEM

As described by references [40] and [9], Riddel contains the features of a complete e-assessment system.

The software consists of an editor and a reader. The assessment is *compiled* on a computer which has the *editor* installed, while the assessment (formative or summative) can be *accessed* on a computer where the *reader* is installed. Hence, the academic compiling the assessment has to have the editor installed, while the learner should install the reader, to view and take the assessment.

Riddel runs on the local network, where the results of the test are captured into a database. The results can then be altered (if automatically marked), marked manually and statistically analysed.

An advantage of using the Riddel editor on a local machine is that the assessment can be compiled offline, like a presentation, without being connected to a network. This allows the academic the flexibility to create the assessment, at their convenience (with respect to time and location).

Prior to uploading the assessment to the server for students to take, the names and student numbers of the registered students are incorporated into the assessment, merely by copying and pasting from the current class list. This facilitates the marking process, as Riddel writes all the responses of the students back to the server from where it was retrieved with an extractor file.

Riddel also offers comprehensive statistical reporting on the student marks file.

Since Riddel runs on a local server, the file size and the number of students writing the test simultaneously, is not an issue, provided the network infrastructure can support this.

Furthermore, it makes provision for different types of multiple choice questions including crossword puzzles, hot spot questions, one sentence written answers, as well as essay type questions. One sentence written answers are marked by the computer according to the memorandum, but can also be remarked manually afterwards. Riddel cannot automatically mark short answer questions or essays but makes the marking of these questions much easier and faster, with the in-built onscreen marking tool. Riddel can be used for both official online summative assessment, or formative assignments offline.

5. DISCUSSION ON THE IMPLEMENTATION OF RIDDEL

Following an introduction to the Riddel e-assessment system at the School of MIG (Management, Information Technology and Governance) at the University of KwaZulu- Natal (UKZN), the researcher undertook to experiment with, and implement this e-assessment tool at UKZN. The ability to offer students a variety of question formats in a single assessment, that would be marked automatically, was of particular interest to the researcher.

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 – 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 had not been exposed to any form of e-assessment, in any module, during their degree program. They were thus using Riddel, and e-assessment, 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 University provided Exam Logins, before students arrived at the venue. The Riddel tool was also opened on each machine, prior to student arrival. 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.

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	44

The MCQ component, which utilised three 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, and the unique code generated by the tool, had to be entered. The code generated is associated with the student number, and 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 were extracted separately, with the MCQ component being marked automatically 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 marking of these Short Answer questions was effortless. The only shortcoming faced by the examiner was that the marks for the 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 28 mark Short answer section, of all fourteen (14) scripts).

6. STUDENT PERCEPTIONS ON THE RIDDEL E-ASSESSMENT SYSTEM

A short survey of student opinions on the adoption of e-assessment, conducted immediately post the assessment, indicated that all fourteen students (100%) were pleased with the use of the Riddel tool. Their overall comments were positive, and are summarised and illustrated in Figure 2.

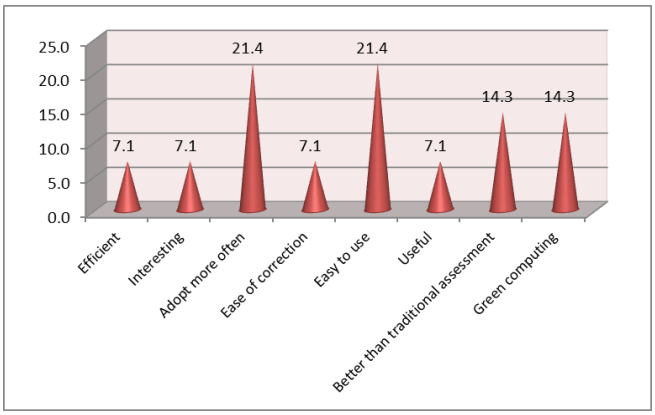

Figure 2: Student opinions of the Riddel e-assessment tool

Student1 (S1) stated that the Riddel e-assessment tool was "efficient…especially for diagram based questions". S3 found Riddel an "interesting" way of testing. 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 (S6) to erase my work, and it still looks tidy". Despite not being exposed to Riddel (or any other form of e-assessment), S7 and S13 commented that "it (the Riddel e-assessment tool) 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. S13 added to the 'ease of use of Riddel' by stating that the interface was simple enough implement this form of e-assessment to "benefit to both IT and non-IT students, in the future". This was supported by S9 who found the "Riddel assessment tool to be user friendly, with an easy to use format". S13 added that Riddel was better than traditional assessment as it helped him to "focus on answering the questions asked", thus providing his

"understanding of the content material", rather than worrying about his hand-writing. S11 also preferred the electronic format to the manual format of assessments "… much better than writing with pen and paper format, as the structure and layout is much neater". S1 and S14 stated that 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). Thus the alignment with the module objectives, was perfectly achieved.

A few students provided suggestions on improvements to Riddel's functionality and usability. These comments are 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 and progress bar. Letting students monitor 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 timer facility could serve a secondary role, by recording 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 of thought in his mind.

Instructions and messages - S4 said that the instructions provided at the start of the assessment should be more specific. Additionally, 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 re-visit a section, once it has been completed" to allow them to review 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. This is even great importance now, with the current power shortage faced in South Africa, and the implementation of regular load shedding.

7. 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 who are encouraging academics to increase their research productivity, which can be accomplished through the time saved from implementing e-assessment, rather than manual assessments.

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