

**Web-based Assessment in Higher Education:
An effective tool**

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Abstract

In this paper we report on research related to the pilot project of provision of Web-based assessment used in the final exam of physics and medicine university undergraduates. A cohort of 449 university undergraduates took part in a computerized assessment and was provided with automated feedback on their performance. A sample of students responded in a short questionnaire to assess their attitude to the accessibility, usability, assessment delivery and quality of the feedback provided. In this paper, we briefly describe the web-based assessment and the system of automated feedback used in our research, and we also present the findings of the attitude survey and their perception about the usability and accessibility of the assessment. On average students reported that they had a good attitude to our web-based assessment and automated feedback system.

Keywords: Electronic Exam, Web-based, Assessment, Computerized Assessment

Introduction

Assessment is an essential component of any education system. To a large extent, educational institutions use summative assessment to size up what students have learned on the completion of a term or year. This ensures that students meet necessary standards for promotion to the next level of education. The final exams help in the improvement of education process if the exams are designed to motivate the students to keep them well prepared (Morgan et al. 2004). The primary purpose of assessing students at the end of their academic year is to inform them about their strengths and weaknesses (Morgan et al. 2004, Brown et al. 1997). The students have a chance to make their learning better and increase their performance based on the feedback provided by an assessment whereas the final exams normally tells about the final grade scored by the student in relevant module. (Yorke 2001). The students have a potential opportunity to improve their learning experience based on the feedback provided by an assessment and this improvement can encourage the students to take more interest and help in student retention. The amount of work generated as a result of this activity can discourage the staff for effective assessment and feedback (Morgan et al. 2004, Brown et al. 1997 and Yorke 2003).

Although the computer has become helpful in the improvement of educational process and the computer technology has provided many tools that are helpful in all levels of education system, the oral test and the paper and pencil test are still commonly used tools of evaluation and assessment. The goal of traditional as well as technology tools is to evaluate the abilities and capabilities of the students so that feedback can be provided to enhance their learning experience. The E learning technology is coming handy to provide supportive solutions for online instructions and testing and provides the organization potential means for provision of computerized assessment and feedback. Charman (2002), Sly and Rennie (2002) and Steven and Hesketh (2002) suggest positive results by providing computerized assessment and feedback. In this paper we present our approach to the provision of automated assessment and feedback using a self created web-based assessment (e-

exam). The focus of this paper is to identify if the automated assessment will be useful for students and this paper will talk about usefulness of the assessment.

Computerized Assessment

The economic pressure all over the world has generated an interest in the education community to develop online systems to deliver courses, collect feedback from students and give assessment back so that the evaluation is quick and can help the students in taking an opportunity to improve and enhance students' learning experience. The universities and the institutions are in the process to change their strategies of instructional mechanisms so that the online support tools can be used either to completely use online and E learning tools or use as a support tool to enhance the learning experience. This will give the students to complete the courses at economic price and also the universities will be able to extend their services across globe and earn more revenues. Computerized assessment (CA) is increasingly being used to assess student learning both formatively and summatively in higher education. CA offers both pedagogical benefits and efficiency gains where appropriately and effectively implemented and can provide immediate supportive feedback for each question, tailored to the answer given. Superior graphical and visualization exercises can also be included with the use of multimedia files such as graphics, sound and video clips. CA offers a facility for reporting results and analyzing student responses. An increasing number of systems are web based. CA is a form of computer-assisted assessment in which questions are presented and responses assessed entirely by computer software, with no paper involved. Subject domain experts add questions with a different level of difficulty based on the set criteria for marking. The level of difficulty of the questions administered to individual students is randomly and dynamically tailored to their proficiency levels. Wainer (2000), Conejo et al. (2000), Fernandez (2003), Brusilovsky (2004) amongst others have reported on the benefits of the computerized assessment approach across a wide range of educational settings.

The researchers focused on a web-based assessment (e-exam) prototype designed, implemented and evaluated at the King Abdulaziz University. The e-exam software prototype introduced here comprises a graphical user interface, an adaptive

algorithm based on the Three Level Randomization model and a database of questions. The database of questions is employed to store information about question stem, distracters, key answers, topic area, recommended revision task and values for the parameters required (Lord 1980, Wainer 2000). One of the central elements of this model is that the software automatically randomizes the difficulty level and questions being answered by the students. For questions an initial value of the difficulty parameter for each question is defined by subject domain experts ranging from 1 (easy) to 3 (hard). The randomization is updated after every assessment session. Contrary to other computer-based tests, our a-exam is an efficient program that requires considerably a smaller amount of time to manage. Every test carries a certain criteria, such as, waiting time or closing the test. When the test stops, the computer reports the results.

E-Exam – An Overview

This e-exam is designed to hold the 'periodic' tests and 'end of the semester' examinations electronically in order to save time and effort which is required to create, publish, and check the examination. Since the tests are electronic, their checking is also performed electronically to reduce the chances of human error.

The a-exam process is completed in five steps:

Step 1. Adding Questions

This step is specific for the subject domain experts who add questions from the topics given in the curriculum. This is followed by adding the right answers in the program. They also classify each question according to the difficulty level, marks, and approximate time required for its solution. The faculty member may add as much questions as he wants from each chapter or unit making sure that no question is repeated.

Step 2. Formation of the Exam

After including all possible questions, the subject domain experts define the testing standards by deciding the number of questions, their difficulty level, and marks, forms different tests according to the number of the students so that all students are given mutually different test but of the same difficulty level.

Step 3. Examination

The students take the test through a specialize software which gives student certain facilities, like marking a specific question and returning to it any time later during the test, displaying number of the answered questions and showing the time left. The system is username and password protected and secured. Once the student enters in to the system by a unique username and password, the system only provide him/her access to the courses he/she is registered for. The software asked to close all other windows and applications on the computer and stop all other programs running on it.

Step 4. Evaluation

The test submitted by the student is electronically evaluated and students are provided with the feedback on the exam taken.

Step 5. Assigning Grades

The integrated electronic system of the university then automatically assigns grades to the students after the evaluation.

The study

A group of 449 university undergraduates participated in the pilot project of web-based assessment using our e-exam software prototype as part of their 40% of final exam marks. 164 students were from medicine and 285 students were from physics. The participants had two hours to answer 20 multiple choice questions in

physics and 79 multiple choice questions in medicine. In physics, the difficulty level of 20 questions was of mixed difficulty level. In medicine, 43 questions within the difficulty level easy and 36 questions were from moderate difficulty level. As mentioned above, the difficulty levels ranged from 1 (easy) to 3 (hard). All 449 participants received feedback on performance using the automated feedback application. It was therefore important to investigate the perceived usefulness and ease of use of the a-exam and automated feedback application.

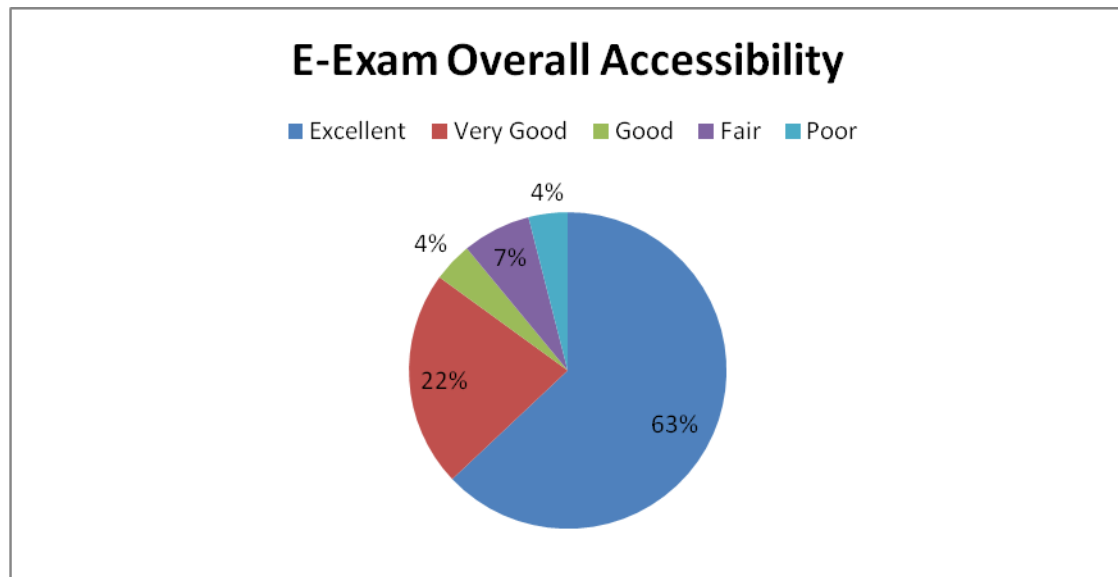
Results

In order to investigate the students perception about the usefulness and ease of use of the a-exam and automated feedback application, the participants were invited to complete a questionnaire in which they were asked to rate a series of statements using a Likert scale from 5 (excellent) to 1 (poor). A group of 449 participants from the physics and medicine undergraduates participated in the evaluation. An important assumption of our work was that e-exam to be useful should be timely, support individual development and informs students about their strengths and weaknesses. The mean score and standard deviation of the participants is presented in table 1.

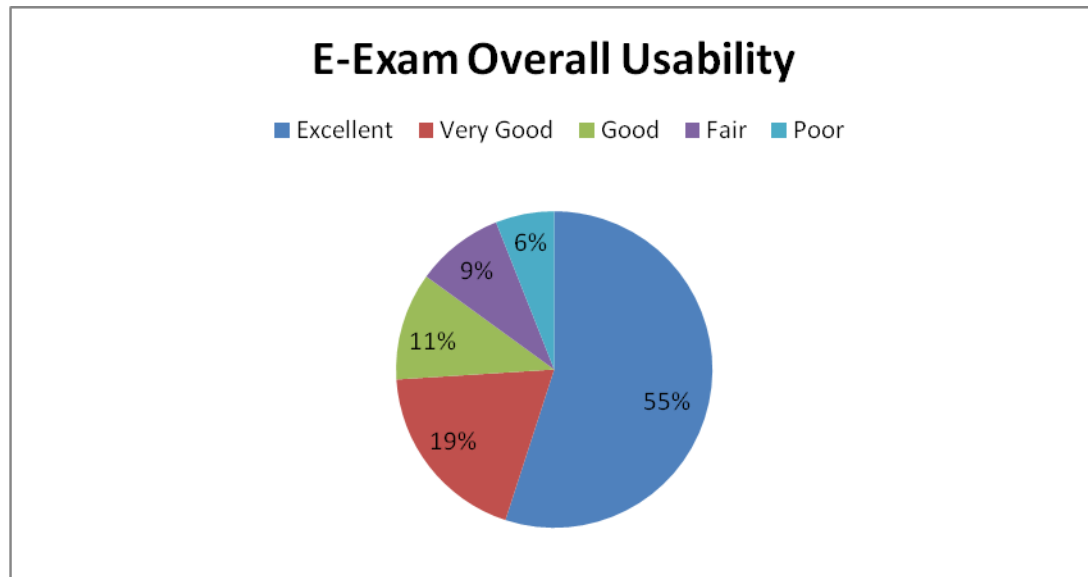
Table 1: Descriptive Statistics for physics and Medicine Students

Topic	No. of Students	Mean	SD
Usability	449	2.50	1.38
Accessibility	449	4.33	1.51
Delivery	449	3.33	1.51

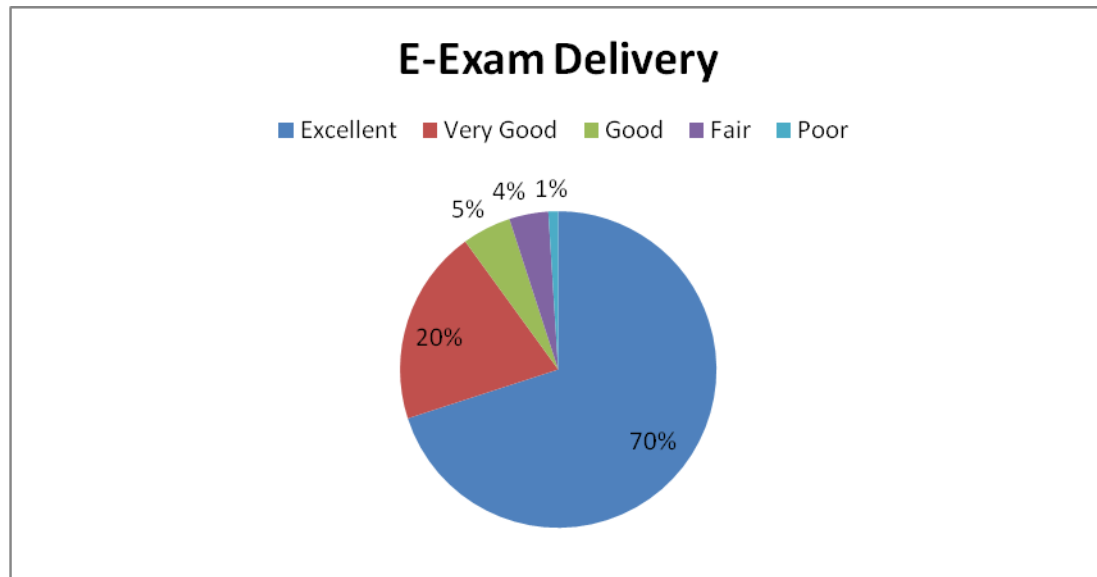
In a structured set of survey questions using a Likert five point survey, with 5 representing excellent and 1 representing poor, high mean scores were obtained in the areas of accessibility, usability and delivery of the assessment (Table 1). Overall the e-exam has maintained highly favorable response from students across both disciplines.

Chart 1. E-exam overall accessibility results

More students (63%) believed that the accessibility issues of the software were addressed well and they had a very comfortable accessibility experience with software, whereas 22% thought that software was good in accessibility but still had some issues in consistence of fonts across the entire interface. Although 4% of the students thought that the software was not accessible and had issues with navigation and ease to understand the pattern of animations used in system, 7% of the students rated it to be fair in use and were able use the system with some training with 4% of the students having an overall good experience with some difficulties.

Chart 2. E-exam overall usability results

More than half of the students (55%) thought the software was usable and doing the purpose as it should whereas 19% of the students also were comfortable using the software with very little difficulties. These students were satisfied to use the system. Very less students (6%) had usability issues and most of these students included the ones having accessibility issues as well. The 9% of the students were fairly happy with the system but having some major usability issues like the way activities were performed in the system were not according to their understanding level and they had difficulties following the activities properly. The 11% of the students had overall good experience in using the system with some problems in usability like they did not follow some activities partially because of the speed with which activities were performed by the system.

Chart 3. E-exam overall delivery results

Majority of the students (70% having excellent satisfaction in delivery of the desired content and 20% having some very minor issues with their expectation of information being presented and the feedback system) thought the software was delivering the desired content in a good and understandable way and there was reasonable feedback mechanism in the system to help students use the system effectively. The 5% of the students were overall happy with delivery of the content however a very small percentage of students (4% having some reasonable experience of the software 1% having major difficulties in the delivery of contents and their understanding) had some major issues with using the software and reported some problems like contextual help availability issues, content delivery time issues and the relevant content display when needed problems.

The results show that the application was favorably received by the participant students. On average students thought the e-exam to be quick and capable of providing useful information for individual development. In addition, the e-exam was

perceived as easy to use. An interesting finding was that the participants deemed the performance per topic and per question as a better indicator of how successfully they have learned than the overall score. One reason for this could be that the each subject is broken in parts and into different topic areas, providing a clearer indication of what has been achieved. These results suggest students' perception of the e-exam and automated feedback provided was good. Students on average found it useful in understanding how successfully they had learned. The e-exam was easy to use and the automated feedback was fast and effective in identifying strengths and weaknesses.

Summary and discussion

This paper is concerned with the use of a web-based assessment in a higher education context. The work reported here is an extension of a previous study by the e-learning committee and examination department in King Abdulaziz University. In this study, e-exam was initially piloted and was employed to provide students with feedback on performance in a formative assessment context. The focus of this study was to evaluate the usefulness of the assessment with particular emphasis on accessibility, usability and content delivery of the assessment. The university is showing more and more interest in using online assessment and testing technology solutions and this study was a step to understand and evaluate the acceptance of the online assessment by the students and collect their feedback so that a data analysis can be done to get some findings that can become a basis for future technology innovations for E learning tools and technologies. The computer based online and offline assessment tools are emerging for different subjects and domains and our university is also joining this campaign to get benefit of the technology and extend its services so that the students on campus can get support from using these tools and also the off campus students can get their degrees effectively with an interactive assessment and consequent feedback system.

The students were evaluated for their accessibility preferences in using the assessment based on different metrics like High Contrast, Keyboard preferences and Screen reading preferences etc. The purpose of the evaluation was if the color scheme used to present the information was liked by the student, keyboard was visible when

needed or there was easy way to get keyboard help where needed and the information was presented textually or graphically as expected. The assessment was also evaluated against usability preferences of the students if the assessment design was based on the the understanding and consideration of human psychology and behaviors and about content delivery of the assessment system.

The study data indicate that the students showed good interest in usage of the online assessment systems. The staff involvement in the assessment process is also optimized in a way that the staff has to add the questions for assessment in the system and then schedule the exams when needed so once the system has been setup, it will not use much time from the staff and therefore save the staff from extra fatigue. This will encourage the staff and the students to use the online assessment system for evaluation and quick feedbacks so that an effective learning environment can be established

Educational Implications

The system has been successful in providing formative assessment and therefore we will move to using it for the final year exams in the coming academic year. This will allow a much greater range of question types to be used in both the formative and summative modes by removing the limitations imposed by the use of the optical mark reader for the summative assessments. The system will also be extended to cover all of the material in the courses and the results of the study reported here used to encourage more students to use the system.

In Kingdom of Saudi Arabia, as elsewhere in the world, universities are using information and communication technology more and more to deliver instructional materials, to communicate with students and to assess their academic progress. In our study we believe that the use of web-based assessment, both formative and summative, has led to significant benefits for staff and students. Staff has more time to concentrate on effective instruction and students have more opportunities to gain extensive, immediate, quality feedback at a time to suit them.

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المؤهلات العلمية

دكتوراه في الاقتصاد من جامعة كلورادو الحكومية
(Colorado University State) بالولايات المتحدة الأمريكية.

ماجستير في الاقتصاد من جامعة كلورادو الحكومية (Colorado State University)
بالولايات المتحدة الأمريكية.

بكالوريوس في الاقتصاد من جامعة الملك عبد العزيز بجدة.

الخبرات العملية

١٤٣٠/٢/١ هـ حتى الآن عميد التعليم عن بعد

١٤٢٨/٢/١ هـ إلى ١٤٣٠/١/٣٠ هـ عميد كلية الاقتصاد والإدارة.
١٤٢٣/٨/٢٩ هـ إلى ١٤٢٨/١/٣٠ هـ وكيل كلية الاقتصاد والإدارة.
١٤٢١/٦/٤ هـ إلى ١٤٢٢/٧/١٤ هـ المشرف على إدارة الشؤون التعليمية (انتظام / انتساب).
١٤٢٠/١١/١٠ هـ إلى ١٤٢١/٦/٣ هـ المشرف على إدارة شؤون الانتساب.
١٤٢٠/٥/١٠ هـ أستاذ الاقتصاد المساعد.
