

Evaluation of Online Assessment: The Role of Feedback in Learner-Centered e-Learning

Noorminshah Iahad
Computation Department
UMIST

N.Iahad@postgrad.umist.ac.uk

Emmanouil kalaitzakis
Computation Department
UMIST

E.Kalaitzakis@postgrad.umist.ac.uk

Georgios A. Dafoulas
Computation Department
UMIST

dafoulas@co.umist.ac.uk

Linda A. Macaulay
Computation Department
UMIST

lindam@co.umist.ac.uk

Abstract

Advancement of the Information and Communication Technologies enables the integration of technology with daily activities and education is not an exception. E-learning, which applies the concept of open and distance learning is learning through the Internet. It had been reviewed as an efficient knowledge transfer mechanism. E-learning is seen as a future application worldwide, promoting life long learning by enabling learners to learn anytime, anywhere and at the learner's pace.

This paper presents the evaluation of an online test based on a case study of an e-Commerce course offered by the Computation Department, University of Manchester Institute of Science and Technology (UMIST). The main aim of the online test is to provide 'rich' feedback to students, which is one of the requirements of the learner-centred learning paradigm. The online test, in the form of multiple choice questions, provides feedback through automatic grading, providing correct answers and referring the students to the learning content which explains the correct answers.

Evaluation of the online test was based on two criteria: functionality and usability. In terms of functionality, evaluation was meant to get the students' view of the feedback provided by the system, while in terms of usability, the evaluation sought to ensure that the system not only functions as expected by the users but is also usable. Results show that the online test is

suitable for online-learning and provides rich feedback.

1. Introduction

Electronic learning (e-learning) refers to the process of learning or training online, meaning acquiring knowledge via the Internet and the Web. The three main factors urging higher education institutions to get involved with e-learning are (i) the increasing number of students, (ii) the need for life-long learning and (iii) the need to prepare students with knowledge and skills for succeeding in the knowledge economy (Irvine, 1998), (Harasim, 2000). Education is now changing from an instructor-centred to a student-centred paradigm; these paradigms are realisations of the instructionist model and constructivist model respectively (Sanchez et al., 1999). In the instructionist model, knowledge is transferred from the instructors to the students, while the constructivist model focuses more on the learning process. In a learner-centred paradigm, knowledge is constructed by students through gathering and synthesising information and integrating such information with skills such as inquiry, communication, and critical and creative thinking (Huba & Freed, 2000).

E-learning is seen as a future application worldwide as it promotes life long learning by enabling learners to learn anytime, anywhere and at the learner's pace. Heralded as the future of learning, most organisations offering online learning material, must examine the role of assessment and evaluation in this new learning

medium (May, 2000). In addition, Huba argues that there must be a paradigm shift from the instructor-centred paradigm to the student-centred paradigm. In order to do this, instructors must grapple with fundamental questions about the role of assessment and feedback in learning (Huba & Freed, 2000).

Assessment in the learner-centred paradigm is used to diagnose learning problems and promote further learning, in addition to evaluating learning outcomes (Irvine, 1998), (Huba & Freed, 2000). Additionally, feedback is part and parcel of learner-centred assessment. Feedback can perform several functions depending on the purpose of assessment (Gibbs & Simpson, 2002). This paper refers to 'rich' feedback provided as part of an online test, offering the opportunity for students to reflect on their learning. Feedback received by learners or provided by them to instructors through the evaluation of the learning mechanisms can improve the student learning process (Huba & Freed, 2000).

There are two types of assessment. Summative assessment is assessment used for grading. Some functions of summative assessment include grading or ranking students, passing or failing students and telling students what they have achieved (McAlpine & Higgison, 2001). On the other hand, formative assessment is assessment that promotes learning. It is designed to assist the learning process by providing feedback to the learner, which can be used to highlight areas for further study and performance improvement (May, 2000), (McAlpine & Higgison, 2001), (Brown et al., 1997). Both types of assessment are investigated in this research study; however, as the main objective is to identify the role of feedback in the learner-centred assessment, more emphasis is given to formative assessment in the form of multiple choice questions (MCQs). It is also of interest in this research study to identify and enhance the summative assessment in providing a variety of feedback mechanisms for promoting learning.

The main objective of this paper is to identify the role of feedback in learner-centred e-learning approach through the evaluation of an online test. It is imperative to study the functionality and usability of the online test. Lumsden stated that the goals of evaluation are to access usability, functionality and problems in the design (Lumsden, 2001). In terms of functionality, this evaluation obtained the students' views of feedback provided by the e-learning environment. In terms of usability, the evaluation aimed to ensure that the e-learning environment was usable in terms of ease-of-use, friendliness, navigability and speed. Through an

extensive analysis of the evaluation results, this paper investigates how the summative and formative assessment types may affect the way that e-learning environments are evaluated. This paper also identifies key factors of evaluation techniques that should be taken into account when developing online tests based on MCQs.

2. Computer Assisted Assessment in the Learner-Centred Paradigm

Computer Assisted Assessment (CAA) provides the means for shifting from the instructor-centred to the learner-centred paradigm (May, 2000), (Huba & Freed, 2000), (Wood & Burrow, 2002). Huba outlined four fundamental elements of learner-centred assessment as shown in Figure 1 (Huba & Freed, 2000).

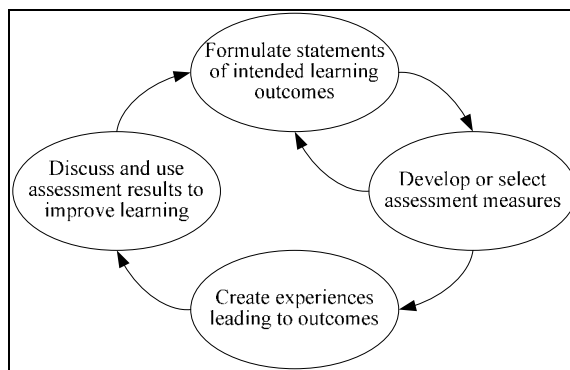


Figure 1: The Assessment Process (Huba & Freed, 2000).

First, intended learning outcomes are formulated. Learning outcomes are one of the issues which must be considered when planning and designing online feedback and assessment (Hanson et al., 2002). Learning outcomes provide the students with information on what they should know, understand and be able to do with the knowledge. For the instructors, learning outcomes help determine what will be evaluated at the conclusion of the course or program (MSACHE, 2002). Next, both direct and indirect assessment measures are selected. Direct assessment involves examinations and quizzes, research projects and case studies that assess student learning, while indirect assessment involves teaching evaluation surveys distributed at the end of each learning period (e.g. semester) (Huba & Freed, 2000), (MSACHE, 2002).

The third element in the assessment process is ensuring that students have experiences both in and outside their courses that help them achieve the

intended learning outcomes. By providing a series of assessment techniques students can put the taught theoretical skills into practice and therefore acquire a suitable level of experience and knowledge base. These in turn will provide the proof for achieving (or not) the learning outcomes that were initially identified. Finally, assessment results provide the basis for a discussion between instructors and students for better understanding the experience level reached and further clarify the learning outcomes. This research study is particularly interested in the third and fourth elements and the importance of feedback related to assessment results in improving learner-centred e-learning.

CAA is a common term for the use of computers in the assessment of the student learning process (Brown et al. 1997). The primary motivation for using CAA is its efficiency in providing immediate feedback (Dalziel, 2001), (Baggott & Rayne, 2001) and reducing marking load for instructors (Davies, 1999). Another advantage of using CAA is that it provides the opportunity for student self-assessment (Brown et al. 1997), (Dalziel, 2000). Regular self-testing and feedback during learning through CAA may significantly enhance overall learning outcomes (Dalziel, 2000). Current research on CAA is focused on enhancement of student learning through the provision of feedback, regardless if learning environments are based on stand-alone applications or web-based systems (Davies, 1999), (Baggott & Rayne, 2001), (Dalziel, 2001), (Wood & Burrow, 2002).

Commonly available forms of CAA include: online surveys, online quizzes and tests, online submission of assignments, discussion forums, and group areas (Wood & Burrow, 2002). Dalziel provides both formative and summative online assessment using MCQs in forms of pre-tests, mini-tests and end of section tests by providing different types of feedback such as multi-layered feedback and option specific feedback (Dalziel, 2000). MCQs are also being used for online assessment by providing the students with the correct answer after answering each question and allowing a second attempt (Davies, 1999). CAA was introduced by Wood and Burrow in two engineering courses to encourage student-centred learning, to provide detailed feedback and to direct students to learning resources (Wood & Burrow, 2002). Three types of questions within the CAA are multiple true/false questions, label diagram questions and text entry questions. Baggott and Rayne provide multiple and frequent, summative and formative assessment in their research through the use of the following types of questions: (i) MCQs, (ii) label diagrams, (iii) classification/sequence and (iv) text entry or

combination of both (iii) and (iv) (Baggott & Rayne, 2002). With respect to feedback, students are provided with the correct answers, score and final grade via email. From their evaluation, students showed positive perception of the approach. The formative CAA was also well used, especially as revision aid for the final exam (Baggott & Rayne, 2002).

Following the discussion above, in terms of the assessment process as suggested by Huba, seven learning outcomes were outlined for the “CT-338/438 E-Commerce: Theory and Practice” module. However, as the main purpose of this paper is to identify the role of feedback in a learner-centred e-learning, the online test discussed in later sections is used to cover the first learning outcome which is defined as: “Students will be able to demonstrate a good understanding of the generic web architecture and the various technologies associated with it”. Other learning outcomes had been covered by other types of assessment available to students including course assignments, in-class activities and a final written examination.

The online test using MCQs is used as a direct assessment measure. Both summative and formative assessments are used for the online test by using MCQs. MCQs were chosen for the online test, based on previous positive results from their use as discussed earlier (Davies, 1999), (Baggott & Rayne, 2001), (Dalziel, 2001), (Wood & Burrow, 2002). Furthermore, MCQs were also used due to (i) time limitations in developing test questions, (ii) difficulties in providing adequate feedback for the specific module (i.e. very theoretical in nature, rich content, large number of topics covered) if other types of questions were used and (iii) human resources constraints (i.e. no teaching assistant/demonstration allocation). A questionnaire was used for the indirect assessment measure. The online test is further discussed in section 4 while the questionnaire is discussed in section 5.

3. Online assessment: a case study

This section focuses on the third assessment process step which is “to create experience leading to outcomes”, while the final step in the assessment process, “discuss and use assessment results to improve learning”, is covered in sections 5, 6 and 7.

The case study used for this research study is an electronic commerce module taught in the Department of Computation, UMIST. The module is titled CT-338/438: Electronic Commerce Theory and Practice and is available to six different courses at both

undergraduate and postgraduate level including BSc in Computation, BSc in Management Information Technology, MSc in Electronic Commerce and MSc in Business Information Technology. One of the special characteristics of this module is the diversity of student backgrounds and level of studies. The module consists of 70% examination (i.e. 3 out of 5 questions over 3 hours) and 30% of an assignment followed by a report. Postgraduate students are allocated an extra assignment to compensate the required extra workload. The module is primarily theoretical, is delivered over 12 three-hour lectures that include a variety of teaching aids, a series of talks from industrial guest speakers and covers 6 thematic topics from web marketing and e-CRM to privacy enhancing technologies and web architectures. The 135 students enrolled attend in-class activities with immediate feedback and are given a detailed marking of their assignments prior to the final examination. During the last year, an online test was introduced to provide students with an alternative learning mechanism and an opportunity for additional feedback. The online test covers almost all topics taught and consists of multiple choice questions with four possible answers.

4. Developing an online test for a theoretical electronic commerce module

This section discusses on the implementation of the online test. As mentioned in section 1, the main objective of the online test is to identify the role of feedback provided by an online test in a learner-centred paradigm. Additionally, other objectives for providing such an online test are to: (i) offer practicing questions to students, as a preparation for their final examination, (ii) provide students with the experience of using a CAA system as part of an e-learning environment, (iii) investigate the effectiveness of CAA in e-learning and (iv) undertake a thorough evaluation of CAA.

The online test included fifty MCQs with each answer consisting of four options (i.e. A, B, C and D), covering a significant part of the lecture material provided throughout the semester. Students were required to register themselves prior to taking the test by filling in an online registration form. This early profiling section of the web site obtained personal details (e.g. name and gender), any previous relevant experience with online tests and each student's preparation level for the specific test. Students were informed that all the details provided were also to be used for this research study under full compliance with the Data Protection Act (DPA, 1998).

Next, the students were directed to a web page consisting of three example test questions. These questions introduced the students to the online test mechanism by representing how feedback is provided by the online test. Then, students were to proceed with the actual test by answering each one of the fifty available questions. Upon submitting the test, the students were provided with a variety of feedback options. The final step required them to fill in an evaluation questionnaire for the specific online test. Figure 2 shows the process followed for the specific online test. The two feedback concerns were to provide students with a variety of feedback options but also to support instructors in evaluating online testing as a CAA method. The feedback which students received from both practice questions and online test questions consisted of the following:

- The marks each student obtains for the test (e.g. "You answered 30 out of 50 questions correctly").
- A suggestion on what the student should do next, based on the range of marks obtained (e.g. "Very Good, Good Preparation for Your Final Examination").
- The correct answer if they answer the question wrongly. The student will be presented with the questions that they answered wrongly together with an informative message (e.g. "The Correct Answer is C").
- A hyperlink to the content explaining the correct answer, which is a Power Point slide image.

On the other hand, instructors did have access, apart from the information provided in the registration phase, to the student evaluation forms as a direct source of feedback but also to the overall test marks as indirect source of feedback.

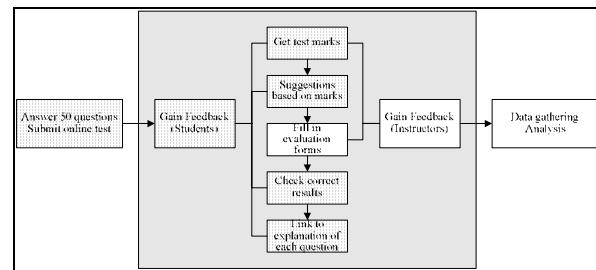


Figure 2: Online test process

Finally, in terms of technical implementation, the online test was developed using a typical client-server three-tier architecture. Cold Fusion version 4.5 was used as the web application development technology, while MS FrontPage was used for the user interface design. As the number of student responses expected in this case study is relatively small, MS Access was the

preferred database. Figure 3 graphically represents student feedback and more specifically, how participants of the online test are guided towards the correct answers of each question by direct links to the relevant module content, which in this case, is a slide from the lecture notes.

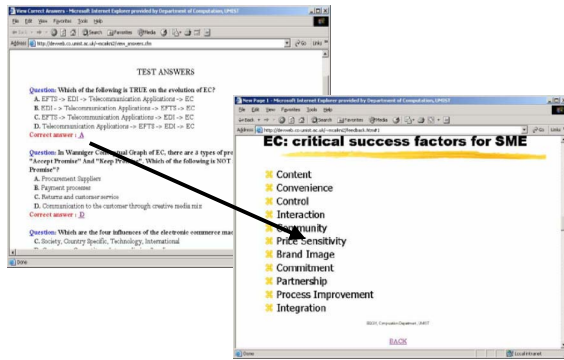


Figure 3: Student feedback screenshot

5. Evaluating the MCQ-based online test as a CAA approach

The evaluation of the online test by the students took place after the end of their semester and their Christmas break. The online test was available for a period of one month prior to the final examination. All students were notified via email twice, with an interval of one week between each message to the module's mailing list. Distance learning was partly simulated since students had access to this test regardless their location. That provided access to students residing in various locations in the Greater Manchester area (i.e. accommodation halls) and also to those that were using the UMIST dialup service within the UK. In total, 115 students participated in the online test, with 47 students completing the evaluation questionnaire. The main objectives of the evaluation are:

- To identify students' perception of feedback provided by the online test, which is whether the various forms of feedback provided, enhance their learning.
- To investigate the suitability and effectiveness of the online test for e-learning including distance and open learning.
- To study the effects of usability issues of the online test.
- To identify students' preparedness and the relationship with the marks they obtained.

The first and second objectives focus on the evaluation of the test's functionality, while the third objective focuses on the evaluation of its usability. The fourth objective is related to the analysis of the data obtained

from the evaluation, which will be discussed further in section 6.

The evaluation questionnaire is structured in such a way that both functionality and usability are evaluated based on a number of criteria. Effectiveness of the test for e-learning, delivery, assessment and feedback are the criteria used for evaluating the test's functionality. The criteria for usability include ease-of-use, navigability, availability and response time. The criteria used to specify most functionality-related questions are based on the key objectives of the specific module and the early objectives of this research study. However, the usability evaluation criteria and corresponding questions are also based on literature guidelines on system usability (Nielsen, 1998).

The evaluation questionnaire consists of both closed questions and open-ended questions. For the closed questions, summated rating or the Likert Scale is used where all the questions are quantified on a five-point scale from Strongly Disagree to Strongly Agree (Trochim, 2000). The five point scale is chosen as one of the most popular scales for the agreement attitude instrument (Barnett, 1991). There are 10 questions for the functionality evaluation including 2 open-ended questions. For the open-ended questions students are asked for their comments on the specific online test and suggestions on what online tests should provide to support e-learning. There are 10 closed questions for the usability evaluation.

6. Analysis of evaluation socio-demographic data

Student-related data collected from the evaluation questionnaire are classified under four variables, which are: (i) course and level of study; with both undergraduate and postgraduate students belonging to a range of six different courses, (ii) experience in undertaking online tests, (iii) preparedness to take the specific test and (iv) gender. Gender is not discussed in this paper as the vast majority of the students enrolled in the module are male. Instead most discussion is based on the remaining three variables and the analysis of their correlation to responses of the 20 evaluation questions. These questions are split into 10 usability questions, 8 functionality questions and 2 open-ended questions which cover both usability and functionality of the online test.

Early findings show that 115 out of one hundred and 35 registered module students participated in the

optional online test. However, only 47 participants answered the evaluation questionnaire. An initial assumption is that students were mostly interested in obtaining an overall mark for the entire test rather than retrieving the detailed feedback. Another assumption is that students did not proceed in submitting the evaluation questionnaire and viewing individual feedback due to tiredness or boredom after answering such an extensive test.

However, some interesting findings can be obtained from the initial student data of the 68 students that answered only the test questions. These show that 33 students had previous experience of online tests, 30 claimed that they were prepared for the test and 15 seemed uncertain of their preparation level. The authors are still puzzled with the 23 completely unprepared students that proceeded in taking the test! Although almost half of the students were experienced in online tests, and also agreed that they were prepared for the test, they were still not interested enough to access their detailed feedback. Furthermore, students who were not prepared may also be reluctant to spend time in evaluating after obtaining their marks. A hypothesis that can be made is that test preparedness and obtained results are contributing factors to students participating in the evaluation and getting detailed feedback. Future work is to be invested towards the proof of such hypothesis.

32 of 47 students had experience in taking an online test. Moreover, 23 agreed that they were prepared for the test, while 15 were not sure. There was no significant difference on their level of study with 25 undergraduate and 22 postgraduate students. Thirty six students achieved the passing mark, of whom 15 (9 postgraduate) students obtained a distinction mark higher than 70%. It is important to highlight here that 11 out of 15 students who gained distinction are those who had experience in doing online tests before. Following the above hypothesis and based on the significant differences between the numbers of prepared students that were also experienced in taking online tests, it can be argued that experience in e-learning environments is an additional factor contributing to the willingness of students to answer evaluation questions.

7. Discussing the main evaluation findings

This section is concerned with the discussion of the key findings derived from the responses of the 47 evaluation participants.

7.1. Usability evaluation

The evaluation starts with the usability questions. Keeping in mind that the students had gone through an extensive test consisting of 50 questions, it was very difficult to accommodate questions, covering all aspects of usability. The questions for usability are divided into three evaluation criteria, which are loading and response time, ease-of-use and whether the online test is informative.

There are four questions for the loading and response time criteria. For all the questions more than half of the students provided positive responses (chose "Agree" and "Strongly Agree"). Overall, 32 students agreed to the question "The time for processing data and providing results was satisfactory", while 3 of them were neutral and 12 disagreed. In terms of experience, 20 students that agreed to the question had experience in doing online tests. One of the characteristics of the online test is its ability to provide test marks automatically after the students submit their answers. Majority of the students' agreement to this question may indicate that students expect immediate feedback, which is one of the advantages of CAA as mentioned in section 2.

Four questions are also asked in terms of ease-of-use. More than half the number of students agreed on two of the questions while for the other two, results show the number of students that agreed and disagreed, are separated almost evenly. One particularly interesting question is: "The messages displayed on pages within the online test are relevant to the user's task at the time". Overall, 26 students agreed with this question, while 9 were neutral and 12 disagreed. Out of the 26 agreeing students, 15 had experience in doing online tests. The distribution of students based on their experience which is almost even shows that although, they had no previous experience, they managed to finish both the test and the evaluation questions. This further suggests that the factor preventing students from participating in the evaluation is their preparedness rather than their previous experience in doing online tests.

As for the questions which are related to the online test being informative, students are asked two questions: The first question is "The links are obvious in their intent and destination", with 23 students agreeing, 11 being neutral and 13 disagreeing. The second question is "There is enough information provided on what personal information will be used for". The responses to this question are non conclusive

with 20 students agreeing, 8 of them being neutral and 19 of them disagreeing.

7.2. Functionality evaluation

The evaluation criteria specified for the functionality evaluation are delivery, assessment and feedback. As the main focus of this research is on the role of feedback, results for the first two criteria are discussed briefly, while more emphasis is given on feedback.

Two questions are asked for both delivery and assessment. The first question regarding delivery which is on the suitability of the online test for distance and open learning, showed that 35 students agreed, only 1 of them was not sure, while 11 of them disagreed. Although most of them agreed to the first question, for the second question which is on the ability of the online test to support self-paced study, only 23 of these students agreed. The significant difference demonstrated in this question, indicates that while online tests may support e-learning in general, in terms of self-paced study additional factors such as differences in personality and learning styles must be considered. It should be noted that, in line with this research study, further work is also conducted regarding the varying perspectives of self-paced study.

For questions related to assessment criterion, 18 students agreed while 17 of them disagreed with the question: "The online test is suitable for assessing my learning performance". As for the second question, 30 students agreed that "Automatic grading of the online test is essential in an e-learning system". This shows that students are concerned about the marks they obtained. This also emphasises the hypothesis that non-participants in the evaluation are concerned more with overall marking rather than detailed feedback.

	Question	Students
1	"The suggestion provided from the online test based on the marks I obtained is very useful in my learning process".	19
2	"The correct answers provided for the questions I answered wrong in the online test are essential in learning online".	31
3	"The links to the explanation of the correct answers tell me what I do not know and help me improve my understanding".	24
4	"Overall, the online test provided me with useful feedback".	22

Table 1: Functionality evaluation - Positive responses to feedback questions

Four questions of the functionality evaluation are devoted to feedback. Table 1 shows the four questions and the number of students that agreed with each question. The first three questions are related to the feedback provided by the online test in sequence as described in section 4, while the fourth question is regarding feedback provided by the test in general. 22 students agreed that, in general, useful feedback had been provided by the online test. For all questions the majority of students had previous experience in doing online tests. In addition, the vast majority of students passed the test. The bar chart in figure 4 shows the number of positive responses for each feedback question based on students' test results.

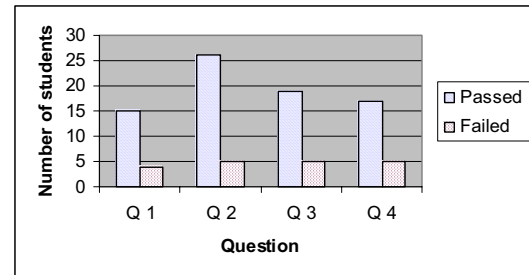


Figure 4: Classifying positive feedback responses according to test results.

Regarding the different feedback types, students showed preference mostly to the provision of the correct answers to each question. Next the students agreed with the usefulness of the links to the explanation for each correct answer and thirdly with individual suggestions provided based on marks obtained. Two important findings should be mentioned at this point based on the questions in Table 1. First, for Question 1, from 19 students that agreed 11 of them were prepared for the test and 3 of them were not sure. Contrasting with the students that did not participate in the evaluation, these 19 students showed particular interest in gaining further feedback. Secondly, although the links to the explanation for each correct answer are provided in the same page with the correct answers, 31 students agreed to Question 2, but only 23 students agreed to Question 3. This difference in responses may be due to the depth of explanation provided, which will be discussed in section 8.

Some interesting findings are also included in tables 2 and 3 that classify student responses to all four feedback-related questions based on the different

course levels (i.e. undergraduate or postgraduate) and on the previous experience of online testing. Table 2 shows that students' perception of feedback quality is entirely independent from their course level and there is a very similar pattern for the answers of both undergraduate and postgraduate students. However, table 3 shows that experienced participants seem to be more positive to the feedback functions available. This is an early indication of high expectations on behalf of inexperienced participants compared to the more realistic views of the ones that have used e-learning systems in the past. It is also important to further investigate the source of gathering so many strongly negative responses.

8. Lessons learned through students comments and suggestions

This section discusses responses to the two open-ended questions included in the evaluation. The first question asked students for their comments on the online test, while the second question asked for student suggestions on what they think online tests should provide in order to support e-learning. Overall, 23 out of the 47 students that submitted the evaluation questionnaire provided their comments and suggestion, 15 of whom had experience doing online tests before. Out of the 23 comments and suggestions, 13 were provided by undergraduate students, 18 of them passed the test whereby 7 of them gained distinction. All students who obtained distinction except for one, had experience in doing online tests before. It can be argued that students' experience and performance contribute to their willingness to provide their personal comments and suggestions.

Students provided positive comments for the online test where they found that the test is good and very useful. Some of them found that the test performs as a useful revision aid: "Good idea, helped me see where to put more effort", "It's a good preparation for the e-Commerce exam", and "It gives a good indication of what you know quickly". On the other hand, most of them suggested that the interface of the test needs to be improved. Some of their comments are such as "Missing look and feel", "The Graphical User Interface should be more professional" and "Perhaps have spacing in between some of the answers".

For the second question, most of the students thought that feedback should provide more specific explanation for the questions they answered wrongly. Their suggestions were such as "Inclusion of graphics, more specific answers rather than just pointing at the slides",

"A bit more explanation" and "More response, e.g. sound or pictures". A suggestion related to feedback which should be provided by online tests is to include a tick box next to each question, which will be ticked if it is guessed by the student. The student will then be able to see the answers for those questions that they guessed. Besides this students suggested that the online test should be timed, and the questions should be in multiple pages instead of putting all questions in a single Web page. Another suggestion was to provide tips and techniques for answering examination questions.

Reflecting on the process followed while developing, performing and evaluating this online test, certain lessons were learned. With respect to the development of CAA tools such as tests, quizzes and sample examinations, it seems that there is a myriad factor that affect not only the choice of tools but their structure and the ways that such tools should be used. More specifically, the online test should be dramatically reduced in size. The amount of questions and the time required for students to spend on a single page proved in certain cases exhausting, and it can be argued that it even altered the number of responses if not the evaluation results. There should be thematic categories with corresponding mini-tests with a maximum of 20 questions for each test. Each test should consist of pages including at most five questions per page. It is expected that these changes would minimise the time required to complete each test, and students would seem more keen to participate in a subsequent evaluation.

In terms of performing an online test, the entire process should be reconsidered. More specifically, the test mechanism that has been discussed in section 4 and represented in figure 2 should avoid allowing students retrieving as much feedback prior to submitting their evaluation response. However, one would argue that participants should have the option not to evaluate the online test. It is expected that generating a discussion among participants after completing the online test would provide useful feedback for both students and instructors.

Finally, it is very difficult to draw definite conclusions regarding the evaluation of usability and functionality with such limited number of available questions. It is expected that questionnaires dedicated solely to certain aspects of CAA would provide far more usable data and enable the drawing of more robust assumptions. Furthermore, providing two more instances of the same evaluation questionnaire after certain intervals with the same participants should

prove very useful towards investigating the evolution of CAA in e-learning.

9. Conclusions and further work

This paper focused on CAA in the learner-centred paradigm. More specifically the paper discussed the role of feedback in e-learning based on the analysis of results from evaluating an online assessment tool. After discussing the assessment process and describing in detail the module that was used as a case study more emphasis was given in developing and performing the online test. Analysis of the evaluation is supported by a series of tables and graphs that represent a significant amount of the data gathered. Evaluation of the online test was based on two criteria, which are its functionality and usability.

Arguably, current research on the evaluation of CAA is very limited. The findings of the early stages of this research study provided some evidence supporting a series of assumptions with respect to the delivery, assessment and feedback of e-learning environments. There is evidence that experience in using e-learning systems is directly linked to evaluation results and that higher expectations exist for feedback rather than assessment.

Further work is focused on how computer-mediated communication affects distance and open learning, how the development of content delivery and assessment tools is directly related to learning styles, how feedback in e-learning environments can be enriched and finally how the evaluation of e-learning methods differs from more traditional ones.

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	Course								
	BSc				MSc				
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	All questions
Strongly Disagree	5	7	4	5	6	8	7	7	21
Disagree	3	2	1	2	3	0	0	0	8
Neutral	6	6	2	4	4	5	2	5	18
Agree	9	9	12	9	10	8	10	9	39
Strongly Agree	1	0	5	4	0	2	4	2	10
	24				23				-

Table 2: Classifying responses to feedback questions according to course level.

	Online Test Previous Experience								
	No				Yes				
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	All questions
Strongly Disagree	3	5	4	5	8	10	7	7	17
Disagree	1	1	0	1	5	1	1	1	3
Neutral	4	3	2	2	6	8	2	7	11
Agree	7	5	5	5	12	12	17	13	22
Strongly Agree	0	1	4	2	1	1	5	4	7
	15				32				-

Table 3: Classifying responses to feedback questions according to previous experience.