

INTEGRATING CAA WITHIN THE UNIVERSITY OF ULSTER

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Abstract

Marking coursework is a time consuming activity, further exacerbated by the need for regular submission and timely, informative feedback. Increasing student numbers (particularly within computing and management) coupled with a decline in resources, mean that staff are unable to give formative feedback on student learning to the extent they may wish. Understandably there is concern that as the quantity of marking increases, there is a corresponding deterioration in the quality of assessment. This has led staff at the University of Ulster to investigate new ways to assess students. Computer Assisted Assessment (CAA) offers the opportunity to assess students more regularly without increasing staff workload.

This paper outlines how WebCT has been used to support computer assisted assessment throughout the Faculty of Informatics and the Faculty of Business and Management at the University of Ulster.

Introduction

The University of Ulster, through its Institute for Lifelong Learning has recently invested in WebCT. All Faculties within the institution have been tasked with developing an e-learning strategy which will make use of this environment. The Faculty of Informatics, houses one of the largest schools of computing in the UK with approximately 2,500 students and more than 100 academic staff. Likewise, the Faculty of Business and Management in the University of Ulster is one of the largest of its kind within the United Kingdom, with over 4,000 students studying in either full-time or part-time mode. Widespread adoption of WebCT will therefore be a considerable task.

One of the greatest challenges faced by both Faculties is the increasing student numbers and the associated issues of assessment, groupwork and communication. As numbers rise, the task of setting regular assignments and providing timely, formative feedback becomes increasingly onerous - hence

the attraction of computer assisted assessment methods has increased accordingly.

This paper outlines developments during the first year of implementation of WebCT, highlighting how WebCT has been used to support assessment throughout both Faculties.

Getting Started

Both the Faculty of Informatics and the Faculty of Business and Management are challenged with factors that include rising student numbers and associated increased expectations, overburdened faculty resources, and increased competition. Whilst these demands are daunting, technology-supported teaching, learning and assessment provides both possible solutions and new opportunities. Both faculties are currently developing an e-learning strategy, which will incorporate advanced pedagogical tools into a technological framework.

Successful integration of a VLE will not happen by chance – planning is important to ensure that it becomes embedded as part of a coherent package making appropriate use of the different teaching and assessment techniques which it facilitates. A clear framework must be established to meet both the overall context of the module and the learning requirements of the students. Suitable learning activities must be identified and these must be articulated to the students such that they have a clear understanding of what to expect from these educational pursuits.

The skill-set of many educators, is deficient with respect to the development of educational material for use in an on-line manner. To enable staff to migrate proven pedagogies and address the challenges of this new role, the Faculty of Informatics has appointed an instructional designer to support the introduction of WebCT.

A total of 232 modules is on offer within the Faculty of Informatics and a further 750 in Business and Management it will clearly take some time for the full roll-out of the new system. Early priority has therefore been given to support enthusiasts and address areas of perceived need. Table 1 outlines uptake in this inaugural year.

Module name	Course/level	Number of students	Use of WebCT
Professional Issues	BSc Interactive Multimedia Design year 2	34	Course notes, CAA, communication, module survey.
Networks and Data Communications	BSc Computing Science year 2 and BSc Interactive Multimedia Design year 4	162	CAA

IMD Placement	BSc Interactive Multimedia Design year 3	23	Documents, communication, survey
Computing Science Placement	BSc Computing Science year 3	63	Documents, communication, survey
Software Engineering Placement	BEng Software Engineering year 3	18	Documents, communication, survey
Networks and Data Communications (Jordanstown)	MSc Computing and Information Systems	165	CAA
Networks and Data Communications (Magee)	MSc Computing and Information Systems	79	CAA
Management Skills	BA Business Studies, BA/BSc Combined Studies	45	Communication, notes, assignment, survey
Business Policy	BA Business Studies, BA Accounting, BSc Engineering	183	Groupwork, communication, notes, survey

Table 1

WebCT supports all the educational activity normally associated with the learning experience and as such, has the potential to unify, monitor and coordinate all activity within a course or module. Full and effective integration of WebCT would require considerable effort by both tutor and students and is probably only necessary where a course is being delivered fully on-line. However, WebCT is extremely flexible and can be customised to the needs of each course or module. At this early stage, Table 1 clearly indicates a strong emphasis on the adoption of CAA techniques to support large groups and communication tools to enhance learning and delivery. The following sections outline the techniques employed at Ulster in addressing these pressing problems, providing commentary on the practical issues involved in each.

Clearly on-line communication “blurs the distinction between teaching, learning and assessment” (CAA Centre, 2001).

Assessment of Large Classes

As, students become increasingly strategic in their study habits, there is much evidence to show that assessment is the driving force behind student learning (Brown, G, Bull, J and Pendlebury M, 1997). Furthermore, the benefit of

regular testing to reinforce learning and provide feedback to learners is well documented (Ramsden, P, 1992). Staff-student relationships can be significantly enhanced by the efficient collection and marking of assessed coursework. To assist in improving learning, feedback to submitted assigned work needs to be both timely and accurate, in order to deliver a quality of service which meets student expectations.

Within the Faculty of Informatics, students are currently taught in a conventional lecture environment, with assessment employing both coursework and formal examination. Whilst the conventional classroom lecture can accommodate numbers limited only by physical space provision, the need for timely assessment and rapid feedback to large student groups presents a significant workload. Automated methods for testing and assessment therefore have become increasingly attractive.

The introduction of WebCT has provided a timely and efficient mechanism for dealing with CAA techniques, which have been adopted to support the delivery of objective tests for both formative and summative assessment of large student groups as outlined below.

Networks and data communications

Second year students on the BSc Hons Computing Science and final year Interactive Multimedia Design students study a compulsory module on networks and data communications. In 2002/01 there were 108 students enrolled on this module which was taught over a period of twelve weeks. On week 5, students were traditionally required to undertake a paper-based class test which accounted for 10% of the total coursework mark. The main purpose of the test is twofold:

1. to make the students aware of their level of knowledge;
2. to alert academic staff of weak students and difficulties encountered by the group as a whole.

In 2001/02 WebCT was used to create, deliver and mark the test on-line. This had many benefits, in particular a considerable saving on the time spent marking with the added advantage that students received their results in a timely fashion. When the entire cohort had completed the test, the correct answers were released to the students.

A similar system is in operation with students on the MSc Computing and Information Systems where numbers exceed 400. In 1998/99, driven by the increase in student numbers, it was decided to incorporate an element of CAA into the coursework component of the "Networks and Data Communications" module in order to limit the manual effort. The CAA tests were originally administered using the assessment component of 'WBTSYSTEM's Topclass'.

During the past four academic years, the CAA component has evolved to become fully integrated in the assessment process (Alexander, S., O'Reilly, U., Sweeney, P.J., and McAllister, H.G., 2002). Students currently registered on this module are assessed using 3 methods: a series of on-line class tests (delivered using WebCT), a paper-based multiple-choice examination (taken under formal examination conditions but automatically marked), and a conventional examination paper.

An analysis of each assessment method, with the conventional examination paper considered as the benchmark has been carried out (Alexander, S., O'Reilly, U., Sweeney, P.J., and McAllister, H.G., 2002). Results indicate that whilst students generally achieve better marks with either of the first 2 methods, continual refinement of the assessment procedures and selection of suitable questions can lead to a system with a high degree of automation. Creating pools of questions (in particular, the calculated question facility available in WebCT, where up to 100 different versions of a question can be generated), means that the possibility of cheating is also greatly reduced.

There have been significant improvements arising from the adoption of WebCT. The most obvious being the robustness of the system which stems from the support that the University has directed in this direction.

The educator is now able to pinpoint difficulties that the student cohort has with areas of the course as WebCT supplies scores for each student for each question. This was unavailable with TopClass version 3.1. Thus remedial activity can be targeted to match the class needs. Furthermore as the numerical components of the tests are comprised of large pools of questions, they are more useful to students as a revision aid, since post-assessment, students are offered a different question from the pool at each attempt and can hone their skills at any time.

Object-Oriented Programming

The "object-oriented programming" module is taken by part-time and full-time students on the MSc Computing and Information Systems course. The module is taught by two members of academic staff with a switchover at week 6. As with the networks and data communications module, student undertake a test in week 5 in order to monitor progress.

General Observations

Electronic marking of responses is completely non-subjective as no judgement needs to be made on the correctness or otherwise of an answer at the time of marking. Since marks were only allocated according to the final answers submitted, students who had adopted the correct approach but introduced late errors (perhaps due to transcription) were considerably disadvantaged. To overcome this problem future tests might either become formative in nature or require students to submit hand written evidence of their work. Marking the latter would of course negate the time benefits associated with computer assisted assessment techniques.

Another common anxiety about objective testing is that students may gain an inflated score simply through guessing. The following tables indicate average scores for each of the CAA tests undertaken.

MSc Network and Data Communications Jordanstown

Test	Week	No. of Students	Average % Score
1	3	157	73.92
2	5	160	62.63
3	7	159	72.60
4	9	149	71.27
5	11	141	65.71

MSc Network and Data Communications Magee

Test	Week	No. of Students	Average % Score
1	4	76	63.65
2	6	75	63.49
3	8	76	68.75
4	10	75	71.96
5	11	67	49.47

MSc Object-Oriented Programming Jordanstown

Test	Week	No. of Students	Average % Score
1	5	132	74.20

BSc Network and Data Communications Jordanstown

Test	Week	No. of Students	Average % Score
1	5	162	41.00

In the MSc Network and Data Communications, where multiple tests were used, students performed equally well across all of the tests. The tutors had envisaged that performance might diminish over time due to the greater complexity of the course content and increased pressures due to assignments in other modules. Test 5, which covered the entire course material, enabled students who had missed a test to complete their assessment profile. Many students, particularly those who had performed badly in previous tests, attempted test 5 in an attempt to increase their score as only the best 4 results were used to determine the final assessment mark. On the whole, students who had performed well in tests 1 to 4 did not take test 5, consequently the latter was taken by fewer students.

At the time of writing no correlation can be made between these CAA marks and those obtained in the examination. However, previous experience would indicate that the difference between the average score in CAA coursework and examination is similar to that on other modules and is therefore not a cause for overdue concern (Alexander, S., O'Reilly, U., Sweeney, P.J., and McAllister, H.G., 2002). The following factors contribute to this effect:

- the equal weighting of each test, earlier tests are easier, for encouragement;
- students have less information to retain for a shorter time in the test scenario;
- assessment is continuous and drives students to score well

Assessing Group work

Part-time students often find difficulty in participating in group work activities – time spent with peers is constrained by both personal commitments and geographical distribution limiting opportunities to meet outside timetabled classes. Part-time students taking a module on Business Policy attend the university one evening per week. This time is allocated to lecture and seminar activity leaving little time for group work. Seminars are student led and each student group must do a presentation to their peers and lead discussions to facilitate student learning. The lecturer and student groups assess the presentations using criteria established and agreed in the initial weeks. In the current academic year Computer Enhanced Assessment has been facilitated using WebCT.

Based on the outcome of a Belbin group team role questionnaire, students are allocated to groups of approximately 8 people with each group allocated their own presentation area using WebCT. Group members have access to a shared area where they can upload, view and edit documents. They also have access to a discussion board where they can discuss privately development of their group project. The tutor can also view the group files to monitor progress of the group as a whole and the individual levels of contribution from each student. Furthermore, feedback against the agreed criteria (both student and lecturer views) is collated at the end of each seminar and posted to the bulletin board. Students thus receive more detailed feedback, ensuring that groups receive pointers for improvement and enhancement. This regular weekly cycle of feedback thus informs the content and delivery of succeeding seminars.

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Evaluation and Student Feedback

Evaluation is an integral part of good professional practice (Hounsell, D, 1999) which depends on monitoring performance in order to recognise strengths and achievements and identify areas for improvement. As such evaluation should produce not only quantitative data to be used for summative purposes but also objective contextual information which can be used for developmental purposes. All students were informed at the outset that use of WebCT was a new and were encouraged to provide feedback either via the system itself or in person. As a result the process was extremely interactive with students suggesting changes as the course progressed as outlined below.

Increased stability

Questions are displayed one at a time. The student must save the answer before moving to the next question but can revisit the question and change their answer at a later date. This has a number of advantages:-

- Encourages students to save their answers to the server as they proceed through the test. In the event of a computer crash, the student responses will not be lost.
- If the test does not load correctly at the first attempt the student could potentially have answered all of the questions before they discover that the answers cannot be saved.

Time remaining

In WebCT the "time remaining" display is taken from the server and only updates when a student makes contact with the server – usually when they save an answer. A JavaScript patch was written to update the clock at fixed intervals. This maintains constant contact with the WebCT server and ensures that the "time remaining" display is current at all times. However, this adds extra pressure to the system - students are now contacting the server at regular time intervals to refresh the time remaining as well as contacting the server to save answers. An optimal refresh rate of 45 seconds was chosen. Countdown timers, which start when the page is first displayed were also considered. However these are often inaccurate and can be reset by students.

Surveys carried out by Griffiths, F. (Griffiths, F, 1994) conclusively that students prefer computer-based tests to paper-based methods. This is a view echoed by experiences gained within the Faculty of Informatics. New strategies for assessment using WebCT reflect the change of emphasis in the work undertaken. By adding this new dimension of assessment and introducing greater variety into the process, this enables testing of a broader range of knowledge, understanding and skill that has normally been the case with each assessment having specific learning outcomes. This process has changed the emphasis from assessment of knowledge to assessment of understanding and skills (know what to know how).

Student-derived evidence (from module evaluations) suggests improvement due to this changing pattern of assessment. Informatics students have a positive attitude towards CAA, they like the fact that it is reliable, objective and that in a competitive environment opportunities for contamination of the assessment process are severely reduced.

Facilitating CAA Using a VLE

In addition to supporting CAA, VLEs offer functions to support pedagogy, management of learning materials, student administration and communication. As such, there are significant opportunities for students to develop skills in other areas namely:

Key Skills / Communication

Students on the BSc Hons Interactive Multimedia Design take a second year module on Professional Issues. Whilst this module is primarily involved with imparting knowledge relating to the legal, social and professional aspects of computing there is considerable emphasis on developing effective communication and groupworking skills. In an attempt to encourage deeper learning and critical thinking, students were asked to contribute to on-line weekly discussions relating to material on the course. Contribution to the discussion forms part of the overall assessment for the module (10%). Analysis of student contributions to discussion indicates that those students who were reluctant to participate in class performed well using the electronic environment.

Critical evaluation

Peer assessment encourages students to develop the ability to make critical judgements on the work of others (a vital skill in the workplace), learning from the mistakes of others and discovering alternative methods to achieve the same goal. This technique is currently being adopted within a number modules e.g. to support website design where students provide formative feedback to peers (on a prototype system) prior to development of the final product.

The Way Forward

Evaluation of the pilot studies carried out in 2001/02 demonstrates the feasibility and potential benefits of WebCT to support the assessment process. In this inaugural year, 625 questions have been developed (Table 2), many of which can be modified and reused within other modules at different levels.

Topic area	Number of questions developed
Networks and data communications	600
Object-oriented programming	25

It is envisaged that the existing question bank will form a focus and catalyst for other similar activity within the institution.

Students are motivated by feedback on their work, and regular formative feedback has been shown to have a marked improvement on students' overall performance (Schmidt N, Norman, G and Boshuzen H, 1990). As this initiative develops the instructional designer will work in constructing effective formative feedback for all questions in order to enhance student learning.

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