Using Computer Based Tests to allow Multiple Attempts at Assessment

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Abstract

Computer based assessment has been used at UWE for a number of years on certain modules run by the School of Mathematical Sciences. In this case study we discuss the operation of the assessment for a first year engineering mathematics module in which students are permitted multiple attempts and are allowed, within an specified period of time, to choose when they take the assessment. Feedback from students has been highly positive about the assessment regime and our observation is that operating the tests in this way does encourage students to work steadily throughout the year.

The Execution

This case study is about the assessment of an engineering mathematics course delivered to all first year students registered on BEng programmes at UWE. Around 180 students who come from a wide variety of academic backgrounds are registered on the module. The most significant groups, in terms of numbers on the module, are students with 'A' level mathematics, those who passed our foundation year and overseas students with qualifications taken as equivalent to 'A' level. The coursework (30%) for the module consists of four computer based tests on Algebra and Functions, Calculus, Linear Constant Coefficient ODEs and Linear Algebra. To pass the module, students must obtain an overall mark of at least 40% subject to a minimum mark of 35% in both the coursework and the examination.

The decision to use computer based testing as a method of assessment in this module arose from the need to provide all students with regular and timely feedback as to the progress they were making in their mathematical studies. Weaker students needed to know the extent to which they were struggling, stronger students needed to know that they were making good progress. These aims had to be achieved without increasing the workload on academic staff.

The tests are designed to give the students a high degree of control over how they manage their time during the test period. Students are permitted three attempts at each test which they can take over a two week and a half week period. Students also have Internet access to the tests which are delivered using Questionmark Perception. The time permitted on a test is two hours although many complete the test in half this time.

All of the questions are presented so that students may answer the questions in any order they choose before submitting an attempt. This feature has the disadvantage in that any technical failure prior to submission results in the loss of the student's work. However, over the four years these tests have taken place, the students have expressed a strong view that this is their preferred mode of operation. If a technical problem occurs we normally grant an additional attempt. The mark for the test and any feedback is displayed immediately after the test has been submitted. The questions are randomly chosen from a bank of questions on a particular topic. Therefore, each student should receive a different test of comparable standard.

The operation of the tests has evolved over a four year period. Multiple attempts were introduced last year. Although initially suspicious of the software, students enjoy the flexibility this test regime offers. When asked to comment on the module during module evaluation, the computer based tests get a very positive response. It is interesting to note that not all students use all three attempts, including some with very modest scores. However, a significant number use the tests as planned and seek help in between attempts.

What Support Was Needed?

The project, which involved a number of mathematics modules, was initiated using Faculty funds set aside for developing new methods of assessment. This support was essential as it allowed staff to get to the stage where they could realize some of the benefits of reduced marking loads. These staff were then able to develop the question databank further. Technical support, principally connected with database management, was obtained from the on-line help service provided by Questionmark and from the Faculty's own IT support staff.

Students themselves require very little training in the use of the system. They get the opportunity to test the system out for themselves prior to the real tests taking place. They usually do this by themselves with the aid of a handout. Any student requiring additional help can receive this from their tutor.

The Barriers

Some academic staff were reluctant to support the development of computer based assessment. Often this reluctance is justified by the particular aims of a module, made more so by the fact that current software cannot test algebraic manipulation skills directly. This does limit the depth of understanding that can be assessed by this method although it is possible to design questions which test manipulation skills implicitly. The main point here is that at present computer based testing in mathematics can effectively test some skills and promote activity which we might describe as positively contributing to learning, but the method has its limitations and must be used appropriately.

There are a number of aspects of computer based testing which students find uncomfortable. Lack of "method" marks mean that small errors by the student can lead to a large penalty in marks lost. This problem can be moderated by careful design of the question and allocating multiple attempts. Any error in a question can clearly erode the confidence of the student in the system. Technical failures such as server crashes seriously disrupt the operation of the test, possibly compromising the pedagogic aims of the whole exercise.

The Enablers

The principal strategy adopted in encouraging student participation was compulsion! By making the tests part of the formal assessment of the module, students have to achieve an average mark of at least 35% in these tests. When initially piloting the test material we did offer the tests in a self-assessment mode. Student participation was not high. That said, students clearly like the flexibility in being able to choose when to make their attempts and appreciate the security of being able to have further attempts if required. The other significant factor in this exercise is that the tests are very simple to use, so while compulsion has clearly helped in promoting the use of the tests, the design of the tests greatly contribute to the way in which the tests are used.

Evidence of Success

Student feedback through module evaluation has been very positive about the use of computer based tests, especially the multiple attempts. In addition, we know that the tests encourage the students to work through previous exercises because of the questions they ask in tutorials and surgeries, between attempts! Since the multiple attempts have been introduced into the tests, the overall pass-rate for the module has improved. While this improvement could be the result of other changes that have taken place, it is likely that the tests have made a positive contribution towards this improvement.

How Can Other Academics Reproduce This?

The main issue in introducing computer based assessment is the initial work involved in developing the module. There must therefore be a strong commitment from the University and from individual staff. A considerable amount of work is being carried out in this area by many Universities, with some expectation that over the next few years much of this material may well be brought together and made available to the wider community. The single most useful thing somebody can do starting off down this route is to network with other academics. Some of the ideas used in our tests came from listening to the experiences of others at Learning Teaching and Support Network (LTSN) sponsored events.

Quality Assurance

There are regular meetings held between the academic and IT support staff to review the operation of the computer based tests. All test questions in the data bank are attempted prior to publication on the system. Any errors which are found in any published question are logged with the IT manager and removed from the databank. The tests are moderated using the same procedures as any other piece of assessment within the University.

Other Recommendations

In addition to points made in the preceding text I would also recommend when developing computer based tests

- Ensure that there is adequate in house technical support available.
- Take time over the design of your question database so that it can be easily used by colleagues.
- If any part-time students are involved then it is essential that Internet access is available.
- Be careful that this method of testing does not lead to assessment overload on the student.
- Take care over feedback given in questions. Avoid making the feedback too module specific as you may want to use the question elsewhere.
- Establish a rigorous quality testing procedure for questions prior to publication.
- Be clear to students how you are going to deal with technical problems. You will not be able to avoid server failures but this problem will be easier to manage if the students remain calm!