

Test-Based Support

Diagnostic Driven Support at UMIST

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Abstract

Students arriving in many of the UMIST departments are required to take a brief maths test on arrival. Mathematics students who underachieve on this test are assigned some questions relevant to sections where they did poorly and also referred to sections from texts and Internet notes. The student's attempt at the assigned questions acts as a basis for a feedback session. Certain students in other departments (receiving mathematics as a service course) are asked to complete a computerised assignment on areas where they underachieved. Again, they are provided with references to texts and Internet notes.

The Execution

The department of mathematics at UMIST has long tried to provide special treatment and classes for students who were seen to be underachieving. This applies both to mathematics students and to students in other departments. In 1993, some initiatives allowed special classes to be given to groups of students who started degrees in Engineering and similar courses but whose mathematics background was weak. Although a certain amount of success was seen in these classes, the fact that the system did not feed into assessment meant that fewer students were motivated to attend.

In 1996, Engineering and other students were streamed into courses on arrival at UMIST by means of a paper-based diagnostic test and previous qualifications (see page 6 for details). There were three streams i.e. P, Q and R with the P-stream being for the most able/advanced students and the R-stream for the least able/advanced. While this information made use of the overall score in the diagnostic test the distribution of marks across the topics was not being used. Quickly, the test was divided into 6 sections i.e. A: arithmetic, B: algebra, C: trigonometry and coordinates, D: logarithms and exponentials, E: differentiation and F: integration and stabilised at a length of 40 minutes for 24 questions. Marking was carried out by the author and around 8 postgraduate students working closely with him. Questions were simple to mark i.e. a numerical question or multiple choice or a simple algebraic expression. A simple analysis of results on a year-by-year basis shows a slight downward trend although the scatter is of a level consistent with the trend.

Many students on the Q-stream and a few students on the P-stream were carrying one or more weak sections i.e. a score of 2 or less out of 4. Such students were asked to attempt and hand-in work (paper based) on similar topics to those on which they underachieved in the diagnostic test (up to a maximum of two topics as chosen algorithmically by the Director of Service Teaching - when a student showed weakness in more than two sections, in general the two most basic sections were assigned). These questions counted as the first piece of coursework.

This scheme has evolved with time and is now in the following form. Students are still assigned one or two sections on the basis of the diagnostic test but now the follow-up assignment takes the form of a computer session with Question Mark for Windows rather than a paper-based assignment. Students are given the opportunity to download questions from a website that will look similar to the questions that the computer will ask. Students are also told of references to specific sections (e.g. by section or page number) from certain text books and some Internet notes written for this purpose on the relevant topic (see references). Help is also available in the regular weekly tutorials. The theory is that the students can spend time preparing themselves for the computerised sessions by getting familiar with the mathematical material and then, at a time of their own choosing (within publicised deadlines) carry out the test. Also available is a 'practice' test using Question Mark. The questions are trivial mathematically but they identify the two types of questions used i.e. multiple choice questions and numerical questions and show the students how to enter answers in each case.

For students on the Q-stream, each assignment counts 10% of the first semester coursework which, in turn, counts 20% of the total module. For the P-stream, relatively few students will be assigned this work and fewer still will be assigned two units; hence the work counts a total of 10% of the coursework mark. For both the P and the Q-streams, students who do well in all sections of the diagnostic test are exempted this work.

This work serves to familiarise (or re-familiarise) the students with topics on which they underachieved in the diagnostic test and to prepare them better for the rest of the course.

The followup sessions for the mathematics students are organised along different lines (e.g. no use of Question Mark) but the same diagnostic test is used. Five sessions were organised, corresponding to sections A, B, C, E and F. No session was organised for section D as so many students underachieved here; instead extra time was allocated to this topic in one of the lecture courses.

Students who scored a total of 12 out of 24 or less in the diagnostic test were asked to participate in all sessions except those where they scored 4 out of 4 in the relevant section of the diagnostic test. Students who scored 13 or more in the diagnostic test were asked to participate in sessions where they scored zero or one out of 4 in the corresponding section of the diagnostic test. The build-up to a session was organised as follows; about a week before the session, students were issued with a sheet giving questions on the relevant topic and were asked to hand in their attempts to the questions the day before the session. The sheet also gave references to sections of texts and some Internet notes (the same references as for the service course students). The member of staff in charge of the session looked at the work and made comments but did not assign a mark. The students' attempts at the questions formed the basis of the one-hour session but there were cases where the session evolved to cover other matters.

What Support Was Needed?

The Director of Service Teaching had been to several sessions regarding Computer Assisted Assessment e.g. at Birmingham University. Question Mark is a relatively easy package for the user and no special training was required although students had an opportunity to carry out a 'practice' test as many times as they desired. However, it was thought that a little time was necessary to get familiar with the package (at least for certain students) and so any temptation to use Question Mark for the original diagnostic test was resisted.

The Barriers and Enablers

For the service course students, carrying out assignments in their own time, with a mere six topics, answers might be passed from student to student. Answers were available after each question of the test in order to continue to help the students to learn. It was decided that each question would come in four slightly different versions (i.e. coefficients changed etc.) and the actual question chosen at random. This could not happen for all questions, as certain questions were required as follow-on from other questions e.g. a further question using the same coefficients. To enable these questions to follow each other, four different versions of each test were designed. Each version had a set of questions unique to that version and also a set of questions chosen at random. Thus, every time a student took a test, the test was unique and there is no evidence of sets of answers being passed around.

Participation rates in the sessions for Mathematics students are low and it is believed that the independent nature of these sessions is responsible. If a mark were to be derived from these sessions which were to feed into the coursework for one of the actual modules, then participation would probably be much higher. This matter is currently under review.

Evidence of Success

Several students completed the 'response' test to comment favourable on the scheme. It is not meaningful to comment on the comparison between students who were assigned to this procedure and those who were not as a) the students who were assigned to this procedure came in a certain band in the rankings from the diagnostic test, thus producing selection effects and b) such a comparison would involve a comparison with students following other initiatives rather than with a control sample.

How Can Other Academics Reproduce This?

Others can definitely reproduce this approach. It may have to be modified in light of the exact material required for the courses. Transferring the approach to non-scientific subjects (or indeed to certain scientific subjects) may require changes to the approach using Question Mark, as numerical type questions would have to be replaced by other questions e.g. 'word match', with associated problems. Question Mark Perception may be advantageous in establishments where it is fully supported.

Quality Assurance

In addition to the Question Mark modules devoted to the topics and the practice module, there is a module named 'response'. This is an opportunity for students to comment on any aspect of the system. The students have an opportunity to remain anonymous while making such comments. The system operates during the early weeks of semester 1, including week 3 when, for all modules, a questionnaire is run giving students the opportunity to comment on courses at an early stage. At the end of each course, full questionnaires are run for each course. In addition, students have the opportunity to comment through the staff-student council in the mathematics department or relevant other department or through the personal tutorial system.

Other Recommendations

Mathematics students: – Module lecturers who are aware of, and sympathetic to, the procedure certainly help. If the scheme is to run again in autumn 2002, relevant points are:

- It is essential to arrange a mechanism whereby the project feeds into the assessment of the students e.g. through the coursework component of one of the courses.
- The scheme should cope with changing circumstances e.g. Curriculum 2000 students entering the system.

Service course students:

- A campus computer network with many public clusters and a good reliability record certainly helped the project.
- It is necessary to provide each student with a paper document detailing what is required of him/her as an individual (or giving a reference to a website where this information can be found).

The author gratefully acknowledges funding from the Teaching Development Fund at UMIST, which enabled employment of a student in summer 2000 to develop certain materials. For more information on these materials please email:

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References

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UMIST; Diagnostic Follow-up Questions;
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(13-09-02).

UMIST; Index of Courses;
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For example, 1q1/1q1cw1.html