EXTENDED MATCHING SETS QUESTIONS FOR NUMERACY ASSESSMENTS

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Extended matching sets questions (EMSQs) are a form of multiple choice question (MCQ) consisting of a stem (the question or scenario) followed by an extended number of possible answers (Wilson & Case, 1993). An EMSQ is defined here as a question with ten or more alternative answers. EMSQs have been most frequently applied to medical education (Case and Swanson, 1994; Alcolado and Mir, 2002), but can also play a valuable role in assessment of numeracy.

Biological Sciences students at the University of Leicester are required to take several study skills modules as an integral part of the first and second year curriculum. Partly owing to the number of students (~200), modules designed to test and improve numeracy skills are delivered and assessed by computer. For a number of years, this was achieved over the world wide web (WWW), but since 2003 the Blackboard virtual learning environment (VLE) has been used (www.blackboard.com). Overall student responses to the VLE were highly positive, but assessment of numerical ability for large groups of students has proved to be problematic due to limitations of the Blackboard software.

The previous system of assessment involved data capture via web forms, producing answers in the form of a text file which was marked and annotated using Microsoft Excel. Marks and automatically generated comments were returned to students by email merge. The previous web content was transferred directly to Blackboard, thus assessments performed in previous years via the WWW and assessments performed in the VLE are directly comparable.

One of the drawbacks of the Blackboard system is that there is no provision for accepting a range of numbers to allow for variations introduced during calculation, e.g. for an answer of 2.51, accept 2.49-2.6. To attempt to overcome this problem, students were given detailed instructions on how to format answers, e.g. " do not type anything except letters/numbers in the boxes, and a decimal point if necessary (no spaces); use the same number of decimal places in your answer as are used in the question; do not round your

answers; check that you have used the correct units (as indicated in the question)". In spite of this, students repeatedly failed to enter calculated answers successfully, frequently due to formatting errors. This resulted in a loss of confidence in the Blackboard software and even formal complaints that the assessments were unfair.

The alternative approach, to allow students to choose numerically-defined answers in MCQ format, is unsatisfactory for a number of reasons. Answering MCQs involves a fundamentally different thought process from entering a calculated number into a textbox. Also, with conventional MCQs, many students are tempted to avoid calculations and simply guess the answers by elimination of obviously wrong distractors, thus eliminating the educational benefits of repeated practice calculations.

To attempt to overcome this problem, in a subsequent module calculated answers were assessed using an EMSQ format spanning a wide numerical range. This gives students no clues as to the correct answer and the large number of alternative answers forces them to perform the calculation to at least estimate the correct solution. This approach was highly successful. The resulting marks were better than those obtained by similar cohorts of students using the previous system of textbox entry and range marking, indicating that students did not find the EMSQ format difficult to use. These results indicate that EMSQs are an efficient and acceptable method of assessing numerical ability in large groups of students.

References

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