

## COMPARING ASSESSMENT MODES AND QUESTION FORMATS IN UNDERGRADUATE MATHEMATICS

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When presenting an online course within a virtual learning environment such as WebCT, the facility of online assessment becomes readily available. It then makes sense to replace paper assessment with online assessment but before doing so one needs to be aware of the differences in the two modes and the influence it has on student performance.

In order to investigate such differences two broad question types are defined. Distinction is made between *Constructed Response Questions* (CRQs) where students have to construct their own response and *Provided Response Questions* (PRQs) where students have to choose between a selection of given responses. CRQs include open-ended paper questions, essays, projects, short answer questions (paper or online) and paper assignments whereas PRQs include multiple-choice questions (MCQs), multiple-response questions, matching questions and “hot-spot” questions. All the different formats of PRQs are suitable in online courses. In contrast, in mathematics, short answer questions are effectively the only CRQs that can be used online.

Comparisons are made, firstly comparing performance of students in online PRQs to performance in online CRQs and secondly comparing performance in online CRQs to performance in paper CRQs. In the online section of one of the semester tests in a calculus course presented online the same concept was assessed twice in almost identical questions, firstly formulated as a CRQ and later as a PRQ. The experiment was then repeated involving a different concept. In both instances students performed significantly better in the online PRQ.

In the same study the difference in performance between online CRQs, where only a single answer is required, and paper CRQs, where the full exposition of the problem solution is required was investigated. In a test consisting of both a paper and an online section, two similar questions were asked, both CRQs, one in each section. Again the experiment was repeated. In both cases students performed better in the paper CRQs than in the online CRQs, even when discounting partial credit. When taking partial credit into consideration, the difference in performance obviously increased. Although it is not possible to come to any statistically valid conclusion because of the overall nature of the questions the difference is too substantial to ignore.

In a comparison of the performance in paper sections of tests with the online sections, data was collected on performance in both the online and the paper sections over a period of two years from eight semester tests. Students do seem to perform slightly better in the online section in general although this is marginal in most cases and not even always the case.