

**Summary report:** Learning and Teaching Development Fund / BLU-Sky Fund: 2005/6

**Title:** Accessible semi-automatic feedback systems to enhance the teaching of statistics.

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**Aims and Objectives:** The overall aim of this blended learning project was to evaluate and further develop simple methods of giving electronic feedback to students undertaking modules in statistics and methodology. Setting up this electronic feedback system requires no specialist computing expertise and was first piloted with half of the Level 1 cohort in the School of Psychology during the academic year 2004/5. As well as attending a weekly workshop session (mandatory), students were able to complete and submit statistics homework on a weekly basis (voluntary, though encouraged) and were provided with rapid informal text feedback on their completed work.

Specific goals:

1. Evaluate whether assessment performance improved in students receiving feedback compared to those who did not in the 2004/5 cohort.
2. Make the feedback system available to the entire cohort in 2005/6
3. Further develop the homework / feedback system by:
  - a. Withdrawing the requirement for all students to attend weekly workshop sessions.
  - b. Including a formal numeric marking scheme for each homework
  - c. Requiring students who did not attain a satisfactory level in the homework to complete and submit a second version and attend a remedial workshop session.

The overall aim of this project is to promote flexible, independent learning, and also to improve students' learning outcomes in terms of final exam performance and progression.

**Work undertaken and outcomes achieved (\*main findings in bold):** In general, the programme of work proceeded as described above. However, the large amount of data collected, particularly in the second year of the study, enabled more research questions to be answered than was originally envisaged

1. The first goal was to evaluate the effect of receiving feedback on final exam performance in the pilot cohort of 2004/5. **The group who received electronic feedback produced significantly better average final exam performance (61%) than those who did not (55%).** This improvement in performance was sufficient to cross grade boundaries and remained once the effects of prior mathematical ability and attendance rates had been extracted.
2. The second goal of the project was to extend the feedback system to the entire cohort in 2005/6. This goal was achieved successfully and all students in the cohort were able to submit homework and receive feedback on a weekly basis. The extension to the feedback system involved several other changes to the course, which could have either a positive or negative impact on performance.
  - a. For example, the requirement to attend a weekly workshop session was withdrawn. The intention was to promote an independent flexible learning environment but this could also, perhaps, disadvantage less motivated and less able students. Overall the cohort grades increased again in the 2005/6 year (to 64%), however this increase was not significant once prior mathematical ability had been accounted for. **It is interesting to note that removing a mandatory requirement to attend workshop sessions did not produce a decrement in performance and did produce savings in staff time.**
  - b. Another adjustment to the extended system was in the quality and manner of feedback given. The 2004/5 cohort received informal text style feedback giving praise for correct answers and guidance for incorrect ones. The 2005/6 cohort were given a mark and marking scheme for each homework, and the feedback was briefer and more standardised to save time. In order to analyse the effect of this, as well as the removal of the workshop attendance requirement, two subgroups of students were extracted from 2004/5 and 2005/6 data set. **The first group who received informal feedback and attended sessions produced average exam performance of 59%, where as the group who received formal feedback and didn't attend sessions produced average marks of 69%.** This increase in grades was highly significant once differences in prior mathematical ability had been partialled out.
  - c. One reason for providing a formal marking scheme was to identify students who were struggling. So, for example if a student received a grade of less than 40% in a weekly homework, they would be required to attend a remedial practical session (not advertised as such) where they would receive guidance and complete a second version of the same homework. This strategy proved to be somewhat problematic. At the time of planning this project there was no official requirement for students to complete the second version of the practical or attend the remedial workshop. Thus there were no sanctions available for non-attendance and non-

completion. Therefore out of 10 to 15 students who were asked to attend the remedial workshop on any given week, around 1 or 2 (sometimes none!) actually did. Two conclusions arise from this. Firstly, students found it useful to have several versions of homeworks with model answers available for practice and revision. The second conclusion is that **students are unlikely to attend a session and complete a second homework unless there is some official requirement to do so.**

Additional research questions addressed in this project:

1. We were concerned that students with lower academic ability in particular would be disadvantaged by a reduction in contact time. Groups of students, who had fulfilled lower and higher entry requirements, were identified. Groups were further subdivided into those who had submitted less than 75% of their homeworks and those who had submitted greater than or equal to 75% of their homework assignments. During the course, these students received several timed formal assessments: 1) Simple numeric, computational skills; 2) Use of statistical software and interpretation; 3) Final exam: Conceptual, computation, and interpretation. The analysis of these data was particularly interesting. **Performance on all three assessments was higher in students who had submitted => 75% of their homework assignments, and thus received more feedback, produced significantly better performance than those who had not, irrespective of level of entry requirements fulfilled.**
2. We also wanted to check whether provision of feedback contributed to practical knowledge and laboratory performance. As data on marks from the lab course was also available, we entered all the data collected into a multiple regression analysis (initial maths ability, average homework mark, number of homeworks submitted, % of lectures attended). **It was interesting that overall the best predictor of laboratory performance was the number of homeworks submitted and the amount of feedback received.**

In summary the findings of this study have shown that students can benefit substantially from receiving regular feedback. There was no significant decrement in performance associated with withdrawing practical sessions. Both lower and higher ability students produced better marks in all their assessments when they submitted more homework assignments.

**Transfer to other areas:** This study involved a 1st level statistics course for psychology students. It is not a new idea that students will learn better if they practice frequently, however they often fail to do so. Setting regular marked homework can be a solution to this problem if electronic means are used to produce marks and feedback for large cohorts. This strategy would be suitable for any subject area where repetition and practice are vital for good performance.

**Evaluation:** The project was successful and goals were achieved with no particular resource issues. We were able to collect more data than was originally envisaged and extend the research questions beyond those outlined in the original proposal. The project was, in particular, able to evaluate one consequence of a blended learning strategy, that is, combining traditional face-to-face teaching with technology based learning rather than relying purely on face-to-face teaching. Large numbers of students (up to 300) were provided with regular electronic feedback rather than being required to attend practical sessions. The reduction in contact time was not detrimental to performance and the best predictor of performance on all formal assessments was the number of homework assignments actually submitted, irrespective of prior ability.

**Dissemination of project outcomes:** The outcomes of this project will be disseminated in several ways. The methodology and results will be presented at future UH learning and teaching conferences. The first author will describe how electronic feedback can be used to improve learning and a UH ERSN session in November 2006. The full results of the project will be described in a full-length research paper (in preparation) to be submitted for publication in an appropriate journal.