using results from on-going systematic evaluations, which in itself is a form of research, it is possible for a teaching development project to thrive. An awareness of educational research, and the inclusion of results from educational research further strengthens the project and improves the quality of dissemination. Successful internal small grants and presentations at conferences and internal meetings provide an environment in which interest is readily maintained. The opportunity then exists for larger scale interactions and collaborations.

The Workshop Tutorials provide a dynamic learning environment in which issues in physics education research can be investigated. Aspects of the workshops are available as research projects for students.

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The HSC syllabus changeover and first year student experiences in physics and biology

Chris Stewart, **Manjula Sharma**, School of Physics, The University of Sydney, **Mary Peat**, **Charlotte Taylor**, **Elizabeth May**, **Rosanne Quinnell**, School of Biological Sciences, The University of Sydney, **Michael Prosser**, Institute for Teaching and Learning, The University of Sydney, and **Peter Logan**, Department of Applied Physics, University of Technology, Sydney
kipper@physics.usyd.edu.au

Introduction

Student approaches to learning vary from surface approaches to meaningful, deep learning practices. Differences in approach may be related to students' conceptions of the subject, perceptions of the learning environment, prior experiences studying the subject and performance on assessment. Investigating these issues provides insight into student learning processes, a powerful evaluation and feedback process for improving tertiary science teaching and learning.

We are in a unique position to investigate the effects of recent changes in the NSW HSC syllabus by examining differences in student learning from 2001 (the final intake taught primarily under the old HSC) to 2002 and beyond, and to study how the transition from HSC to first year university affects student learning.

Changes in the HSC

The Stage 6 (preliminary and HSC courses) syllabus for each of the sciences is part of a learning continuum learning from Kindergarten to Year 12. In Stage 6 students continue to develop skills through a range of experiences focused on planning and conducting investigations, communicating information and understanding, developing scientific thinking and problem solving techniques, and working independently and in groups.

We would expect the first group of students learning under the new science HSC courses, who will be entering universities in 2002, to have a broader view of their chosen science discipline, to have developed an inquiring mind and to be confident and competent in group activities.

Survey instrument

The survey instrument is composed of three questionnaire sections:

- the *Approaches to Learning Questionnaire*, adapted from Biggs' (1987) *Study Process Questionnaire.* It consists of 28 statements about students' approaches to studying physics or biology, sorted into ***Surface*** and ***Deep Approach*** scales;
- the *Conceptions of Physics/Biology Questionnaire*, adapted from Crawford et al. (1998), consisting of 20 statements on the nature of 'doing' physics or biology, sorted into ***Fragmented*** and ***Cohesive Conception*** scales; and
- *Experiences of Studying Physics/Biology Questionnaire* **(**post-test only), adapted from Crawford et al. (1998), which asks students to evaluate their courses based on their perceptions of the teaching style, the workload and assessment, their level of learning independence and whether the course goals were clearly defined.

Analysis and preliminary results

We will employ a raft of statistical tools to examine the responses to our survey. A **Reliability Analysis** will be used to test the correlations between questionnaire items and related items within each scale. A **Correlation Analysis** will provide a basic look at the structure of the student responses. Then we will use a **Factor Analysis** to identify more carefully any links between variables. A **Cluster Analysis** will allow us to identify groups of students who are responding in similar ways throughout the survey.

A random sample of physics and biology students' responses was selected for preliminary analysis. Correlation, Factor and Cluster analyses of the preliminary data set were performed on the Cohesive and Fragmented Conceptions of Physics scales and the Surface and Deep Approaches to Study scales. The results indicated that correlations exist between Surface Approach and Fragmented Conceptions scales, and Deep Approach and Cohesive Conceptions scales.

The Cluster Analysis highlighted two distinct groups of students. One group tended to score highly on the Deep and Cohesive scales, and low on the Surface and Fragmented scales; the other group tends to reverse this pattern. These early results suggest a link between students' approaches to study and their conceptions of the subject being studied. These two groups have qualitatively different experiences of their studies of physics.

Conclusions

A successful new science-education collaboration between eight researchers in four departments and two institutions has been formed to examine similarities and differences between the first year student experience in different disciplines. The preliminary analysis of the survey data is going well, with links already evident between students' approach to learning and their conceptions of the subject.

Similar correlations were previously noted in Crawford et al.'s (1998) study of students' experiences studying mathematics at university. The results of that study suggest we may find more complex structure after the inclusion of post-test data. We expect to uncover relationships between the students' prior and post-perceptions and understandings of the subject, their perceptions of their learning environment and their prior and post-achievements on assessment.

We will compare student responses across disciplines and institutions to look for differences in learning experiences. We also intend to administer the survey again in 2001, 2002 and beyond to look for early changes in student learning experiences resulting from changes to the HSC, to evaluate undergraduate university courses and programs, and potentially to provide valuable feedback to high school educators.

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