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NSW 2006 AUSTRALIA

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The Dean
Faculty of Science

RE: SCIFER ANNUAL REPORT, 2001

The SCIFER (**SC**ience **F**aculty **E**ducation **R**esearch) group was formed towards the end of 1999 and has continued to function as a small group of academics in various disciplines of the Science Faculty engaged in research into teaching and learning science. Meetings are held once a month with an average attendance of around 15-20 members.

In 2001 SCIFER members have remained active working on various projects and writing grant proposals for the new round of grants made available this year. We made a substantial contribution to the Vice-Chancellors Showcase of Scholarly Inquiry in Teaching and Learning September, 2001 with a member on the organizing committee and other members giving presentations, posters and a workshop. Conference presentations have been made outside the University at various venues. We have links with both UniServe Science and the Institute for Teaching and Learning.

Listed below are the projects that have been undertaken from the first round of grants in 2000 and the projects that have just been funded in the second round in September and November 2001. Any conference presentations, papers etc are listed with the projects. Individual Reports from the 2000 projects are attached.

2000

GRANT 2000:1 - Learning Quantum Mechanics

Team leader: Peter Fletcher (Physics),

Team members: Assoc. Professor Ian Johnston (Physics), Dr Meredith Jordan, Dr Adrian George (Chemistry), Dr Susan Gordon (Mathematics Learning Centre)

The primary goal of this project was to reveal the conceptual difficulties that students experience whilst learning quantum mechanics in chemistry and physics settings. The investigation explored how chemistry and physics students conceptualise the quantum mechanics presented in the current undergraduate curriculum. The study focused on mathematical skills, metaphors, analogies, visualisations and problem solving strategies adopted by students to solve both formal text book and novel questions. Academic staff, undergraduate and postgraduate students participated in the study.

Conference Presentation:

How tertiary level Physics and Chemistry students learn to conceptualise quantum mechanics. Conference on University Physics Education, 14th National Congress of Australian Institute of Physics, Adelaide University, South Australia, December 10 - 15, 2000.

Journal :

Selected results from the research will be submitted to the American Journal of Physics and the International Journal of Science Education early 2002.

GRANT 2000: 2 - Integration of Science Courses

Team leader: Adrian George (Chemistry)

Team Members: Sue Franklin (Biological Sciences), Sandra Britton, Jenny Henderson (Mathematics).

Aims:

To identify the common ground between the "core" First Year Science subjects of Chemistry, Physics, Biological Sciences and Mathematics at the University of Sydney.

To investigate what connections students make between related first year topics.

To develop strategies that will help students integrate their knowledge of related topics.

Forum :

Poster Presentation: *Linkages between Biology, Chemistry, Mathematics and Physics at Junior Level*, The Vice-Chancellor's Showcase of Scholarly Inquiry in Teaching and Learning September 27-28, 2001.

GRANT 2000: 3 - The Role of Memorising in Learning Science

Team Leaders: Drs Sue Gordon and Jackie Nicholas (Mathematics Learning Centre)

Team Members: Ian Cooper (Physics) Miriam Frommer (Physiology)

The role of memorising in education is a controversial one. Memorising may be seen as rote learning, "parrotting", even as the antithesis of learning with understanding. Nevertheless memorising is a strategy frequently used by students to reproduce information in examinations. However, in recent years, cross-cultural research has raised the question of a more general claim for the synthesis of memorising and understanding. In their data with Chinese students, Marton, Watkins & Tang (1997) present memorisation or committing to memory in a continuum with understanding rather than as its opposite. This project seeks to explicate the role of memorising from the perspectives of university science teachers. It investigates the conceptions of the role of memorising and its relationship to understanding held by a small group of university teachers, and how they incorporate memorising in their teaching strategies and assessment.

Conferences:

Cooper, I., Frommer, M., Gordon, S. and Nicholas, J. (2001). *University teachers' perceptions of the role of memorising in learning science.* Paper presented to the 3rd

Annual Change in Education Research Group Symposium (CERG), UTS, February, 2001.

Cooper, I., Frommer, M., Gordon, S. and Nicholas, J. (2001). *Memorising and understanding in learning - An interdisciplinary study*. Paper presented to the 24th Annual Conference of the Mathematics Education Research Group of Australasia, Sydney, July, 2001.

Paper (in preparation for journal such as Higher Education Research and Development
Cooper, I., Frommer, M., Gordon, S. and Nicholas, J. (2001). *University teachers' perceptions of the role of memorising in learning science*.

GRANT 2000: 4 - Instrument for testing transferability of mathematical skills

Team Leaders: Ms Sandra Britton (Mathematics and Statistics), Dr Manjula Sharma (Physics)

Team members: Dr Judy Kay (Computer Science), Dr Peter New (Microbiology)

Science students are required to use mathematics, at various levels, in all their science subjects. Certain mathematical skills are essential for success as an undergraduate student, and in the student's future career. An ability to transfer the skills learned in mathematics to other disciplines is expected of both undergraduates and graduates. It is important to discover therefore, whether or not students have this ability. An instrument has been developed to test the transferability of mathematical concepts across various scientific disciplines. The instrument consists of mathematical problems set in various scenarios. The instrument has been trialled with mathematics, microbiology and physics students from higher years. First year students from the different disciplines will be tested using the instrument once it has been refined using the results from the trials. Results of the trial with students from higher years will be presented. The research methodology and the process of developing a useful instrument will be discussed. The results of this research will have an impact on curriculum design and the teaching and learning of mathematics, both within the discipline of mathematics and other disciplines within science.

Refereed paper:

P. New, S. Britton, M. D. Sharma and A. Brew, Researching the transferability of mathematical skills, Proceedings of the UniServe Science Annual Workshop

Conferences:

P. New, S. Britton, M. D. Sharma and A. Brew, Researching the transferability of mathematical skills, UniServe Science Annual Workshop, Research and Development into University Science Teaching and Learning, April 2001.

Conference presentation with abstract published:

M.D. Sharma, S. Britton, A. Brew, P. New, Transferring mathematical skills into physics, AAPT Summer Mtg, Rochester, NY, USA, Announcer, 31, pg 72, 2001.

Poster:

M. D. Sharma, A. Brew, P. New and S. Britton, Do students in the Faculty of Science transfer mathematical skills between subject areas?, VC's Showcase at the University of Sydney, Sept 2001.

2001

Four projects were funded in the recent round of grants. They are listed below.

GRANT 2001: 1 - First-year Student Experiences in Physics and Biology: The 2001–2002 HSC Syllabus Changeover

Project Leader: Dr Chris Stewart,

Team members: Dr Manju Sharma (School of Physics); Dr Elizabeth May, A Prof Mary Peat, Dr Rosanne Quinnell, Dr Charlotte Taylor (School of Biological Sciences); A Prof Michael Prosser (ITL); Peter Logan (UTS, Department of Physics)

GRANT 2001: 2 - Learning from feedback: student interpretation, understanding and use of feedback on first year science assignments

Project Team: Dr Charlotte Taylor, (Biological Sciences), A Prof. Cyril Latimer, (Psychology)

GRANT 2001: 3 - The role and usage of educational multimedia and communications technologies in supporting student learning across *Life Science* disciplines

Project Leaders: Drs Rosanne Quinnell and Elizabeth May, (Biological Sciences),
Project Team: Dr Hilary Lloyd (Pharmacology), Dr Sue Franklin, (Biological Sciences).

GRANT 2001: 4 - How do students in a science degree gain skills in understanding and interpretation of mathematical relationships in quantitative data?

Project leader: Dr Rosanne Quinnell (Biological Sciences),

Team members: Drs Manjula Sharma, John O’Byrne (Physics), Irene Schneider (Physiology), Peter New (Microbiology)

The group continues to provide a forum for discussion of cross disciplinary issues in Science and allows members of the Faculty who are very involved in teaching to find research issues that interest them. By presenting papers at conferences, the group increases the awareness of the academic community at large to the commitment by the Faculty of Science at the University of Sydney to high standards of research based development in teaching.

Thank you for your continuing support.

Rosemary Millar