Chapter 1

Language Problems of First Year Science Students

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ABSTRACT

The chapter discusses the background of a project which aimed at addressing the language needs of a diverse student body (both domestic and international student body) by embedding strategic approaches to learning and teaching in first year sciences in tertiary education. These strategies consisted of active learning skills which are widely used in language learning. The disciplines covered by the project were Biology, Chemistry and Physics and involved the University of Canberra, University of Sydney, University of Tasmania, University of Technology, Sydney, and University of Newcastle in Australia. This project was funded by the Australian Learning and Teaching Council (ALTC).

INTRODUCTION

Specialist terminology in Biology, Chemistry and Physics has proved difficult for most students (Wellington & Osborne, 2001). Students have difficulty recognizing where a concept begins and ends and therefore cannot differentiate concepts. Zhang and Lidbury (2006) identified difficulties with language as contributing significantly to problems students experience in studying science (specifically Genetics). In this study, we seek to implement language oriented strategies (Table 1) developed by Zhang and Lidbury (2006) for First Year Biology, Chemistry and Physics lectures and tutorials with the aim of evaluating the benefits of those methods.

One distinctive feature of this project is that the language expert worked collaboratively with lecturers in the disciplines closely as a novice first year student with no previous HSC experience (but an expert in language learning and teaching). In this project, the language expert ‘learned’ the
content of the disciplines by direct experience and in this process, attempts to (a) make lectures more accessible; (b) look for opportunities for small group participation; (c) look for opportunities to develop students’ communication skills in communicating scientific knowledge to lay communities; (d) create opportunities for providing formative feedback both face-to-face and through online activities by negotiating and collaborating with the disciplinary lecturers. Some of the activities focused on language issues, others focused on active learning strategies.

**Context and Characteristics of the Students**

Students undertaking tertiary studies in science are a highly diverse group. For instance, at the University of Sydney, Australia in 2008, there were 969 students from various faculties in the first year Chemistry cohort. Three-hundred and eighty eight students had little or no High School Certificate Chemistry while 116 students have very high University Admission Index Chemistry scores (greater than 98 for Veterinary Science students). With such a diverse group there was, naturally, a wide range of interest in and aptitude for the subject. Such diversity is typical in cohorts in Biology, Chemistry and Physics at the participating Australian universities.

**Administration of the Language Difficulty Questionnaires**

In this project, we adopted a model which varied slightly from that of Jacobs (1989). We distributed one questionnaire through the Learning Management System (LMS) of the participating institutions. In this questionnaire, we tested comprehension of ten common terms. The examined terms are; ‘research’, ‘power’, ‘concentration’, ‘equilibrium’, ‘graph’, ‘system’, ‘equation’, ‘experiment’, ‘model’ and ‘significant’. The criteria for selection of the words were that they have to be:

- Words used as basic currency in physics, chemistry and biology lectures and for which definitions would be assumed unnecessary; and
- Words which in lay contexts acquire more flexible and approximate meanings.

For example, in the question related to ‘research’ for the Chemistry and Physics disciplines, the following was provided:

“We carry out research to find out the answers to scientific questions”

What is meant by the word ‘research’ in the sentence above? (There may be more than one correct answer; see Table 2). They are then provided with five answers for this question:

**Table 1. Proposed language oriented techniques to be implemented in the project**

| 1. Small group work in tutorials using guided questions. | 6. Attaching sound files to vocabulary |
| 2. Students are provided with a list of terms and, through the process of group work, place these terms in relation. | 7. Breaking down long words to aid memory by identifying prefixes and suffixes, and exploring the roots and origin of words. |
| 3. Giving students opportunities to put forward their points of view in groups. | 8. Using warm up activities such as matching scientific terms to definitions for revision purposes. |
| 4. Using online language exercises such as crosswords, gap-fill (Cloze) exercises. | 9. Role playing: students practise conveying complex scientific discoveries to the public. |
| 5. Providing stimulus quizzes for lecture and tutorial materials on WebCT thus encouraging students to prepare before the lecture. | 10. Role playing: students practise conveying complex scientific discoveries to the public. |