Changing perspectives in tertiary teaching: A collaborative approach between Science and Education Faculties ®

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ABSTRACT

There is an expectation that universities need to improve the quality of their teaching. At the University of New England, this movement has been facilitated by the establishment of a Teaching Development Fund to support selected projects. This paper reports on one such initiative involving members from the Centre for Cognition Research in Learning and Teaching, and lecturers and demonstrators in the Faculty of the Sciences involved in one of the largest foundation units within the University. The purpose of the grant was to assist the staff in creating a richer learning environment for students that catered for the diverse range of student backgrounds and ability levels upon entry. The project was carried out within the professional development framework provided by HITS (Help in Teaching Science). During the course of the project the focus moved away from an emphasis on what scientific content was to be taught towards an awareness of the complexities of student thinking and learning of the scientific content. In addition to this, the traditional role of demonstrators was seen to be inadequate and the view of a demonstrator as a teacher emerged. This newer role carried with it greater responsibility in terms of student learning, more autonomy, and a realisation of the centrality of the demonstrators as the link between lecturers and students in the learning process. The results of this close collaboration between professional educators and science staff have wide implications for Science Faculties in universities throughout Australia given the lower numbers of students opting for science degrees and the high attrition rates.

INTRODUCTION

Universities, as institutions of higher education, are charged with the responsibility to impart higher level knowledge to students within discipline areas. Traditionally, this involved the transfer of knowledge from the lecturer to students using a specified sequence of events including a series of lectures, utilisation of a range of textbooks, assignments, and a final examination (November, 1997). However, this represents only one of three conceptions of teaching identified by Biggs (1989). In his first view, there is a perception of teaching as the transmission of knowledge whereby a good teacher is recognised as someone who knows their subject well communicates this knowledge fluently to students. Learning is believed to have occurred if students can reproduce this knowledge in assignments and examination situations. The nature of the learning, i.e., whether it is surface or deep, is not considered. Any failure within this context is due solely to the individual student.

The second conception of teaching according to Biggs (1989) is when the environment for learning is perceived as an "orchestration of teaching skills" (p.9). In these situations, teachers use a variety of strategies, which they adapt to suit particular individuals or groups of students. The implication of this approach is that good teaching involves the effective management of teaching resources. While this represents an improvement upon the earlier view of teaching, from this perspective the student is perceived as being one component in the system that needs to be managed. A consequence of this approach is that the educational institution becomes the guardian of knowledge, with the teaching staff "charged both with extending and elaborating that knowledge according to agreed canons of procedure" (Biggs, 1989, p.8). Learning is institutional in that what is taught, how it is taught, and how it is assessed is guided by requirements and standards set up by the staff within the institution.

The third and final conception of teaching identified by Biggs (1989) involves the facilitation of learning. This requires interactions between teachers and learners so that students construct their own knowledge within a given context. The role of the teacher is to provide a

range of activities which create a rich learning environment. Within this context, learning is perceived as an active process undertaken by students. As a result, there is a change in emphasis in this approach from 'what the teacher does' to 'what the student does.'

Within the Australian setting, Radloff and Sampson (1988) found that the majority of academics in tertiary institutions held one of the first two perceptions of teaching outlined above. Consequently, appropriate learning was demonstrated when students reproduced the knowledge, skills and attitudes of the discipline for which they studied. Recently, this view of learning has been challenged (e.g., Akerlind & Jenkins, 1998; Bruce & Gerber, 1994; Marton, Dall'Alba & Beaty, 1993). These authors suggest that students not only need the knowledge or skills of the discipline or profession, but they need to develop lifelong skills of enquiry, reflection, communication and innovation. Therefore, teaching needs to be about changing students' perceptions and interpretations of their world (Boulton-Lewis, 1995) so that the quality of students' understandings becomes an important focus and not just the course content.

In an attempt to improve the learning environment for university students in Australia, several universities, as well as the Federal Government, have initiated teaching development grants to provide financial support for innovations in teaching. One such scheme is being offered at the University of New England (UNE). Here, substantial sums of money are offered on a competitive basis to encourage and foster innovation in teaching, learning and assessment within a unit or course program. The idea behind the grants is to improve teaching in a particular field through supporting innovative projects with practical outcomes, thereby enhancing the status of teaching at UNE. This scheme has been in operation for the past two years and it is within this context that the ideas in this paper are discussed.

THE PROJECT

This project represents a first attempt to bring together lecturers and demonstrators of foundation units in Biology, one of the largest service units in the Faculty of the Sciences, with members of the Centre for Cognition Research in Learning and Teaching (CRiLT) in the Faculty of Education, Health and Professional Studies. The general purpose of the project is to develop, implement, and evaluate new approaches to teaching given that students enrolled in these foundation units have a broad range of backgrounds on entry, and they undertake the units with diverse career plans in mind.

Specifically, the aim of the project is to develop a consistent program of study for students, as well as improve the professional knowledge base of staff so that they are more able to address learning issues faced by students in these units. It should be noted that the problems associated with these units are widely known and that teaching staff have been attempting to address these over the last few years. While some gains have been made, and overall benefits have been achieved, two key problems remain. The first of these is the difficulty in marshalling together the full teaching team, across different Schools within the Sciences, to collaborate in addressing central concerns with the units. The second relates to the limited teaching know-how of those attempting to address educational issues which lie "outside their area of expertise." This project addresses both these aspects. First, the success of the project in gaining the necessary financial support acted as a catalyst to bring the whole teaching team together with a clear united goal. Second, the inclusion of experts in the field of teaching and learning provided the necessary expertise which had been missing in the past.

In particular, the intentions of the project were to:

(i) cater for the wide diversity of student backgrounds, abilities and expectations. For example, some students had completed the HSC Biology course while others had not.

(ii) develop, trial and evaluate organisational and alternative teaching strategies which are more appropriate for such a diverse group than the more traditional lecture/practical mode. The new structures being put in place offer students a richer environment for learning than was available previously. This means there is a stronger emphasis on students going beyond narrow routine-based knowledge to encouraging them to apply their knowledge. The learning environment is such that students, at all levels, are encouraged to extend themselves.

(iii) produce a cohesive sequence of study that offers students continuity, and a developmentally sustainable set of experiences despite the broad mix of lecturers and demonstrators from a number of Divisions and Schools within the Faculty of the Sciences.

(iv) provide a pedagogy for the unit where there is emphasis on the integration of knowledge as opposed to its compartmentalisation. In this way, the work on a particular section, given by one group of lecturers in the Faculty, is seen to complement and extend (or provide the basis for) another section area. This means that genuine efforts are being made to ensure that the subject is not seen as a collection of stand-alone topics.

(v) allow staff members the opportunity to increase their awareness of educational issues associated with student learning so that they are able to make informed decisions about future teaching and learning directions.

Two additional benefits are also expected. The first is a lifting of the self-discipline and motivation of the students. It is perceived that part of this problem can be traced to the sheer volume of material students encounter in the units and the lack of perceived cohesion of this content. The second benefit concerns the demonstrators. These people are part of the teaching team and are an important resource for students. However, many demonstrators are inexperienced in working within a teaching context. Involvement in this program represents for many of these people a first encounter with how they might develop and enhance their teaching skills.

THEORETICAL CONTEXT

The project is being carried out within an action research context using a professional development model (*Help in Teaching Science*, HITS) which has been successfully used at State and National levels (Levins, Pegg, & Creedy, 1994). The success of the model is that it builds upon, and extends, the skills and knowledge base of participants by addressing and solving important practical problems over an extended period of time. At the heart of the process is an attempt to build upon the practices already trialed and developed, and achievable outcomes and a solution to the problem being 'owned' by the participants. The facilitators' role is one of acting as catalysts for innovative actions and providing the necessary knowledge about, and impetus for, change.

Within the context of this project, the HITS model provides a platform upon which professional growth can occur. It provides university teaching staff with access to support on a problem or issue that the staff themselves identify and wish to address. In this manner, the model gives the staff ownership of the issue to be investigated, the solution, and type of support required. The physical aspects of the project are shown in Figure 1.

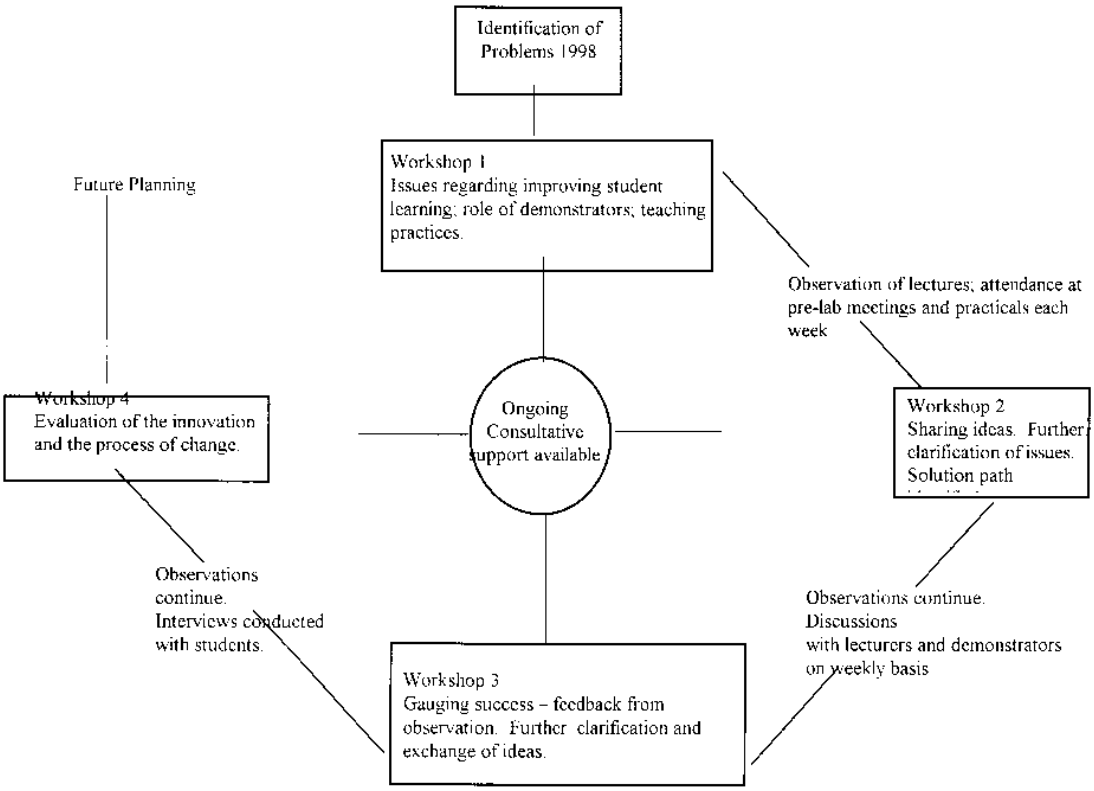

Figure 1. The HITS Model as it relates to the project for the first six months 1999.

As indicated in the HITS Model (Figure 1) the project began with an exploratory workshop in late 1998 for all lecturers and demonstrators involved in the units for the following year. At this workshop participants were asked to identify the strengths, weaknesses and problems associated with the units as they stood. A number of issues emerged from the group discussions including ways of improving student learning within the course; the role of demonstrators in supporting changes; and, the need for strategies to be developed to assist demonstrators, given that a number of them have had limited teaching experiences.

With these issues identified, a series of four workshops were set to be held in the first six months of 1999. Each of the three-hour sessions was attended by the teaching team which comprised six lecturers and fifteen demonstrators involved in the units, although this number varied slightly depending upon other teaching commitments. Within each of these sessions, the time was split between input by the facilitators, and small and large group discussions with the discussion sessions taking priority.

The participation of both lecturers and demonstrators provided an ideal opportunity for different perspectives to be shared. The facilitators organised, attended and chaired all meetings, however, their primary role was as catalysts for change. This involved

encouraging participants to reflect on the nature of change and providing methods of inducing and managing change.

Outside of these meetings, an experienced educator in the field of teaching and learning in science attended (as an observer) most lectures, combined practicals and tutorial sessions, and teaching-team pre-laboratory meetings. In addition, in the later part of the project this person also undertook a series of interviews with students.

In the context of this project, the HITS model provides a framework for lecturers and demonstrators to learn about teaching as they help their students learn about Biology. From a research perspective, there are at least two pertinent outcomes from utilising the HITS model. First, it provides answers to issues or problems that, in this case, the science teaching team felt they needed to address, and, second, it allows the facilitators an opportunity to observe and analyse the acquisition of new skills and understandings by the participants involved.

Of the issues identified during the workshops, and of relevance to this paper, the role of the demonstrator, in terms of their contribution to student learning, arose as a main focus of discussion. To this end, a large part of the time allocation in the first two workshops addressed this issue. In particular, the following questions were considered:

Workshop 1: What do you perceive as the role of a demonstrator?

Workshop 2: What is teaching? What are the differences between the roles of a lecturer, demonstrator, and tutor in this regard?

The views of lecturers and demonstrators, as they attempted to address these questions is the focus of this paper. To provide an additional point of view, eighteen students enrolled in the unit were interviewed regarding their perceptions of the role of demonstrators and how important are demonstrators in assisting student learning and understanding. These students had consented to the interviews and were selected using stratified random sampling so as to represent the range of variation evident within the student population in terms of sex, degree program, and life experience (i.e., mature-aged versus straight out of school).

RESULTS AND DISCUSSION

The results and discussion are presented under two sections. In the first, the findings from the two workshop sessions involving the lecturers and demonstrators are presented. In the second section, excerpts from interviews with three students are provided and discussed.

Views of teaching staff

In the first workshop in 1999 the teaching staff were presented with the question: "What do you perceive as the role of a demonstrator?" After each staff member was given time to consider the question, small groups were formed consisting of either demonstrators or lecturers. Each group was required to summarise their views at the end of their discussions and present it to the whole group. The dot points provided below are the summary points taken directly from the overhead transparency sheets provided by each discussion group.

In terms of the demonstrators' responses, the responsibilities they identified were grouped broadly to include both academic and personal spheres. Within the academic sphere, they perceived their duties to be:

- taking theory and helping students apply this to the practicals thereby improving students understandings of scientific concepts;

- aiding each student in the development of technical skills;

- marking practical tests and providing feedback for students;

- encouraging the notion of independent learning; and

- conducting tutorials.

In regard to the personal sphere, demonstrators believed that they needed to:

- develop a rapport with students so that individual needs were met;

- provide encouragement and reassurance for each student; and

- be able to direct students to other avenues of help (e.g., people) or information (e.g., people or resources).

Overall, the three groups of demonstrators identified similar responsibilities. These related to the practical specifics of their day-to-day role. One difference emerged between the groups as each spokesperson tried to encapsulate, or provide an overview of, their group's perspective. One group perceived their role "to be that of a guide" whereas the remaining two groups believed they acted as intermediaries between the lecturers and students in the unit. This distinction is important. Being a guide implies a degree of ownership and autonomy, whereas acting as intermediaries suggests that the demonstrator is part of a process in which they have little say or impact. None of the demonstrator groups were comfortable with the notion that they were teachers, in fact, one group stated explicitly that in their view they "were not teachers."

In their feedback, the lecturers identified responsibilities for demonstrators falling into academic, personal, and professional spheres. Within the academic sphere, they specified that demonstrators should:

- assist students in learning 'material' in practicals by highlighting the key concepts in the subject area and helping students make linkages between these and other areas;

- ensure that each individual student has achieved the goals of the practical;

- assist students in the development of technical skills;

- encourage students to think scientifically, i.e., stress the importance of observation, interpretation and the generation of questions; and

- run tutorials.

In regard to the personal sphere, lecturers perceived that demonstrators should:

- encourage the participation of students in teamwork and collaboration;
- be enthusiastic, interested, compassionate, and fair in their dealings with students;
- establish a 1:1 relationship with each student, and act as a mentor.

Finally, lecturers required demonstrators to act in a professional capacity so as to:

- provide feedback to lecturers - i.e., be their eyes, ears, and mouth;
- be able to target at-risk students; and
- support each other.

In perusing the responses provided by both demonstrators and lecturers, it is interesting to note the high degree of similarity in the comments regarding the perceived role of demonstrators. However, what stands out about the lecturers' comments is the explicit belief that demonstrators play a critical role in helping students learn. This should occur as demonstrators encourage students to think scientifically and make linkages between concepts. This point of view suggests that the group of lecturers not only require demonstrators to provide technical help and support to students at an individual level, they expect a strong emphasis on the facilitation of learning.

Notwithstanding this view, it was interesting that the word 'teaching' was not used by the lecturers in their discussions. To investigate this issue further, the notion of teaching was explored in Workshop 2 when the teaching team was asked the question "What is teaching?" Once again, participants spent some time considering their view individually before sharing their ideas in mixed groups consisting of both lecturers and demonstrators.

Emerging from this process was the view that teachers need to be good communicators in that they must be able to:

- impart facts, concepts, linkages;
- extend student knowledge;
- help students apply this knowledge;
- establish a framework for learning;
- stimulate student learning, problem-solving, questioning, thinking; and
- encourage students to develop understandings.

Furthermore, teachers were expected to:

- provide inspiration and motivation;
- reassurance; and
- direction and guidance e.g., grabbing a person and help to take them somewhere else.

These points, along with the ensuing discussion, indicated a change in focus in the group's views about teaching. Initially, they perceived teaching as helping to develop and extend students' scientific knowledge using a variety of techniques to achieve this successfully. However, this perception gave way to a deeper appreciation of teaching as the participants recognised that teaching should encourage and facilitate students' understandings of concepts. The discussion that emerged from this reflection was enlightening for the group with a number of participants raising the question: "What are the differences between the roles of a lecturer, demonstrator, and tutor in regard to teaching?" This question was addressed within mixed smaller groups with results reported back to all the participants. A summary of the results as presented are provided Table 1.

Table 1 Summary of points regarding the differences between lecturers, tutors and demonstrators

Lecturer	Tutor	Demonstrator
subject specialist	broad knowledge base	generalist
provides information to the masses	provides links between students and lecturers	historically, a technical assistant
sees the bigger picture	helps students develop understandings of concepts	helps students develop understandings of concepts
identifies the key concepts	does not have much authority	does not have much authority
organiser of unit		
researcher		
administrator		

The perception for most of the participants was that these three roles formed a continuum with the distinction between them not being as marked as they had been in the recent past. Emerging from this discussion was the realisation by both lecturers and demonstrators present that what was being expected of the demonstrators in this particular biological sciences units was for the demonstrators to take on a more active teaching role.

Overall, the participants were surprised by what had emerged from these discussions. Not only were the demonstrators made aware of the importance of their contribution to student

learning but the lecturers recognised that they were required to do more than stand in front of large groups of students and provide scientific information. This was a significant outcome for the teaching team because it provided a shared meaning about their individual roles, and it established a sound basis upon which future planning could be based. In particular, there was an acceptance by the teaching team that for student learning to be optimised, all parties had an important contribution to make.

Views of students

The discussion thus far has focused on the role of demonstrators as perceived by the staff involved in the biological sciences unit, however, an additional perspective was gained from the students who were studying the unit. This was achieved during interviews with 18 first-year student. At one stage in the interviews, students were asked: "What do you see as the role of your demonstrator?"

> S: Well, at the start of the practical to make sure you understand what's going on and why you're doing it, and what it's actually uum, what the practicals are trying to simulate. Then I think throughout the practical while you're doing it, just to answer your questions. Not to give or not to give you answers but to point you in the right direction so you can come to the answers. I don't think they should just give you the answers, I think they should just be there so that you know that if you get stuck you can get direction but you're not going to get an answer

(Steve, Student 12).

Steve appears to hold a traditional view of demonstrators in that they are expected to provide technical help and guidance. During the practical sessions, Steve seemed happy to work independently of the demonstrator, requiring help occasionally. Helen's initial comments supported Steve's view in that she relied on the demonstrators for clarification as to whether she was on the right track. However, under probing Helen alluded to a far more substantial role for demonstrators.

> H: I think they play a large role because if you do not know what you are doing then they are always willing to show you, or do it this way. If you didn't have them there, well you never know whether the answers are actually correct. Help you know where you are and that you are doing the right thing. They help you learn.
>
> I: So are they valuable for your learning?
>
> H: Yeah, I think they are, you can run things by them and they help with your understanding of concepts

(Helen, Student 3).

In the case of Therese, she expressed higher expectations of her demonstrators right from the outset. As a mature-aged student who had undertaken some units at another university in the previous year, she felt that demonstrators were vital for her learning.

T: Demonstrators should be approachable and have the knowledge and a lot of them don't. X is good because he has the knowledge but is also funny. Y is great because she makes you work, she knows when you are not pushing yourself. Some of the others are too easy-going, they back off too much and don't keep control over the groups as they should. Have to keep people on task.

I: So in terms of helping you understand your learning. What role do they play there?

T: Ahh, they should be knowledgeable. Like Y, she is a good teacher, she has the knowledge but doesn't just give information to you, she makes you work for it. She makes you go through what you have in your mind to answer the question, she throws it back at you.

I: So give me an example of what Y does?

T: Well, if you ask her a question, she makes you go back over what you have done and asks why you have done these things. Then she asks "well what do you think?" Y makes you think for yourself, so she is getting you into it and making you do it. Others just walk off and let you get away with it. They need to be approachable but not a push-over. I think the demonstrators are really important and that Z needs to develop a good pool of demonstrators.

I: Can you elaborate here?

T: Well, a number of them are new and are PhD students. I understand that but we need someone who can helps us learn and understand the concepts and how they all fit together. Some are under-confident and get bowled over by students who are big-mouthed. They are the ones who inspire you and show how what you are learning is so interesting. Students need someone they can approach and get help from because they won't approach the lecturers.

Clearly, Therese sees the demonstrators as more than guides and transmitters of knowledge. During her interview she actually referred to the demonstrators as 'teachers' on a number of occasions. Given the high value she places on the role of the demonstrators in terms of her learning, she was critical of the way in which they were selected. This raises an interesting issue for coordinators of science units in that many demonstrators are postgraduate students without a background in teaching and learning. In fact, the two demonstrators referred to by Therese in the interview transcript above have degrees in teaching.

The responses provided by Steve, Helen and Therese are representative of the comments made by the group of students interviewed regarding the role of demonstrators with three important findings emerging. Firstly, students recognised the importance of demonstrators in terms of the support, encouragement and help they provided with learning. Secondly, students were acutely aware that the demonstrators formed a vital link between them and the lecturers given that few of the students felt comfortable about approaching lecturers for

help. Thirdly, students' perceptions regarding the role of demonstrators mirror those identified by the lecturers and demonstrators during the workshop sessions that formed part of the professional development program.

Finally, it would seem from the responses of lecturers, demonstrators, and students that there are a variety of expectations of demonstrators. Some perceive the role to be that of a guide and technician while a greater proportion staff and students in these biological sciences units consider demonstrators to be major players in aiding student learning and understanding. This is of some concern considering that most of the demonstrators involved in this unit have not completed any studies in teaching and learning.

CONCLUSIONS AND IMPLICATIONS

The results from this study suggest that there has been both a significant change in the role of demonstrators and in their perceptions of this role in this first-year foundation units in Biology. It would seem that these demonstrators play an important role in the learning process for first-year students and form a crucial link between the students and the lecturers involved in the unit. Not only do they provide support, encouragement, and technical help for students, they initiate questions and seek explanations as a means of facilitating the construction of knowledge by the students. This was not only recognised but was valued highly by most of the students interviewed during the study. This view is succinctly summarised by Ted during his interview.

> The demonstrators in these units are so important because they do not change as frequently as the lecturers and they are the people you see from week to week. You can really get to know them and they are only dealing with 12 of us at a maximum. Students will see demonstrators about problems, not lecturers, uum, the demonstrators are so approachable
>
> (Ted, Student 13).

The dilemma with this situation is that even though the demonstrators play such an important role in these science units, only three of them have teaching degrees with the majority being PhD students lacking expertise in the fields of teaching and learning. While it is difficult to postulate, the scenario identified in this study is not likely to be an isolated occurrence given that all science degrees, regardless of the university, have a practical component requiring the utilisation of demonstrators.

Subsequently, Science Faculties within universities may need to consider providing professional support for their demonstrators if student learning in the sciences is to be improved. The response from demonstrators discussed in this paper were enthusiastic about such help with one of the more experienced demonstrators stating about the professional development aspect of the project, "this has been great - it has really been like a staff meeting for demonstrators giving us a chance to share and extend our ideas with other demonstrators and lecturers as well."

Learning to be an effective teacher requires an ongoing commitment to knowing more about teaching, subject matter, and how students learn. Knowing ways to assist teaching staff to face these challenges is an important focus for research and professional activity within universities. The implementation of such a program requires additional funds being made available which in the short-term may be difficult to justify at a faculty level given the economic rationalism being experienced within universities at present. However, there is the potential for such a scheme to improve not only learning but also the retention rates of

students in science degrees providing long-term advantages for Science Faculties, universities, and Australian society as a whole.

In considering any improvement in the quality of teaching at a university level, lecturers are the prime focus (Akerlind & Jenkins, 1998). In Science Faculties, however, demonstrators and tutors play an important role given their contact with small groups of students over extended periods of time. Nevertheless, within the research literature their role in the teaching-learning process, and the importance of their views of learning are rarely considered. One important implication of the work reported here is that unless this situation changes, real gains in student learning in large units in science programs may well be illusionary.

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