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Researching practice as a teacher educator.

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Abstract

The starting point for this Doctoral project was to examine student teachers' responses to the introduction of a collaborative assessment task intended to encourage peer teaching and motivation and to increase understanding of teaching and learning subject content knowledge in science. The research reported will include student evaluations of the pilot study carried out in 2003 which highlighted that the students felt that they had little time or preparation for working collaboratively in the science course. Their response to the assessment task (a theory and pedagogy content test), where their final grade was dependent on others in their group, will be reported.

Preliminary findings from a questionnaire to ascertain background information about the 2004 cohort of Graduate Diploma of Teaching (Primary) students' perception of their subject confidence and competence across all subject areas will be given. It appears from an initial analysis that regardless of each student's background knowledge they self-report relatively high levels of confidence and competence to teach at primary level. Another finding was their overwhelmingly positive attitude towards teaching all subjects. This information was reported back to the cohort for comment and formed the basis of the introduction to the science education module.

Details of how the science course has been adjusted in 2004 to address the issues raised in the pilot study will be presented. Students have been asked to give feedback about the changes as they have been implemented and this has been variable. Students have also been asked to critique both their lecturer's and peers' teaching and their own learning. The tensions that the assessment strategy and emphasis on peer teaching has created for the lecturing staff will be discussed. Lecturers involved in teaching on this course will have been interviewed at the outset and conclusion of the course. By encouraging the students to be more actively engaged in teaching and learning with their peers, the lecturer's role has been re-positioned. The lecturer has attempted to capture the challenges and scenarios in weekly, post-session, journal entries. At the conclusion of the course students have volunteered to be interviewed and to be part of focus groups. In all, much rich data is being gathered which will be the focus of this Doctoral project.

Introduction

In 2003, the assessment practices in a science methods course for students enrolled in a one year Graduate Diploma of Teaching (Primary) course were reviewed. The starting point for this Doctoral project was to examine student teachers' responses to the introduction of the new collaborative assessment task intended to encourage peer teaching and motivation and to increase understanding of teaching and learning subject content knowledge in science.

In my experience as a science education teacher educator I have found student teachers', in general, have little formal science background education and a negative attitude towards science. This is supported in the New Zealand context by Alton-Lee and Praat's (2000) review of the published literature. They state 'New Zealand teachers working in science education in the upper primary and intermediate schools lack confidence in their knowledge in science education' (p104). Misunderstandings and misconceptions limit student teachers' ability and willingness to create quality learning opportunities for children to make sense of the world around them. Other authors (for example, Kelly, 2000; Cobern & Loving, 2002) have commented that the school science experience of most prospective primary teachers has been a passive, teacher-driven collection of facts. This has a marked effect on attitudes towards, and an understanding of, the nature of science and frequently obstructs any new perspectives on engaging in science activities. The student teachers' prior experiences of schooling in general, and science in particular, manifest themselves in science sessions as biases and beliefs about teaching and learning science. The student teachers hold many misconceptions about scientific ideas which Osborne and Freyberg (1985) would call naïve views or alternative conceptions. If unchallenged, these misconceptions persist throughout schooling, as shown by numerous studies (for example; Driver, Guesne and Tiberghien, 1985; Garbett, 2003; Harlen, 1997; Osborne & Freyberg, 1985; Sanders & Morris, 2000; Suzuki, 2003), and can inveigle themselves into the teachers' repertoire of inaccurate science explanations.

The issue of what, and how to assess, student teachers' subject content knowledge in science was identified as an issue in this project. The accepted practice in the third year of the Bachelor of Education programme had been to test the student teachers' recall and ability to plan a single topic from the six content areas covered in the science methods course. The topic was kept secret from the student teachers until a few weeks prior to the 'test date' to encourage them to attend all classes and pay attention to the lecturers. Test papers were not returned after marking and no feedback was given, except the final mark, which had a 50% weighting.

In the science methods course taught in the one-year Graduate Diploma Teaching (Primary) course, prior to 2003, there was only one assessment task with 100% weighting. It was based on a microteaching experience. There was no evaluation of students' science content knowledge. Students in the Graduate Diploma course had complained, through programme evaluation, about the high-stakes assessment. It was appropriate to review the

assessment schedule in the Graduate Diploma course to include a 30%-weighted 'theory test'. These student teachers, with undergraduate degrees in a wide variety of areas, had previous experience of an education system that was 'designed to teach people to do things the one right way as defined by the authority figure (Lynch, 1991, cited in Huba & Freed, 2000, p.4). They were well versed in the individualistic, competitive tertiary education system and had mastered it with varying degrees of success. Their motivation to learn often appeared to be extrinsic, to pass the assessment rather than a desire to understand the content as evidenced by their desire to know what was going to be assessed, when the assignments were due and how many tasks there were.

As a teacher educator, I attempted to make science sessions interesting and engaging. If students failed to understand some science subject matter I tried to find new ways to present the information to make it more accessible but as Csikszentmihalyi (1990) claimed:

> The chief impediments to learning are not cognitive. It is not that the students cannot learn; it is that they do not wish to. If educators invested a fraction of the energy they now spend trying to transmit information in trying to stimulate the students' enjoyment of learning, we could achieve much better results (p 15).

It was my stated intention to motivate the student teachers to become more actively engaged in the teaching and learning of the science content through a new assessment strategy. Collaborative groups were to be set up to encourage sharing the workload and to give students the opportunity to teach one another fundamental science concepts. The assessment task was designed primarily to motivate student learning and understanding about teaching science concepts rather than a measurement of recall of information they had gleaned from the lectures.

The pilot project

For the assessment task eight questions were written, which asked students to outline the main science concepts, and two activities to engage learners which covered the most common and important ideas in teaching science at primary school level. These eight questions were given to the student teachers at the outset of the course and printed in their course handbook. The students were told that these exact questions were to be assessed in the final 'theory test' so they were quite clear as to what we considered important primary teachers' level science content knowledge.

The student teachers were instructed to work collaboratively, to teach and learn from each other. They were asked to select their own groups of four. Within the group it was expected that each student teacher would select two of the eight questions to focus on. They were to explain these topics to the others in their group and to provide them with ideas, activities and questions that would make learning the topic enjoyable, memorable and successful. In this way, it was anticipated that each student teacher would be motivated to learn aspects of the curriculum in depth so that they could help others in their

group to achieve the same learning. As student teachers, this also gave them the opportunity to practice teaching their peers in small groups, an authentic means of developing their teaching abilities.

There was a further incentive to learn and support each other in their group. The final test required them to answer only one of the eight questions and each member of the group was given a combined score. Questions were selected randomly so that the possibility of any student answering the question they had personally researched was left to chance. This means of engendering both positive interdependence, whereby group members can only achieve the goal together, and individual accountability, where all members are expected to achieve the set goal was based on an idea from McGookin (2002).

Student teacher evaluation of the assessment strategy introduced in 2003 came through their evaluation of the module and informal discussions. The issues that the student teachers' faced were communicated to the lecturers informally in the corridors and before and after sessions. These conversations and discussions were noted in a journal. Several themes emerged. Time constraints meant that groups had difficulties meeting to share information. There was no time given in class for student teachers to work on this aspect of the course. Some student teachers were overly concerned that they did not know enough about science to be able to teach it effectively to their peers. Others complained that their peers did not appear to be working as hard as they were and that they were 'free-loading' on the efforts of the others. Typically, lecturers listened with a sympathetic ear and counseled that teaching was a profession where they would need the skills to deal with colleagues in a professional, collaborative way and that time management would always be an issue.

The results of the student teacher evaluation pertaining to this aspect of the module are summarized in Table 1.

Table 1: Student teacher evaluation of the course content and assignment 2 (total number of responses 80)

Course Content	**Strongly agree**	**Agree**	**Neither**	**Disagree**	**Strongly disagree**
My science knowledge was adequate to teach science before I started this course	2	15	20	32	11
My scientific knowledge has increased	38	41	1	-	-
My confidence in teaching science has improved	27	44	6	2	1
I feel less confident to teach science than most other subjects.	5	16	17	27	15
My science knowledge is adequate to teach science at primary level	21	52	1	4	-

Assignment 2 (Theory/Collaborative Assessment)					
Assignment 2 helped me to understand fundamental science concepts better	24	43	7	2	3
Assignment 2 has given me practical ideas to use in the classroom	25	44	6	3	-
Working collaboratively was a positive aspect of this task	19	27	12	10	9
Not all members of the group contributed equally	5	17	9	24	24
I am not happy to have my mark for this assignment dependent on others in group	12	9	19	25	2
Working collaboratively encourages a deeper understanding of the task	16	31	14	9	7
Testing me on only one question was a fair indication of how much science I knew	5	16	20	23	14
I learnt a great deal from my peers	15	31	21	7	5
The skills needed to work collaboratively will be required when I am teaching	40	28	7	1	2

Overall, there were more positive comments about the value and effectiveness of the collaborative strategy than there were negative. There was strong support for the assessment in that it gave them the opportunity to learn skills and knowledge from their peers, most thought that all members had contributed equally and that collaboration was a positive aspect of the task. They were most negative about only one question being used as an indicator of their understanding and that their mark was dependent on others in the group.

Student teachers' written evaluations of the module were also informative. How the groups had worked together to complete the task varied markedly. Some groups organized specific meeting times in rooms with white boards to facilitate their teaching of one another. Not surprisingly, these groups reported maximum benefit. Some groups had met only once and exchanged notes, little or no teaching or explanation had occurred. Others communicated by email and telephone, swapping notes and giving little face-to-face support. One of the student teachers claimed she had memorized the information given to her by her peers, hoping it was correct. She thought this assessment task "*a complete waste of time*" since she was sure she would have forgotten all the information within an hour after the test.

Staff evaluation of the assessment strategy was that the questions were an appropriate indicator of the subject content knowledge as indicated by the

decision to use the same questions to assess science subject content knowledge in the Bachelor Education (Primary) and modified slightly for the Bachelor of Education (Early Childhood).

The lecturers involved in teaching the Graduate Diploma course appeared ambivalent as to the merits of the collaborative strategy. No strong opinion either for or against was voiced by any staff. This aspect of the assessment task was not taken up in any other course (i.e. BEd (Primary) or BEd (Early Childhood)). There was no systematic evaluation of lecturers' perceptions of the course. There was agreement that the marking load was reduced and this was seen as a benefit. There was no discussion of the impact of the strategy on our teaching or on the students' learning at the end of 2003.

The Doctoral Project plan

In February, 2004, the cohort of Graduate Diploma of Teaching (Primary) students was given a questionnaire at the outset of their year-long course to ascertain demographic information such as gender, age, and educational attainment in each subject area. Student teachers were also asked to rank their level of confidence in their own subject knowledge, their confidence level in their ability to teach the subject and their feelings towards teaching each of the subjects using a four or five point scale. Student teachers were also asked to write a comment about any subject area that they had particularly negative or positive feelings towards teaching in response to an open ended question.

Subject knowledge was defined by the New Zealand Curriculum Framework (Ministry of Education, 1993a) as seven areas – science, mathematics, english, health and physical education, the arts (drama, dance, music and art), social studies and technology (craft, woodwok, cooking, sewing and technical drawing). An eighth subject area, computing, was included although this is not a separate subject in New Zealand schools.

In the second semester, at the start of the science module, these students were given a further questionnaire which probed their perceived confidence and competence in specific science areas (namely astronomy, biology, chemistry, geology and physics) as well as their response to statements concerning science education in general. They were also asked to rank their personal goals, expectations and motivational influences for the module. Two further evaluative forms have been given to the students to complete, one a mid-course evaluation in August and the other in September, prior to the students going on Practicum.

At the conclusion of the course all students will be asked to write a final evaluation of the content delivery and assessment procedures. A series of interviews (individual and group) will also be conducted for further analysis.

Lecturers in this course were interviewed before teaching commenced and will be interviewed at the conclusion of the course. Detailed notes have also been made in a personal journal at the conclusion of each teaching session and as soon as practicable after informal discussions with colleagues and students.

This journal is a record of my ideas, comments, critiques and reflections as I teach and research my own practice in tandem.

The delivery of this course was changed in 2004 in response to the students' comments in the pilot study. Two of the four classes have been given greater responsibility for teaching aspects of the course during 'class time'. Students in these two classes have provided written critique of the teaching and learning of their peers. They have shared this feedback amongst the group then the lecturer has commented on their critique, copied the feedback and returned the originals to the writers. In the other two classes, students have been given a lesser amount of time and responsibility for teaching and no written peer critique has been required of them.

Preliminary results:

Seventy-five questionnaires, out of a possible 90, were completed by student teachers present at a lecture in the first week of their programme. The information from the baseline questionnaires was coded for analysis using the SPSS programme. Of the 75 questionnaires completed, 12 participants were males and 63 were female. Thirty of the 75 are aged between 20 and 24, 17 between 25 and 29 years old. Sixty-three have been schooled at a tertiary level in New Zealand schools, eight have been schooled in Canada and the remaining four in Australia, the United Kingdom and India (2).

The participants were asked to record their highest level of education in each of the subject areas. Table 2 shows the number of student teachers who had taken each subject up to Year 10, 11, 12 or 13 but no further out of the 75 participants. Physical education and health was a compulsory core curriculum area until recently for all students to Year 10 or 11. Science was not differentiated in to the specialist areas of biology, chemistry or physics for the purposes of this survey

Table 2: Number of student teachers having taken subject to this level (total responses 75)

Subject	Never studied	Year 10	Year 11	Year 12	Year 13	Missing
English	-	-	5	16	54	-
Social Science	1	6	8	10	48	2
Mathematics	-	5	16	14	40	-
Science	-	2	16	15	42	-
The Arts	2	19	11	15	22	6
Physical Ed.	-	15	25	15	16	4
Computing	22	20	11	6	6	10
Technology	13	25	17	10	1	9

Nearly three-quarters of the student teachers have taken English (typically compulsory in New Zealand secondary schools) to the end of their schooling.

The social sciences, which included geography, history and classical studies, were also common choices for senior students. Science and mathematics are commonly divided into separate subjects at senior level (for example, statistics or calculus). Information regarding individual science subject areas has not been gathered by this questionnaire.

Participants were also asked to rate their level of confidence in their subject knowledge and their confidence level in their ability to teach each of the subjects at primary level using a four-point scale from 'very weak' to 'very strong'. Student teachers were also asked to respond to a statement about their feelings towards teaching each of the subjects using a range from 'very negative', 'undecided' to 'very positive'. It was expected that there would be a relationship between subject knowledge and the level to which the subject was taken at school. It was also expected that there would be a correlation between knowledge and ability to teach. A preliminary analysis of these relationships presents interesting results which appear contradictory to expectation. Further analysis is proceeding.

Of note was the number of student teachers who felt positive towards teaching across all subject areas, regardless of schooling background, perceived subject knowledge and/or ability to teach (Table 3).

Table 3: Student teachers' ratings of feelings towards teaching each subject area (total responses 75).

Subject	Very negative	Negative	Undecided	Positive	Very positive
Social Science	0	0	3	35	37
English	0	0	4	37	34
The Arts	0	1	8	35	31
Science	0	2	12	40	20
Physical Ed.	0	4	10	34	27
Technology	1	2	20	33	19
Mathematics	0	6	18	31	19
Computing	1	6	21	29	17

The second questionnaire administered at the start of the science course asked student teachers to note the level to which they had taken each individual subject area in science at school. The results from the 78 completed questionnaires are given in Table 4.

Table 4 Number of student teachers taking each science subject to this level (total responses 78)

Subject	Never studied	Yr 10	Yr 11	Yr 12	Yr 13	Missing
Astronomy	31	21	12	-	3	11
Biology	-	10	19	12	36	1
Chemistry	3	15	34	12	11	3

Physics	4	14	39	8	10	3
Geology	18	22	17	3	8	10

Biology was the subject studied by most student teachers to a higher level in secondary school while astronomy was the least common subject. Knowledge in astronomy and geology are relatively recent additions for teachers' required subject content knowledge since their inclusion as a fourth content strand (Making sense of beyond planet earth and beyond) in the science curriculum (Ministry of Education, 1993b).

Student teachers were asked to record any papers they had taken at university which they thought related to their background knowledge in science. Thirty-four students returned questionnaires with no relevant subjects and others recorded subjects such as psychology, anthropology, pharmacology and archeology as possibly relevant. Only a handful of student teachers have a Bachelor of Science as their undergraduate degree.

Student teachers were asked to rate how confident they were that their background knowledge was adequate to teach at primary level. The results are given in Table 5.

Table 5: Student teachers' responses to the question on adequacy of their background knowledge (total responses 78)

Subject	Very weak	Weak	Strong	Very Strong	Weak/strong	Missing
Biology	2	21	39	10	6	-
Physics	11	45	15	2	4	1
Geology	9	41	16	4	6	2
Astronomy	12	38	17	1	8	2
Chemistry	10	47	14	4	3	-

As would be expected, biology is an area that more student teachers feel their background knowledge is either 'very strong' or 'strong'. Background knowledge adequacy in the four other subject areas of physics, chemistry, astronomy and geology is reported by similar numbers of student teachers as being 'very weak' or 'weak'.

While a more detailed analysis of this questionnaire is proceeding, one section of the questionnaire has provided interesting information to consider. Student teachers were asked to respond to the following statements with 'strongly agree', 'agree', 'disagree' or 'strongly disagree'. The statements were: I learn most from listening to lecturers; I learn most from peers; I learn most from hands-on practical activities; I learn most from teaching others; I learn most from independent study. The results are given in Table 6.

Table 6: Student teachers' responses to statement about whom or what they learnt most from (total responses 78)

I learn most from	Strongly agree	Agree	Disagree	Strongly disagree	Depends
Lecturers	2	33	32	6	4
Peers	0	28	36	5	7
Hands-on	30	40	5	1	2
Teaching others	18	42	13	1	3
Independent study	11	45	19	1	2

It is not necessary to highlight the relative unimportance of listening to lecturers or peers nor the high importance placed on learning from hands-on practical activities. It was noted that similar numbers of students recognised that teaching others and independent study afforded valuable learning opportunities.

Implications for my own practice

The second focus of this paper is to highlight how the study of my practice, and the students' responses to it, have been considered in this project. Self-study in teacher education has, as an inherent goal, improving practice. However, making the changes has not been without challenges. In scaffolding the students to be more actively engaged in teaching and learning with their peers, the lecturers' role has had to be re-examined. Personally, there have been many instances where I have been tempted to revert to the 'sage on the stage' role to which I am accustomed and the students are expecting. I noted in my journal:

> I did teach the A group 'day and night' yesterday and one of the women commented that it was the clearest explanation of day and night she had ever had and that no-one had explained like that before. She said I was a very good teacher and why had I stopped teaching science? (Journal entry, 27.8.2004).

Louie, Stackman, Drevdahl and Purdy (2002) explored myths about teaching and the university teacher educator in their self-study. They report that 'many faculty nourish a deep-seated belief that teaching is about knowledge transmission that depends almost exclusively on the faculty member's quantity of knowledge' (p. 200). They go on to say that 'over-preparation offers a shield of protection to those faculty members who try to uphold the myth that professors must know everything in their fields' (p. 201). I know that this has been my common practice. My sessions have been packed with so much "important" information about the science and teaching strategies that the students do not have the opportunity to think for themselves and engage in learning. When asked, the students have complained vociferously about the sheer quantity of information that has been "thrown" at them in this intensive course in other modules. Complaints about shallow learning and superficial content knowledge, doing a mediocre job of assignments just to "get a pass"

and the realization that the only way to cope is to lower their standards and absent themselves from classes in order to get other assignments in on time were expressed by different students over the course of the semester and recorded in my journal. I have begun to realize that by teaching more I am denying student teachers the opportunity to practice the skills they need to succeed in their own classrooms.

There have been differences in the way the students have been encouraged to take greater teaching responsibilities in the four classes. Both of my classes have been asked to critique my sessions in an effort to increase the dialogue about teaching practice. The students have also been asked to critique the efforts of their peers to teach them and their own learning experiences. The feedback that they are now providing one another appears more constructive and valuable than their earlier attempts. They are learning how to give and receive critique and to reflect on their practice. This has been an important component of my classes where the structure and focus of my sessions has differed from my colleagues.

Initially, the focus of expecting students to prepare sessions and teach one another was not viewed very positively by my students. In the first questionnaire, student teachers in my classes rated the pace and delivery of the course less positively than students in the other two classes. Student teachers in the other classes were positive about the clear delivery of information and teaching strategies they were being shown. However, the results of the second evaluation indicate that the students in my classes are developing a deeper understanding of the art of teaching science and are more aware of differences in learning and teaching styles.

As Loughran (2002) has written about the focus of research in self-study of teacher education practices:

> ‘The problem is not something that can necessarily be held still and studied in a linear fashion and then reviewed and slotted back into practice, because a common aspect of researching teaching about teaching is that new findings and teachings become interwoven…. In teaching there is a sense of the need to act immediately on new possibilities and to adjust one’s teaching in accord with these possibilities. The research focus therefore alters and, as adjustments are made, new insights and possibilities emerge’ (p. 243).

It is the effects of these adjustments to my teaching practice that I am focusing on, in the desire to improve my practice. It may be that the goal of becoming a better teacher educator through research is an illusive one. However, documenting and reporting on initiatives such as these and making public the methods used to examine my practice is purposeful. Research alters my perspective and view of my practice and is presented as a means of generating insight for colleagues in the wider field of higher education.

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