Sailing in uncharted waters: A journey into e-learning in a science education paper

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Abstact: In the world commitment to *Education for all,* distance education became the answer to a far-flung student population with varying needs and with limited access to the resources of more formalised schooling. Distance education in the latter part of the twentieth century often became synonymous with e-learning. In New Zealand computers became the vehicle for transmitting learning to students throughout the country. Teacher education lagged behind this development, but at the end of the twentieth century complete online teacher education programmes were implemented for the primary school sector. The subject specialities of secondary teachers made this a more problematic proposition, but at the turn of the century an online secondary teacher programme was started at Massey University College of Education. This involved developing subject papers for online delivery as well. This paper outlines the development of a science education paper in this programme.

Introduction

The commitment to universal education, or education for all (Connors, 1999; Davies & Guppy, 1997; Fiske & O'Grady, 2000; McNeely, 1995; Mukhopadhyay & Phillips, 1994; Perraton & Creed, 2001) is a vision shared by the Commonwealth, countries in the OECD and more generally in the UN. The 2000 World Education Forum in Dakar, Senegal, reaffirmed the pledge of "providing quality education for all the world's children by 2015" (Sperling, 2001, p. 1). The noble aim founders on the resources available to complete the task. Schools, books and teachers are all inherent components of the equation. The vision may require a move from a physical school to open schools or distance education. The first of these types of deliveries are believed to have started in 1914 in Australia as correspondence lessons, but now have embraced *open learning* where education is delivered in multiple, flexible modes. These modes span *hard copy* paper delivery, face-to-face block courses and the electronic media (Perraton & Creed, 2001). The latter has become synonymous with online deliveries of teaching material and access to virtual libraries and schools. This type of delivery has been expanded from a replacement of traditional type schooling to include *second chance* education and *lifelong learning*.

At the centre of all delivery systems is *the teacher* and the success of the teaching is founded on how qualified this teacher is. Beeby (1962), illustrates three stages of teacher development when a new education system is established where none was before. He refers to a continuum from ill-educated/untrained through ill-educated/trained to educated/ trained teachers (Beeby, 1962, p. 11). This thinking can be extended to distance learning where teachers in open schools may be educated/ trained in face-to-face delivery but have little, if any, education in online teaching.

Teacher education and distance learning in New Zealand.

New Zealand has a large number of high quality teacher applicants who are spread over a wide area, unable to attend teacher education programmes at the teacher education institutions (Anderson & Simpson, 1997).This was realised early in the provision of a distance education programme for primary teachers offered by Massey University College of Education (Anderson & Simpson, 1998, 2000, 2002; Wilson, 2001). This programme enabled the training and provision of qualified teachers in remote areas where teacher recruitment has been problematic in the past. At the same time they also helped fulfil the commitment to universal education of equal standards no matter where the child lives (Wilson, 2001). In New Zealand, the primary school system, like that of Britain and the USA, while universal, nevertheless underwent various reforms e.g. the move towards *learner centred models* inspired by the thinking of John Dewey and Percy Nunn in the 1920s. The abolition in 1936 of the last examination barrier to open access to secondary schooling promised to make the education system more egalitarian and open to the full population. By 1945 early education was becoming more child and learner centred but, many reforms later, there is still debate about how successful this move has been in the New Zealand setting both in the sense of equity of access to higher education and to higher quality teachers and resources (Openshaw, Lee, & Lee, 1993; Openshaw, 1995). The demand for teachers in both the primary and secondary sector increased with the pedagogical changes and with the increase in rolls. Recruitment and training of new teachers became urgent and innovative methods for fulfilling the demand have had to be employed (Anderson & Simpson, 1997).

Online learning during teacher education fulfils two roles: one of accessing good teacher material in remote areas and giving them skills on par with teachers in more central locations, and the other one providing training in online deliveries to all teachers. While the second one is often undertaken by interested teachers as part of professional training, it is possible to give new students the experience of successful online teaching by modelling *best practice* in the compulsory courses the students do as part of their teacher education. A further justification for providing online presentation is to expand the learning experiences of the teacher trainee thus enriching the repertoire beyond those fitting into the comfort zone of the prospective teacher.

A secondary teacher education programme

The course used as an example in this paper to illustrate the journey taken from an internal to an online offering, is a science education course sitting in the one year Graduate Diploma in Teaching (Secondary) at Massey University College of Education. Students enrolling in this programme are graduates with a variety of majors. The major determines the specialist subjects that the student will base their training on (Massey University, 2007). Thus each student undertakes generic pedagogy papers, practicum papers and their specialist subject studies. There is little content in these papers as the students are presumed to have the background knowledge from their first degrees. In science that gives some problems as a science major can be anything from, for example, engineering, cell biology, ecology, or astronomy. These students are then required to identify their own knowledge gaps and fill these with alternative studies at the same time as

undertaking the teaching courses. This is clearly spelled out in the study guide material given to students upon enrolment:

> Although it is presumed that you enter this course with the required knowledge to teach science across the different strands, experience has shown that it is likely you will be more skilled in some strands than in others. For that reason, you will be taught some specific content areas such as Astronomy and Geology and some concepts related specifically to the Physical and Material World strands. It is not possible to teach you everything, and it is expected that you take responsibility yourself for identifying missing or wrong concepts and set about plugging these holes yourself (Massey University College of Education, in print, p. 5).

The Graduate Diploma of Teaching (Secondary) was initially totally geared towards face-to-face presentation. This allowed full integration of the content and intent of all the courses within the programme. That meant that every course in the programme, except most of the practicums, ran concurrently and presentations and concepts in one course interwove and informed those in another. Subject studies were taught in workshop mode every Thursday and Friday of the university year, giving ample opportunities for reflections, discussions and modelling of practice. The students were given little extra study material beyond that presented in the course workshops. In spite of the intention of integration, students' comments on End of Course Evaluation forms showed that they often did not perceive this as an important part of their learning to be a science teacher, for example: "Would be good as a block course in the holidays"; "Block course of 2-3 weeks preferred."

Going distance

In 2002 a decision was made to offer the programme extramurally. None of the lecturers in the programme had much experience with this mode, but were given professional development to help them write study guides that would assist them in presenting their material to distance students. Little emphasis was given to an online component and most lecturers chose to ignore that possibility. At the same time the course itself was reorganised so that distance and internal students followed the same timetable, i.e. weekly workshops were no longer possible and three face-to-face block courses with concentrated content replaced the integrated programme. This immediately disengaged subject specialist material from pedagogical theories presented in other courses. A further complication arose by students enrolling in dual modes for the subject courses. Some students remained internal and some were external (distance). The study guide for both modes was the same with online requirements to steer the extramural students in the same direction as the internal students (Figure 1). In most cases a culture of shared understanding never developed between the students and a critical mass of student voices never eventuated online to fire up the reflections and discussions.

Figure 1

Online requirements

- Access http://www.osh.dol.govt.nz. Then go to 'Learn about Health & Safety Law' in the left hand panel. Find out about the Health & Safety Act and the duties of employers and employees.

Activity

- Who is the employer in the school situation? Who is the employee? Who is responsible when a child has an accident?
  (a) in the classroom?
  (b) outside the classroom?

(Massey University College of Education, 2003, p. 139)

In the science course it quickly became clear that dual mode was not pedagogically sound. The requirement to travel to three block courses from remote areas of the country also raised equity issues regarding the costs incurred by students for the same qualification. The decision was finally made to make the mode of this course totally external with a commitment to increase the online component and to increase the requirement for online participation in lieu of attendance at block courses. One block course remained compulsory, one had optional attendance and one became totally online.

In the old, integrated, form of the programme it was possible to teach all students concepts that were lacking in their repertoire, as the gaps were revealed. This *teach as need* was no longer possible and one constraint that immediately presented itself was the need to teach these concepts in the first block course before the students themselves had reflected on the gaps in their knowledge, and sitting outside the pedagogical focus of the other papers. While not impossible, this nevertheless presents a skewed introduction to the *teaching science* course.

The study guide metamorphosed from a *book presentation* of readings and directions for *session work* to a guide which encourages students to use the Massey University Library online, and the internet as much as possible. Research shows this to be good practice for successful online teaching (Simpson, 2003). Readings are still provided where they can quickly illustrate ideas not easily accessible through the library. The online forum is constantly updated with links to support discussions and research. This has to be flexible as students' reflections and queries can take any direction. The lecturer is the *go-for* in these discussions and guides students towards informed opinions. Readings not easily available by links, and students' own resources are attached to messages on WebCT for common usage. Thus the online forum has become a busy classroom cum discussion venue where students can participate as freely as they would in a real classroom situation. Such interaction and richness of material exchange, represented both by a study guide adapted to the distance mode and by the availability of other material is crucial to the success of online courses (Anderson & Simpson, 1998; Anderson, 1998; Campbell, McGee, & Yates, 1998). Some of the initial versions of the study guide maintained the rigid *block course*

format i.e. the work was set out in the sessions planned for the block courses. In an attempt to encourage students to prepare themselves for the blocks a pre-course section was included that required students to think around the concept of *science* and *science education*. It required students to go online and do certain exercises to encourage participation in the online environment early in the course (Figure 2).

Figure 2

SECTION ONE: PRECOURSE WORK (selected sample)

Online requirements

Please, go online and introduce yourself to your fellow students.

Activity 1

1. Record the dates for your block courses in your diary now.
2. Record the assignment due dates in your diary now.
3. Do the Science Curriculum Pre-test on the next two pages and bring it with you to your block course.
4. Answer the following questions using your readings.
   i. (a) From Reading 1:1 define what the author describes as a "popular" view of science.

      (b) What arguments does the author present to support his contention that this is too narrow a perception of science?

(Massey University College of Education, 2003, p. 29)

This was only moderately successful as a small percentage of students, harbouring under the illusion that *block course* means only that, consequently never opened their guide until arriving at the first session of the block. This always delayed the start as all students had to be brought up to the same level. The latest version of the study guide has removed this pre-course requirement and signals that the course is a year-long learning experience with a mixture of modes: some online, some reading and writing and some face-to-face. The study guide signals what the student is required to do in self directed learning by listing work headed: *Lessons* (Figure 3).

Figure 3

LESSON 1 & 2: Start this work immediately

It is very important that you are familiar with your curriculum documents and your study guide before you arrive for your first block course. It is also important that you have done some thinking about the nature of science and science teaching. The first reading and online activities challenge you to explore these concepts. Please complete the activities in Activity 1 before 3 March (so you have time to digest it all).

Figure 3 continued…

Online requirements

1. Access paper 210.406 on WebCT and write your personal profile (Part 3, Activity 1).
2. Go online on WebCT and access the tki website via the links there.
3. Also do Part 4 (a & b), Activity 1 online.
4. Start the mastery test on WebCT.
5. After Reading 1:01 choose any 5 of the questions on pp. 25-26 of the Reading. Answer these online and comment on the reading in general.
6. On the 'paper information page' you are told that we will teach you the *processes* of teaching science. What does this mean?
7. Earlier on the statement was made: *…Science is a western male dominated domain.* After reading Reading 1.01 why do you think this perspective developed? Please discuss the effects of this on present day science education.
8. After reading pp. 7-22 of the Science Curriculum (SiNZC) and the Draft Curriculum document concentrate on pp. 14-16 of SiNZC, compare and contrast the essence of the two documents: one represents the curriculum in use today, the other, the proposals for the revised curriculum. Note in particular:

(Massey University College of Education, in print, p. 30)

The work that is presented at the block courses is less detailed and listed under *sessions*. In the voluntary attendance block course students not attending will be directed to online work that must be completed. This method has proven to be successful also for students who fully intended to participate but may have been unable to because of sickness (Figure 4).

Figure 4

BLOCK COURSE 2:

By the time this block course starts you should have read Venville & Dawson, Chapters 1-11 and all readings 2.01-2.10. If you do not attend the block course you MUST complete all online activities.

Session 1:

Writing lab reports can be a monumental waste of time where students merely copy notes from the board and do very little thinking.
An alternative method of doing reports is the use of the V-map. V-maps help students conduct their own knowledge as investigations proceed. The V-map requires a focus question or a hypothesis, vocabulary recognition, the assembly of a concept map, events or methodology, results or what was observed as well as an overall conclusion.

Figure 4 continued …

Activity 11

Construct your own V-map from Reading 2:09 over one of the practical investigations in Activity 10. This is to be used in an online discussion.

Online work 13

- Use your textbook, Chapter 7, to list 'tools' available to the Science educator. Choose 1 of these identified 'tools' and online write an example for when in your teaching you would use it.
- Debate the advantages and advantages of computer-based resources online.
  Either of these resources may be used in assignment 3.
- After completing the V-map in the activity, discuss the pros and cons of using a V-map for constructing a lab report with other students online.
- Doing activity (v) using the information on the earthworm as an example, illustrates the difference between teaching the *concept* and teaching *recall*. Discuss what this means in terms of education.

(Massey University College of Education, in print, p. 284)

Conclusion

The journey thus far outlined in this paper represents a quest undertaken by the lecturer in a course on science education in the search for better and more inclusive methods of teaching. The hurdle in moving from face-to-face presentations to distance mode was probably the highest, as there had to be a *culture shift* from a firm commitment of the lecturer as the *holder and disseminator* of the knowledge and correct pedagogies that students could *absorb* from the lecturer. Hidden in that culture was an almost missionistic zeal and lack of trust in the ability of students to *find their own path* once given the opportunities and access to the material that formed their lecturer's stance in the first place. When this hurdle had been negotiated and the culture shifted to include a distance learning component, the examination of the course and reflection on intent dictated that more appropriate pedagogies suited to the distance mode, be applied. Once this shift occurred the move became inexorably firmer placed in online education pedagogies supported by the research literature based on online educational outcomes (Campbell et al. cited in Simpson, 2000/2003; Simpson, 2003). Since this move was instigated the student numbers have increased, suggesting access to a market not previously tapped. Student evaluations have been positive. Feedback and results from students in the course suggests that, while students prefer face-to-face learning, they appreciate the flexibility that the online presentation gives them. For example:

> I wonder if we haven't all chosen to be teachers because we love working with people and communicating, and that would explain why we are reluctant to do online work initially. Great to exchange information with you all and discussing all the points (Student comment online, 2007).

The increase in student numbers also suggests that the move to an online delivery, on the whole, was a positive one. Further work remains to be done

in improving the online presentation to ensure greater ease of access for students and a smoother blending of block-course mode with the online mode. The major transition, however, has been made and future progress will involve expansion of the pedagogies rather than the culture shift which was so obviously part of the first transition.

Online education offers much to the future of teacher education. Where the platforms for delivery of online programmes used to be clumsy and difficult to use innovatively, and where the student body had poor access to computer technology and the internet, we now face a computer savvy population, with access to 'broadband' and high expectations of their lecturers with regard to the use of the electronic tools available. The journey taken by the course described in this paper illustrates that the production of educated/trained teachers (Beeby, 1962, p. 11) using the e-mode is both possible and advantageous. Thus e-learning, engaged in the process of producing capable, adaptable and, not least of all, available teachers, is a large step forward in achieving the ultimate aim of universal education, within New Zealand and ultimately world wide.

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