Teacher Education: A Diluted Environmental Education Experience

Rebecca Miles & Linda Harrison
Charles Sturt University

Amy Cutter-Mackenzie[†]
Monash University

Abstract This paper presents the findings of a small-scale research project about student teachers' perceptions and experiences of environmental education. The context of this study is a pre-service teacher education faculty in rural New South Wales, Australia. A combined methods approach was applied, with a survey designed from rich data elicited through focus group interviews. The focus of this paper is on the findings of the survey, revealing that prospective teachers' preparedness in environmental education is diluted by their teacher education experience and that such experiences are not providing a stimulus for novice teachers to practice environmental education.

Teacher Education: A Priority for Environmental Education

> In Australia... the teacher education goals set out in international agreements [and] global initiatives on reorienting teacher education towards sustainability are yet to be effectively recognised in national education policy. This, reflected in the dearth of teacher education programs in EE, has resulted in a lack of competencies amongst teachers to effectively teach EE in schools. (Tilbury, Coleman & Garlick, 2005, p. 49)

Fien and Tilbury (1996, p. 34) maintain that the inclusion of environmental education in teacher education acts "as a stimulus to its introduction into the school curriculum", and specifically, that the "development of an effective teacher training course in environmental education would result in a top-down curriculum innovation approach". Whilst the inclusion of environmental education at the teacher education level is seen as a means of exposing the wider population to environmental education (Fien & Tilbury, 1996), a number of researchers argue that it is the lack of pre-service and in-service teacher training in environmental education[1] that poses one major barrier preventing and/or limit the effective implementation of environmental education in primary schools (see Ballantyne, 1995; Cutter-Mackenzie, 2003; Jenkins, 1999-2000;

[†]*Address for correspondence*: Dr Amy Cutter-Mackenzie, Faculty of Education, Monash University, Peninsula Campus, McMahons Road, Frankston, Victoria 3199, Australia. Email: Amy.CutterMackenzie@Education.monash.edu.au

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Mastrili, 2005; McKeown-Ice, 2000; Powers, 2004; Spork, 1992; Tilbury, 1992, 1993, 1994).

Oulton (1996, p. 1) claims that "only limited progress has been made at the school and teacher education levels" to incorporate environmental education into the formal education system. This trend was also shown in a study undertaken by the Organization for Economic Cooperation and Development (OECD) in five OECD countries, including Australia, which identified teacher training as the weakest aspect of environmental education programs in all five countries (OECD, 1995). Additionally, the OECD (1995; cited in McKeown-Ice, 2000, p. 4) study found that:

> ...few teachers, or anyone else for that matter, think that teachers are well prepared for teaching environmental issues ... the traditional disciplinary structure and pedagogical practice of higher education serve as impediments to environmental education, and higher education institutions are located in a critical place to both produce and legitimise knowledge.

In Australia, there is limited research about the practices or provision of environmental education in teacher education. Phipps (1991), Cutter (1998), Jenkins (1999-2000) and Cutter-Mackenzie and Tilbury (2002) have all undertaken small-scale evaluative studies of environmental education in teacher education. While the course structure of pre-service teacher education is certainly important, student teachers' personal disposition, perceived knowledge, beliefs and attitudes of their tutors towards environmental education has a significant influence on student teachers' enthusiasm to teach environmental education. Cutter (1998) reported that many pre-service teachers categorise environmental knowledge as unimportant. In addition, Cutter-Mackenzie and Tilbury (2002, p. 30) found that "prospective teachers do not have the pedagogical content knowledge to effectively teach environmental education in primary schools". Furthermore, Cutter-Mackenzie and Tilbury (2002, p. 17) claimed that "university based teacher education reinforces attitudes by its emphasis on ... the downplaying of knowledge". They concluded that prospective teachers' lack of environmental education pedagogical content knowledge has significant implications for environmental education (Cutter-Mackenzie & Tilbury, 2002).

Although research shows that environmental education practice in teacher education is scant, very little empirical research has been undertaken in Australia. More specifically, research is now required which explains existing patterns of environmental education provision and identifies reasons as to why teacher education programs are still failing to adequately prepare students in the area of environmental education (Tilbury, 1993). Whilst this was, in part, the impetus for this research, the overall focus of the study was on student teachers' perceptions and experiences of environmental education in their teacher education programs. We will now discuss the conceptual framework of the study.

Theoretical Underpinnings

The study has theoretical underpinnings in teacher practices, knowledge and beliefs. Turner-Bisset (2001, p. 4) characterises teaching as:

> a knowledge-based profession ... [It] carries with it the notion that teachers work towards a state of expertise, of mastery over all the kinds of knowledge, skills and processes needed for expert teaching.

Lortie (1975, 2002) and Cuban (1984) contend that teachers will often reproduce the strategies they have had as primary, secondary and teacher education students. Lortie (1975, p. 65) discusses the effect and the influences of the time spent as a student on

prospective teachers' images of teaching as the "apprenticeship of observation". Lortie (1975, p. 62) suggests that through the apprenticeship of observation, student learning about teaching can be "intuitive and imitative rather than explicit and analytical; it is based on individual personalities rather than pedagogical principles" (see also Hatton, 1988; Grossman, 1990). Similarly, Thomas and Pederson (2003, p. 322) maintain that "*teachers'* professional frames are both individually and socially derived - shaped by experiences as well as by expectations and values".

According to Grossman (1990, p. 10), through the "apprenticeship of observation" students have an awareness of teachers' actions rather than their goals, resulting in memories that are "unlikely to provoke prospective teachers to connect the means of instruction with potential ends". Another aspect of the apprenticeship of observation refers to the way many pre-service teachers "rely on their memories of themselves as students to help shape their own expectations of students" leading to unrealistically low or high expectations of students (Grossman, 1990, p. 11).

Korthagen (2001) claims that many pre-service teachers often suffer from"transition shock" as they become novice teachers, leading them to conform and dismiss the reform based benefits and methods taught during their initial teacher education. To this extent, Grossman (1990, p. 16) suggests that if teacher education has a strong impact on pre-service teachers' then "what teachers learn from subsequent experiences in classrooms may be shaped by prior coursework". Alternatively, if teacher education has had a weak impact, subsequent teaching is "likely to be overwhelmed by classroom experience" (Grossman, 1990, p. 16). Thus, Morrell, Flick and Wainwright (2004, p. 199) argue that teacher education providers who aspire to drive change and guide pre-service teachers to move in educational reform directions at the K-12 level, need to improve teaching practices modelled at the teacher education level:

> ... if prospective teachers have firsthand experiences in learning... through strategies that are reform oriented, they will develop a stronger appreciation for the value of the coursework and will use this model for more effective pedagogy when they begin their own teaching.

The implications of teacher education practices on prospective teachers' interest and preparedness for teaching environmental education can be far reaching. There is growing evidence that in-service environmental education professional learning and development has a significant influence on teachers' ability and inclination to teach environmental education (Spork, 1992; Cutter-Mackenzie, 2003; Cutter-Mackenzie & Walker, 2003). Researchers such as Phipps (1991), Tilbury (1993) and Cutter (1998) suggest that at the teacher education level the influence of university teaching staff is the most powerful to the provision of environmental education, in comparison to student, institutional and external influences. Whilst Norman (1983; see also Grossman, 1990) has shown that pre-service teachers' beliefs are often developed through observations and experiences of teacher education and school practical experiences, Cutter-Mackenzie (2003) argues that pre-service environmental education (in its current form) has little influence on teachers' knowledge, beliefs and practices. Without the inclusion of effective environmental education at the pre-service level there is not the opportunity for prospective teachers to develop theoretically based understandings of teaching philosophies, methods, beliefs and knowledge in this area. As such, the underpinning agenda of this research project was to examine student teachers' perceptions and experiences of environmental education in pre-service teacher education.

Research Methods

This study is based upon a two year honours program undertaken by Miles and co-supervised by Cutter-Mackenzie and Harrison. A combined methods approach was used to investigate the research question. Second and third year students at one campus of Charles Sturt University were the informants. The key areas of the course where students were exposed to environmental education were through the "social studies" and "science and technology" curriculum subjects. By the conclusion of the course, all students undertook two curriculum subjects in all key learning areas. At the time of this research the second year students had completed the first curriculum subject of both units, and the third year students had completed both social studies curriculum subjects and were part way through the second science and technology curriculum subject. In addition, an environmental education elective, Education for Ecological Sustainability, was available to be taken in the third or fourth year of the degree; however, it had not run for several years and had not been undertaken by any of the current cohort of third or fourth year primary education students. The first year students were not included in the sample as it was felt that they had not yet received sufficient pre-service teacher education. A fourth year sample was not recruited as the course structure meant that no further opportunities for environmental education occurred after the third year of the course as all curriculum subjects had been completed.

Initially, focus groups were used to ascertain the environmental education experiences of the participants using a semi-structured interview format. All second and third year pre-service primary education students were invited to participate in focus group interviews. Three focus group interviews were facilitated with the seven student teachers, four second year participants and three third year participants. The areas of discussion covered in the focus groups included participants' understandings of the environment and environmental education, their experiences of environmental education through their teacher education and school experiences, and their confidence in teaching environmental education.

A questionnaire was designed from the information elicited from these focus groups, a review of similar environmental education questionnaires and appropriate literature. The content of the questionnaire focussed on three key areas: teacher education experiences involving environmental education; knowledge of environmental education and where this knowledge was obtained; and beliefs about environmental education.

The questionnaire consisted of nine closed ended questions including five point Likert scale, multiple choice and ranking style questions, with one open ended question asking participants to describe environmental education. There were also several demographic questions referring to age, gender, course being undertaken, and year level. Demographic questions were asked to establish participants' areas of teaching interest or chosen electives.

The survey was then administered using convenience sampling to collect information "from members of the population who were conveniently available to provide it" (Cavana, Delahaye & Sekaran, 2001, p. 261). As such, a subgroup of second and third year students within the Bachelor of Education (Primary) and Bachelor of Teaching (Primary)/Bachelor of Social Science (Psychology) at Charles Sturt University were surveyed. The total possible population of the second and third year cohort was 176 students enrolled in the subjects where the survey was administered. A response rate of 149 (85%) was achieved.

The age of respondents ranged from 19 to 48, with a mean age of 22. The cohort demographics showed that females accounted for 71% in the pre-service Bachelor of Education (Primary), and for 88% of students in the pre-service Bachelor of Social

TABLE 1: Year level, course and gender details of survey respondents

	Course N (%)		Gender N (%)	
	Primary Education	**Psychology/ Education**	**Male**	**Female**
Second year N = 66	66 (44.3%)	0	21 (14.1%)	45 (30.2%)
Third year N = 76	60 (40.3%)	16 (10.7%)	22 (14.8%)	54 (36.2%)
Out of phase (third/fourth year) N = 7	5 (3.4%)	2 (1.3%)	3 (2%)	4 (2.7%)
Total	131 (88%)	18 (12%)	46 (30.9%)	103 (69.1%)

Science (Psychology) / Bachelor of Teaching (Primary) (see Table 1). As such, the survey sample was representative of the wider cohort and of pre-service teacher education courses in general (Charles Sturt University, 2006).

Following administration of the survey, the data were coded and entered into the Statistical Package for the Social Sciences (SPSS, version 11.5). Rated scale items were entered as scales from 1 to 5 (ordinal measure). Scores for the questionnaire items that were written negatively were reversed when entered into SPSS (1=5, 2=4, 3=3, 4=2, 5=1), to be consistent with the other items. Items requiring a ticked or circled answer were entered as 0 (not ticked) or 1 (ticked), (nominal measure). Preliminary descriptive analysis was carried out to determine frequencies, distributions, and means and standard deviations at the item level.

The survey was intended to provide a measure of student teachers' experiences of environmental education during their initial teacher education. To do this, exploratory analysis of the rated-scale data was conducted at item level using Spearman's correlations and Cronbach's alpha reliability tests, in order to develop composite variables (interval measure) for further analysis. The data are now presented in accordance with the themes of the study.

Results and Discussion

Environmental Education Experiences[3]

Participants were asked to indicate the sources of their environmental knowledge, where they had received exposure to environmental education through their course and which subject areas had covered environmental education content. Overall, the media and previous schooling (primary/secondary) was attributed by many participants as their main source of environmental knowledge (68.7% and 56.8% respectively). As shown in Figure 1, teacher education was reported as a source of environmental knowledge by less than one third of participants (31.8%).

Pre-service teachers begin their teacher education with already established knowledge and beliefs based on their previous experiences. As outlined previously, teacher education needs to challenge and deconstruct prospective teachers' beliefs and develop their knowledge of the subject matter. However, these results show that for many of the prospective teachers sampled, teacher education is not a major source of

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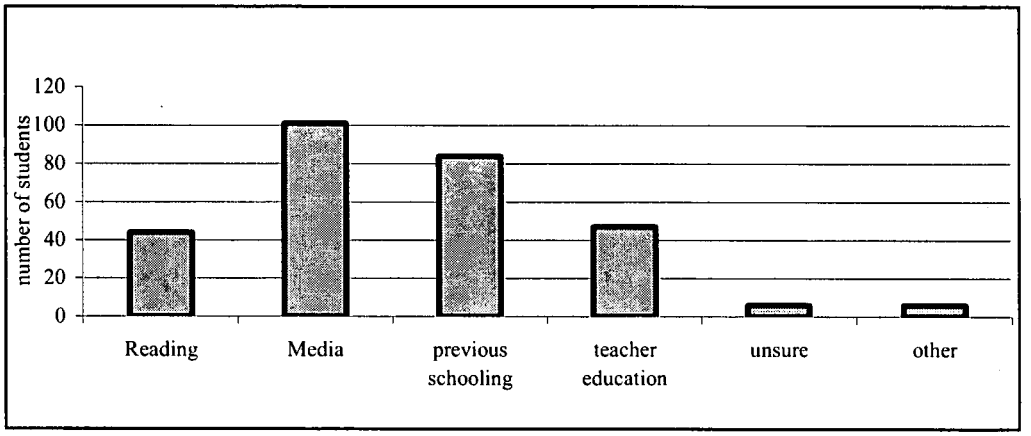

FIGURE 1: Sources of environmental knowledge

environmental knowledge and, as such, is less able to challenge and deconstruct these future teachers' beliefs and knowledge of the environment.

To explore this further, participants were asked which aspects of their course and which curriculum subjects they felt had included environmental education content (see Figure 2 and Figure 3).

Subject tutorials and lectures were reported as the area of most exposure to environmental education (50.3%). Teaching practice experiences in schools were reported by less than one third of participants (28.9%), despite by this stage the second year students having already undertaken 10 weeks of school based experiences and the third year students having undertaken 16 weeks. Rather fewer respondents reported assignment choice as contributing to their exposure of environmental education (9.4%). These results may imply that whilst lectures and tutorials may cover environmental education content, this is not often followed up by assessment or through subsequent teaching practice experiences. It is important to note that as well as university experiences of environmental education, schools and teachers have the opportunity to

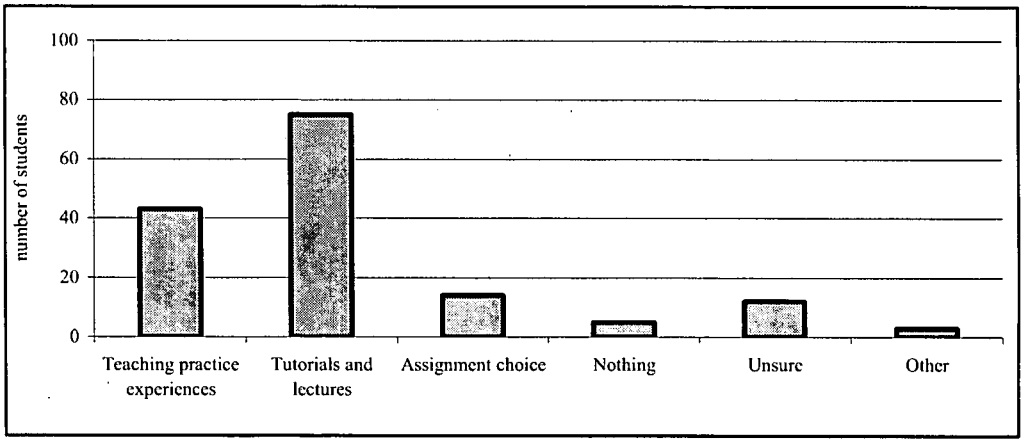

FIGURE 2: Most environmental education exposure

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provide pre-service students with environmental education experiences through their teaching practice experiences.

To extend on this, participants were asked to report which curriculum areas and electives they were receiving the most environmental education exposure to through their teacher education (see Figure 3). Human Society and Its Environment (social studies) and Science and Technology were reported by almost all participants (92% and 89% respectively). This was consistent with the focus group results where participants named these two subjects as covering environmental education content. In addition this supported the work of Cutter-Mackenzie (2003), Robottom, Malone and Walker (2000) and Linke (1980) which found that environmental education was predominantly situated in the social studies and science curriculum areas. The remaining subject areas nominated were: art and personal development/health (18%); physical education and English (11%); and drama, music and maths (6%). Figure 3 shows the distribution of student selections for this question.

In order to describe each participant's overall exposure to environmental education in their teacher education course, a derived variable, *total environmental education content*, was computed by adding together the number of curriculum areas nominated by each student. The maximum number of subject areas that could be nominated was nine. The mean score for *total environmental education content* was 2.6 (SD=1.6), the minimum score was 0, and the maximum 9. Frequency analysis showed that 56.4% of survey participants reported that they had received environmental education content in two subject areas, 14.8% reported three subject areas and 16.1% reported they had received environmental education content in four or more subject areas. Only 12.7% responded that they had received environmental education content in one subject area or less.

Although half of the students sampled reported subject tutorials and lectures as exposing them to environmental education, it is apparent from the above results that this exposure is considered by the majority of students to be contained to primarily two curriculum areas. In addition, these results show that many students do not consider they are being exposed to environmental education through the schools in which they are undertaking their teaching practice experiences.

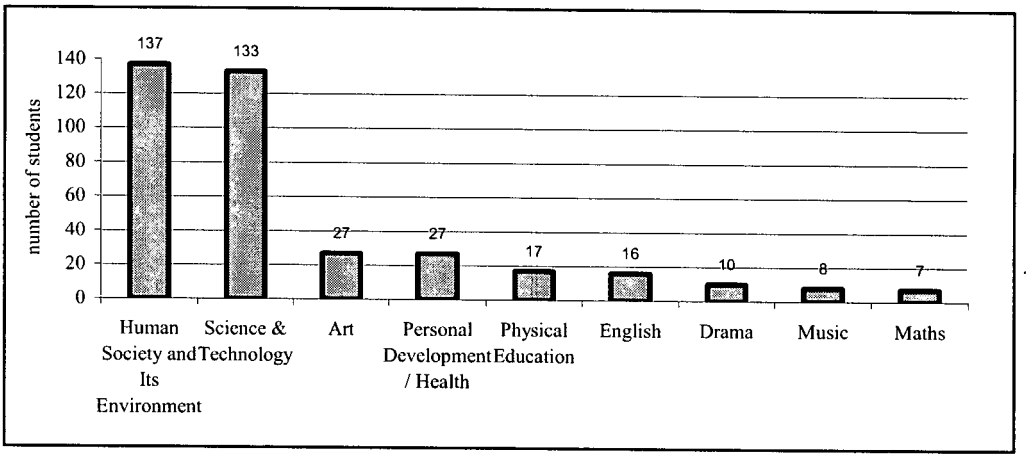

FIGURE 3: Teacher education curriculum areas with environmental education content

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Preparedness to Teach Environmental Education

Previous studies have indicated that teachers are more likely to teach those subjects they are knowledgeable about and have an interest in (Grossman, Wilson & Shulman, 1989). The same study also found that teachers who had received more teacher education preparation in a discipline area were more likely to teach in that area, and that the level of syntactic knowledge of teachers had strong relationship to their curriculum and pedagogical decisions.

Three questions in the survey asked students to rank their level of interest, knowledge and preparedness in teaching environmental education on a 1 (low) to 5 (high) scale. Table 2 shows the distribution of ratings across the scale and descriptive statistics for each of these questions.

TABLE 2: Student interest, knowledge and preparedness to teach environmental education

Survey question item		1 Low	2	3 Average	4	5 High	M	SD
2. Interest	n	2	19	73	38	17	3.3	0.89
	%	1.3	12.8	49.0	25.5	11.4		
8. Knowledge	n	17	51	69	11	0	2.5	0.80
	%	11.4	34.2	46.3	7.4	0		
4. Preparedness	n	25	59	62	2	1	2.3	0.78
	%	16.8	39.6	41.6	1.3	0.7		

These results showed that most students were reasonably interested in teaching environmental education. The Mean score was 3.3 on the 5-point scale, with 85% rating themselves at 3 (average) or above. For knowledge and preparedness, however, a different pattern emerged. Means were 2.5 and 2.3, respectively, with 93% and 98% rating themselves at scores of 3 (average) or below. This is consistent with the stage one interview findings where participants indicated that they were keen to draw on environmental education in their future teaching, but felt that they did not have enough knowledge. Whilst it could be inferred that pre-service teachers do not feel prepared or confident to teach in any area, several studies have shown that effective pre-service teacher education and subsequent teaching practice experiences, in areas including mathematics, health education and violence education, has a significant effect on pre-service teachers confidence and preparedness to teach in these fields (Kandakai & King, 2002; Lowery, 2002; Myers-Clack & Christopher, 2001).

The relationships between participants' interest, knowledge and preparedness were examined using Spearman's rank order correlation analysis. Scores on the three items were moderately correlated with correlation coefficients ranging from $r(149)=.31$ to $r(148)=.46$, $ps<.001$. Table 3 shows the correlation matrix for these three items.

The strongest relationship, $r(148)=.46$, $p<.001$, was between ratings of students' preparedness to teach environmental education and their self-rated overall knowledge of environmental education, showing that those students who reported higher levels of knowledge also reported higher levels of preparedness. Note, however, that most participants had low ratings on both of these items, showing that there is a relationship

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TABLE 3: Spearman's correlation values for student-rated interest, knowledge and preparedness

	Interest in teaching environmental education	**Preparedness to teach environmental education**
Interest in teaching environmental education N=149	-	
Preparedness to teach environmental education N= 149	0.31 **	-
Overall knowledge of environmental education N=148	0.37 **	0.46 **

** Correlation is significant at the 0.01 level (2-tailed)

between lack of perceived knowledge and feeling unprepared (Table 1). Weaker relationships were seen between interest and preparedness in teaching environmental education, $r(149)=.31$, $p<.001$, and interest and knowledge in teaching environmental education, $r(148)=.37$, $p<.001$. This may be due to a mismatch between participants' higher ratings for interest, but lower ratings for knowledge and preparedness.

Conclusion

This study has begun to examine the patterns of environmental education provision in teacher education and has generated findings on the links between students' knowledge and preparedness in teaching environmental education. Over a decade ago, Tilbury (1993) claimed that teacher education was failing to adequately provide environmental education training for prospective teachers and the results from this study support this conclusion. Despite national and international policy rhetoric about the importance of pre-service teacher preparation in environmental education, the present study has shown that there are still inadequate levels of environmental education provision at the teacher education level and that pre-service teachers' preparedness for teaching environmental education is overwhelmingly low. If this study is typical of Australian teacher education in preparing novice teachers in environmental education, little has changed in the adequate provision of environmental education in pre-service teacher education over the last fifteen years. In short, it appears that, at least for the pre-service teachers involved in this study, current teacher education providers are not taking advantage of the interest many prospective teachers have for environmental education. In addressing this, teacher education curriculum must consider new ways and approaches to better prepare future teachers in the area of environmental education.

Keywords: Environmental education; teacher education; pre-service teachers; environmental knowledge; primary/elementary teacher education; mixed methods.

Endnotes

1. The same problems have been reported in early childhood and secondary education. It is important to note that the focus of this study was primary level teacher education.

2. Throughout this paper, use of the term "tutor" refers to all university teaching staff.
3. Environmental education experiences also refers to the participants' knowledge experiences.

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