Ecological Literacy: *The "Missing Paradigm" in Environmental Education (Part One)*

AMY CUTTER-MACKENZIE *Charles Sturt University, Australia*

RICHARD SMITH   *Central Queensland University, Australia*

Notes on Contributors

AMY CUTTER-MACKENZIE is a Lecturer of Education at Charles Sturt University, Bathurst, New South Wales, Australia. Amy's PhD is currently in the initial stages, but formal stages, of submission (CQU). She is steadily developing an international research profile through refereed paper and book chapter publications and international conference participation (iAPED, South Korea; AARE, Australia; AERA, USA (New Orleans & Chicago); and UN Dialogue, UK). Amy is also the recipient of an Australian Postgraduate Award (APA), Australian Association for Research in Education Postgraduate Travel Award, United Nations (BK) Travel Scholarship, North American Association for Environmental Education Scholarship and Griffith Award for Academic Excellence. Her research interests include: understanding (and mapping) the knowledge and beliefs of teachers, student teachers and children in the areas of environmental education, eco-literacy (ecological literacy), science/social education and rural education; understanding and theorising environmental philosophies, the environmental crisis and issues of consumption; mapping and understanding generations; theorising teachers' knowledge (pedagogical content knowledge), adaptive knowledge management and knowledge theory; and rethinking mixed methodologies (quantitative and qualitative approaches). Amy can be contacted at acutter@csu.edu.au.

RICHARD SMITH is a Professor of Education and Innovation and Associate Dean of Research at Central Queensland University, Rockhampton, Queensland, Australia. Richard has a long history of working with Education Queensland (the state education provider) and has served on numerous state committees, including his recent appointment as an educational advisor to the Ministerial policy group. Richard was recently awarded 'PhD Supervisor of the Year' at Central Queensland University, and continues to maintain a strong research and teaching profile in Teacher Education and Doctoral (and Masters) Research Programs. Richard can be contacted at r.smith@cqu.edu.au.

SUMMARY   *Environmental educators often maintain that primary school education should endeavour to improve and protect the environment through producing an 'environmentally informed, committed and active citizenry', yet existing research shows that the implementation of environmental education in primary schools is problematic and has had limited success.   The reasons for these shortcomings are far from clear, with present research merely speculating about barriers to effective implementation.*

To this extent, there is a dearth of empirical research about primary school teachers' knowledge of environmental education and the degree to which teachers' knowledge inhibits environmental education practice. As such, this paper investigates Australian primary school teachers' knowledge about environmental education, and in so doing utilises a combined-methods approach and the theoretical concept of 'ecological literacy' (eco-literacy) to assess primary school teachers' knowledge (and beliefs) about environmental education.

Based upon the findings of this study, we contend that Australian (specifically Queensland) primary school teachers are likely to be functioning at a 'knowledge' level of ecological illiteracy and/or nominal ecological literacy.   Furthermore, such primary school teachers tend to dismiss the importance of knowledge, preferring to focus upon attitudes and values in the teaching of environmental education. As shown in existing research, these trends can be placed in wider theoretical debates to do with knowledge and education generally.   In any case, such levels of ecological literacy are inadequate if ecologically literate students and thus an ecologically literate citizenry are to be achieved within schools.

Environmental Education in Primary Schools

"The world's teachers"… are said to "have a crucial role to play" in bringing about the

extensive social changes needed to address an environmental crisis[i] (World Commission On

the Environment Development, 1987, pg.xiv), yet little is known about the extent to which

environmental education has been incorporated into primary schools[ii]. In Australia, in

particular, there have been few empirical investigations of primary school teachers'

knowledge, beliefs and practices of environmental education. Despite the varying levels of

support for environmental education, the evaluation studies that have been carried out indicate

that policy expectations are rarely met (see Cutter, 1998, 2001a, 2001b; Cutter-Mackenzie,

2003a; Cutter-Mackenzie, 2002; Greenall, 1981; Linke, 1980; Murdoch, 1989; Phipps, 1991;

Spork, 1990, 1992; Walker, 1995a, 1995b).

In 1973 and 1974 Linke (1980) conducted a national study in Australia, utilising both

quantitative and qualitative methodologies, concerning the implementation of environmental

education at all levels of education (primary, secondary and tertiary). Linke's (1980) study

indicated that the environmental education practice was limited in Australia and most often taught through curriculum domains such as science and social studies. The implications for environmental education of this shift to other discipline areas are yet to be fully explored.

Stapp and Stapp (1983) conducted a 'national' qualitative study which listed over one hundred issues and recommendations for the improvement of environmental education in Australia. However, this study was limited in that neither primary nor secondary school teachers' knowledge, beliefs and/or practices of environmental education were thoroughly investigated. Other than the Linke 1973/4 (1980) and Stapp and Stapp (1983) studies, only small-scale regional (see Clark, 1997; Cutter, 1998; Phipps, 1991; Skamp, 1996; Spork, 1990, 1992; Walker, 1995b) and state (see Cutter, 2001a, 2001b; Cutter-Mackenzie, 2003a; Education Department of Victoria, 1981; Greenall, 1981; Robottom, 2000) investigations have been carried out.

All of these studies (Cutter, 1998, 2001a, 2001b; Cutter-Mackenzie, 2003a; Education Department of Victoria, 1981; Greenall, 1981; Phipps, 1991; Robottom, 2000; Spork, 1990, 1992; Walker, 1995a, 1995b), save Skamp (1996) and Clark and Harrison (1997), claim that the implementation of environmental education in primary schools does not achieve the outcomes communicated in policy documents. In contrast, Skamp's (1996) and Clark and Harrison's (1997) New South Wales regional studies suggest that teachers are practising environmental education action components. Clark and Harrison (1997, pg.34) hypothesise that "many Australian primary schools are addressing environmental education, although they might not call it that". However, what they might 'call it' is far from self-evident.

Nonetheless, Spork (1990; 1992) claims that primary school teachers consider environmental education to be an important learning area, but seem to lack the skills and knowledge to successfully teach environmental education. Similar statements have also been echoed in the

works of Cutter-Mackenzie (2003a) and Smith (2001a; 2001b), Murdoch (1989), and Phipps (1991).

Robottom et al. (2000, pg.146) also found in a case study of five schools that, in some cases, "environmental education curriculum has moved out of the school and into the community". In short, Robottom et al. (2000, pg.157) concluded that "behind every successful environmental education program is a committed teacher".

Further, no Australian studies to date, other than the recent works of Cutter-Mackenzie (2003a) and Smith (2001a; 2001b), have actually investigated primary school teachers' 'content' knowledge of environmental concepts and issues. Cutter-Mackenzie (2003a) and Smith (2001a; 2001b) identified that primary school teachers tend to maintain low levels of content knowledge of environmental concepts and do not consider content knowledge to be overly important. Studies undertaken outside of Australia (see Todt, 1995; Wisconsin Center for Environmental Education, 1997) have also made similar conclusions. In particular, Todt (1995) identified in a study of South-Central Ohio teachers that teachers maintain low levels of environmental knowledge, in addition to many misconceptions about the environment. This issue of 'content knowledge' is taken up further in the theoretical framework of this paper.

In these ways, there are theoretical and empirical 'gaps' in environmental education research that require further investigation. Before outlining the methodological approach, we now turn to the theoretical framework of this paper. We briefly begin with a discussion about the concept of knowledge.

Theoretical Framework

'Knowledge'

Palonsky (1993, pg.7) maintains that the profession of teaching assumes "that good teachers possess a special knowledge base – "a codified or codifiable aggregation of knowledge, skill, understanding, and technology, of ethics and disposition, of collective responsibility" – as well as a means for representing and communicating it". Shulman's (1987) earlier work brings focus to this view. Shulman (1987, pg.8) identifies seven categories of teacher knowledge. These include: content knowledge; general pedagogical knowledge; curriculum knowledge; pedagogical content knowledge; knowledge of the learners and their characteristics; knowledge of educational contexts; and knowledge of educational ends, purposes, and values and their philosophical and historical grounds.

Shulman (1987, pg.8) maintains that 'pedagogical content knowledge' lies at the heart of teaching because it represents the ways in which teachers "blend academic content with teaching methods, organize instruction, and unite all these elements with the interests and abilities of the students in their class". Grossman (1995, pg.21) claims that "teachers' knowledge of the content affects both what teachers teach and how they teach it". In this way, "teachers are likely to emphasize those areas in which they are more knowledgeable and to avoid or de-emphasize the areas in which they have relatively less content knowledge" (cited in Grossman, 1995, pg.21). To this extent, it could be contended, based upon the arguments presented in the previous section, that primary school teachers may avoid or de-emphasise environmental education if they have relatively less content knowledge about environmental education. Such propositions can be situated in the wider debates surrounding teacher knowledge preparation.

For example, Good (1990), Reynolds (1989) and McMeniman et al. (2000) claim that teacher education is now able to equip pre-service and in-service teachers with 'state-of-the-art' instructional knowledge. It must be noted that such authors fail to mention 'what' is 'state-of-the-art' instructional knowledge and how this is utilised to equip student teachers and practicing teachers. Our point relates to a previous argument of Shulman's (1986a) which states "major elements of teacher knowledge have not yet been uncovered or sufficiently defined" (cited in Palonsky, 1993, pg.8).

Furthermore, Holbrook et al. (2000) maintain that educational research has had little impact upon Australian teachers and their teaching practices. Holbrook et al. (2000, pg.6) discovered that "university research in schools was largely indirect, unstructured and often mediated through individuals". Thus, it appears that 'the state-of-the-art' instructional knowledge Good (1990), Reynolds (1989) and McMeniman et al. (2000) referred to is yet to be fully defined and developed so as to 'impact Australian teachers and their teaching practices'.

It is this form of instructional knowledge which Shulman (1986b) refers to as 'pedagogical content knowledge'. Almost two decades ago Shulman (1986b, pg.6) argued that teachers' 'pedagogical content knowledge' is the *"missing paradigm"* in the discussions surrounding the issue of knowledge. Grossman, Wilson and Shulman (1989) outline four types of 'pedagogical content knowledge', namely content knowledge, substantive knowledge, syntactic knowledge, and beliefs about the subject matter.

This 'pedagogical content knowledge' framework is grounded in the academic rationalist tradition which assumes that the teacher is an expert of the discipline/s and is able to disseminate this knowledge to students in a capturing and exciting manner. Whelan (1992) argues that Shulman's academic rationalist model of 'pedagogical content knowledge' is rarely implemented nor achieved in classrooms. Whelan (1992, pg.83) further explains: "it is

acknowledged… even among its supporters (Shulman, 1987)… that there is inadequate support for the claim that this model is achieved often".

Furthermore, Wilson (1998) maintains that 'knowledge' as a focus in education has been more or less abandoned for over thirty years now.   In Wilson's (1998, pg.3) view, 'knowledge' lost its salience for teachers and education systems during the 1960's and 70's. More specifically, Wilson (1998, pg.3) argues that the education profession "came to believe that education was no longer about filling up people's minds with a lot of stuff".   Wilson (1998) further asserts that the latter model, of "filling up people's minds with a lot of stuff", is now considered to be a 'bad' model of education.   Wilson's (1998, pg.3) key argument is that this dramatic shift in thinking was entirely about knowledge:

> That was what filled the bucket wielded by teachers. That was what the author had, and has to be disposed of. That was what God was the source of. And it would have been what professors possessed if they has been in their offices… Knowledge.

He claims that "... while we weren't watching, knowledge became a bad thing. It was erased from educational offer, or at least reduced substantially in importance" (Wilson, 1998, pg.3). In this way, the knowledge which Wilson (1998) is explicitly referring to is content knowledge.   Wilson's (1998, pg.5) explanation of this shift is that educators who anticipated the post-modern age were antagonistic to knowledge and reason, especially empirical knowledge and scientific rationality.   Such eductors sought self-realisation in personal experience, creativity and imagination as a means for understanding the world, as a reaction to the perception that teaching in the 1960's was too *fact* oriented and susceptible to rapid changes in knowledge.

The 'Queensland School Reform Longitudinal Study' further supports Wilson's (1998) contentions, with recent findings revealing that "teachers themselves actually rate basic skills

as the highest of their priorities, and intellectual engagement and demand as the lowest" (Education Queensland, 2001, pg.15). Furthermore, Education Queensland (2001, pg.9) reported that teachers "viewed behaviour management as a policy issue that required improvement prior to any considerations of classroom practices". Bernstein's (1996) analysis of the acquisition-competence model covers the same ground such that the internal workings of the learner rather than measurable learning outcomes dominate teaching and teacher education.

Notwithstanding, so as to situate such arguments in environmental education and specifically in the realm of primary school teachers' knowledge about environmental education, we now discuss the theoretical concept of 'ecological literacy'. This concept is utilised for the interpretation, analysis and synthesis of data that appear later in this paper.

Ecological Literacy as Pedagogical Content Knowledge

In this section, we set out a model for gauging primary school teachers' knowledge about environmental education, including environmental concepts and issues. We begin with the concept of knowledge and propose that to teach environmental education, teachers require a relevant stock of knowledge. To do this, we draw on Orr's (1992) concept of 'ecological literacy'.

Ecological literacy is an appropriate concept for use in this paper for three reasons. First, it emphasises the 'content knowledge' referred to earlier as teachers' pedagogical content knowledge. Second, ecological literacy evokes those ideas and approaches that environmentalists consider fundamental in environmental education. Third, the concept provides a yardstick or set of criteria against which we gauge teachers' ecological literacy in the empirical work reported in this paper.

In 1989 UNESCO-UNEP positioned environmental literacy (the predecessor to ecological literacy) as the most fundamental goal of environmental education. In syllabus and curriculum terminology, this means that environmental (ecological) literacy has content, skills and processes that learners ought to know and be able to do to demonstrate 'literacy'. Roth coined the term, environmental literacy, in 1968. Some years later, Harvey (1976, pg.67) defined an environmentally literate person as "one who possesses basic skills, understandings, and feelings for the man-environment (sic) relationship". Buethe and Smallwood (1987) defined it as one's understanding of environmental facts. As these definitions are fairly limited, environmental literacy was later redefined by a series of authors (see Hurry, 1982; Roth, 1992; UNESCO-UNEP, 1989).

Roth (1992, cited in Todt, 1995, pg.17) categorised individuals' environmental literacy into four levels, namely nominal environmental literacy, functional environmental literacy, structural / operational environmental literacy and multidimensional environmental literacy. Although Roth's (1992) categorisations are useful, Clacherty (1993, pg.114) alleges that such categorisations are inadequate for what is required to address the "dominant technocentric worldview which most of us, unwittingly, support"[iii]. For that reason, the term 'environmental literacy' has been reconceptualised to include a transformatory reconstruction of industrial (western) culture.

It is this reconceptualisation which has seen the phrase 'environmental literacy' transform to become Orr's (1992) refined term 'ecological literacy'. Orr (1992) does not identify any differences between the phrases environmental literacy and ecological literacy and uses them interchangeably. Quammen (1994) notes this ambiguity in Orr's work. For the purposes of this paper, we utilise Orr's term 'ecological literacy'.

According to Orr (1992), ecological literacy primarily constitutes '*knowing, caring* and *practical competence'*. Orr (1992, pg.92) further implies that ecological literacy encompasses

an understanding of "how people and societies relate to each other and to natural systems, and how they might do so sustainability". In other words, knowing how the world works, and therein knowing how to preserve and maintain the environment. To this end, Orr (1992) argues that the ecologically literate person understands the dynamics of the environmental crisis which includes a thorough understanding of how people (and societies) have become so destructive.

Orr (1990; 1992; 1994) argues that education is the most powerful mechanism to address the world's environmental challenges. He propounds that no student should graduate from any educational facility without knowing seventeen key subject areas; in other words pedagogical content knowledge. Orr (1992, pg.109) refers to this complex knowledge base as a "syllabus for ecological literacy". Echoing Allan Bloom's approach, he nominates over one hundred articles and books as essential readings for all students and teachers. Orr (1992) draws works from distinguished philosophers such as Ehrlich, Bacon, Kahn, Berry, Merchant, Emerson, Lovelock, Eiseley, Leopold and Thoreau.

It is this knowledge that Orr (1992) claims will enable educators, teachers and citizens to ask "what then?" Sturdavant (1993, pg.209) postulates that asking 'what then' requires:

> Interrogating the interconnected layers of practices, trends, and assumptions upon which we construct our present life style will render those interconnections and their ramifications more explicit, thereby making their sustainability available to assessment.

Orr (1992) and Sturdavant (1993) both argue that asking 'what then' will enable key stakeholders, such as educators, to construct a very different agenda for educational reform. In order to begin the process of reform in education and environmental education, identifying primary school teachers' ecological literacy levels is a necessary step. Table 1. identifies

various indicators which can be utilised to gauge teachers' ecological literacy levels about the environment and environmental education. Of course, each level is not mutually exclusive and teachers may be located within and between levels. As indicated earlier, pedagogical content knowledge and beliefs are inextricably related. As such, I coin the concept *eco-literacy* in order to appropriately encapsulate *(measure)* both ecological literacy (complex knowledge) and environmental *(eco)* philosophy (belief) indicators.

'TABLE 1. ABOUT HERE'

Table 1. is based upon the works of O'Riordan (1981), Fien (1992), Roth (1992) and Orr (1990; 1992; 1994). Ecological literacy is ideally about developing a rich knowledge base and multifaceted beliefs and/or philosophies about the environment. The object of Orr's (1992) theory of ecological literacy is not to develop one particular view of the environment, but rather a complex understanding of the various philosophies which lead to ecological sustainability. As such, we now turn to a brief discussion of the methods, techniques and modes of inquiry utilised to investigate *(measure)* primary school teachers' eco-literacy.

Methods, Techniques and Modes of Inquiry

A combined-methods approach was applied to investigate primary school teachers' eco-literacy. The methodology consisted of two stages which included a series of ethnographic interviews[iv] followed by the use of a quantitative mail survey.

An ethnographic approach was adopted in this study as the ethnographer ultimately seeks to document the 'knowledge and belief systems' of a given group. In this case, the authors as the ethnographers, sought to document the 'knowledge and beliefs systems' of primary school

teachers toward environmental education. According to Bernstein (1996, pg.137), in the classic ethnographic position "the researcher has first to learn the language of the group or society and know the rules of its contextual use". Moreover, Bernstein (1996, pg.138) explains:

> From here on, the researcher is developing reading rules (of recognition and realization) to grasp how members construct their various texts or mange their contexts. The researcher here is modeling the members' recognition and realization rules, or the strategies of practice those rules constrain… The problem is to construct the tacit model. If the researcher fails to construct the model s/he is marooned in the specific contexts and their enactments, is in no position to appreciate the potential of the meaning of that particular culture, and thus its possible enactments. Without a model, the researcher only knows what his/her informants have enacted.

As such, the previous section (Theoretical Framework) presents a tacit model which allowed the authors to 'grasp how members [teachers] construct their contexts [environmental education]'. Further, this model also enabled the authors to develop the analytical codes (reading rules) for interpreting data. To this end, the application of ethnography, in conjunction with the theoretical model, provided a means for understanding what teachers' know and believe about environmental education. In order to determine the extent and distribution of the informants' meaning and understanding of environmental education among the wider population of primary school teachers, the application of a state-wide quantitative survey was administered so as to confirm and elucidate the theoretical model and the views discovered using ethnography. We now briefly describe the methodological strategies utilised in stage one and stage two.

Stage One

In total **26** primary school teachers were interviewed. **85%** of the participants were female and fifteen percent were male. The most current Education Queensland data reveals that **78%** of primary school teaching staff are female and **22%** percent are male (Cheong, 2002). Thus, the ratio of females to males was reasonably consistent with Education Queensland data. Further, the age range of the participants was from **22** to **57**. The average age of the participants was **39.5** years of age. Once again, this was consistent with Education Queensland data which indicates that the average age of Queensland primary school teachers is **40** years of age (Cheong, 2002).

Each of the **26** informants were interviewed once. The average duration of an interview was **90** minutes. The shortest interview was **60** minutes in length and the longest interview was **170** minutes in length. There were no time restrictions placed on the interviews and all interviews progressed for as long as necessary.

Intensive ethnographic interviewing techniques were utilised in this study. Lofland (1971, pg.76) describe intensive interviewing as "a guided conversation whose goal is to elicit from the interviewee (usually referred to as the informant) rich, detailed materials that can be used in qualitative analysis". According to Lofland (1995) intensive interviewing serves as a tool to discover the perceptions and experiences the informant has had of a particular situation or topic. Whilst the chosen interview technique can be labeled intensive, it was also ethnographic in nature. In Potter's (1996, pg.96) view, the ethnographic interview "is not as balanced as most conversations are", rather the "ethnographer informs the interviewee of the purpose of the interview and then takes control by asking questions and probing the person's responses".

In accordance with Potter's (1996) advice and so that the informants' perspectives and experiences, or as Marshall describes "rich narrative descriptions" (1995, pg.82), were elicited and fully understood one-to-one interviewing was applied. Potter (1996, pg.97) recommends that the ethnographer "must cross-examine the subject so the researcher is sure he or she understands the subject's meaning". One-to-one interviewing allows for such cross-examination and profundity[v].

We utilised the computer software program NVIVO (QSR, November 2000) to store, categorise, code and analyse all stage one data. As Richards (2000, pg.59) notes, "qualitative researchers usually create categories in two different ways 'up' from the data, as meanings of the data are noted and stored, and 'down' from prior ideas, project designs and theories". We utilised both methods to categorise (code) the data. Such categories were refined into themes, and then into stories, which in turn formulate the substance of the qualitative data analysis presented in this paper.

Stage Two

So as to elucidate the findings discovered in the stage one phase of data collection, a state-wide survey was administered in Queensland primary schools. To assist with the development of the survey, a pilot study was trailed. For purposes of this paper, only the pilot survey data will be discussed in this paper[vi].

For the pilot survey, primary school teachers from various Queensland regions were sampled using convenience sampling methods. **5** primary schools agreed to participate in the pilot survey. The stage one informants also participated in the survey. The pilot survey acts to pretest the survey instrument and procedures for the study, in addition to testing data collection and analysis techniques (using SPSS) and identifying variance in the targeted sample population to do with age, gender, experience and training backgrounds.

90 primary school teachers were sampled in the pilot survey. **78** completed questionnaires were received which equals an **86%** response rate. **78%** percent of the sample were female and the remaining **22%** were male. The age range of participants was from **22** years of age through to **61** years of age. The average age of participants was **41** years of age. Once again, such gender and age break-ups were consistent with current Education Queensland demographic data (Cheong, 2002).

The pilot questionnaire was personally administered at the **5** participating school staff meetings, which ensured a high response rate. The stage one informants were mailed and emailed a questionnaire. The pilot questionnaire format and structure replicated the mail survey questionnaire. So as to increase the success of the survey, all elements of Dillman's (1978) total design method for mail surveys were utilised in the pilot study.

The quantitative data was analysed using the statistical software package for the social sciences (SPSS Version 11.5). As this study was exploratory, each item was analysed individually utilising univariate and bivariate analysis techniques. In doing so, a predictive analytical model was developed to measure the relationships between and significance of data.

Data Presentation

The data are presented in three sections, namely 'Teachers' Training in Environmental Education', 'Teachers' Knowledge about (and Practices of) Environmental Education Pedagogy' and 'Teachers' Beliefs (and Knowledge) about the Environment and Environmental Education Content'.

Section One: *Teachers' Training in Environmental Education*

In order to gauge the participants' knowledge and beliefs (eco-literacy) about environmental education, it was considered necessary to determine the level of formal environmental education training undertaken by the participants in the sample.

78.1% of the pilot survey sample indicated that they had never undertaken in-service training in environmental education, whereas **21.9%** indicated that they had undertaken in-service training. This represents **18.0%** of the female sample and **31.8%** of the male sample having undertaken in-service environmental education training. Thus, significantly more male participants had participated in in-service environmental education training than their female counterparts.

The majority of teachers *(in stage one)* indicated that they had not undertaken any in-service training in environmental education because such in-serving was not offered, as outlined by one participant:

> The opportunities are not there. When you do professional development, that's not what we are in-servicing on. We're in-servicing on other sorts of things (11) [vii].

Several teachers *(in stage one)* indicated that they would undertake in-service training in environmental education if it were available, although one participant who is a committed teacher of environmental education and who has undertaken on-going in-service training in environmental education, saw it differently:

> I think it is more personal. We give them every opportunity at our place [school]. If they want to go to a workshop, everything is paid for. No commitment to follow up

or report. It couldn't be easier. Like the upcoming workshop organised, there is only one person who has expressed an interest (2).

84.5% of the sample also indicated that they had never undertaken pre-service training in environmental education, whereas only **15.5%** indicated that they had undertaken pre-service training. This represents **16.7%** of the female sample and **13.7%** of the male sample having undertaken pre-service environmental education training. More specifically, participants aged twenty-one to thirty had undertaken the *most* amount of pre-service training (**54.5%**), followed by participants aged thirty one to forty (**18.2%**). In contrast, participants aged forty-one to fifty (**43.3%**) and fifty-one (+) (**31.7%**) had undertaken the *least* amount of pre-service training. Such variances in training between participants of different age groups were statistically significant at *.000 (Pearson Chi-Square).* These trends were also apparent in *stage one.*

Section Two: *Teachers' Knowledge about (and Practices of) Environmental Education Pedagogy*

The authors sought to determine the stock of 'environmental education' knowledge among the participants. In this regard, the following comments are typical perceptions of environmental education offered by the participants in *stage one*:

> In my classroom it means educating the children about the environment and their impact upon the environment (4).

> It is making sure that the people we are teaching understand what has to happen to keep where we live the way it should be and to improve it from what has been done to derogate it or to keep the status quo (20).

Such comments display simple understandings of environmental education according to Table 1. Even so, another participant displayed a more complex understanding of environmental education through conveying a 'futures perspective' as can be seen in the following comment:

> That the future generations that we teach understand that the environment, local and global, has to be conserved so that it is there for future generations (12).

Notwithstanding, the majority of the participants expressed their own lack of knowledge of environmental education. Approximately half of the *stage one* participants responded with comments such as "I don't know a lot about it [environmental education]". More specifically, when asked "do you feel you know a lot about environmental education?" one participant said:

> No I don't. I think I know a little bit about it and I have an interest in it, so I can maybe start an interest in the children, and perhaps that will lead me to finding more information. I don't have a good awareness (4).

As Figure 1. illustrates, the pilot survey results further confirm such findings with **42.3%** of the total sample rating their knowledge of environmental education concepts, theories and teaching approaches as '*low' to 'very low'*. **46.5%** rated their knowledge as *'average'*.

'FIGURE 1. ABOUT HERE'

As illustrated in Table 2. female participants rated their knowledge lower (**46.9%**) than their male counterparts (**31.8%**). Male participants also tended to rate their knowledge as more 'average' (**54.5%**), 'high' (**9.1%**) and 'very high' (**4.5%**) than their female counterparts (**42.9%**, **8.2%** and **2.0%** respectively).

'TABLE 2. ABOUT HERE'

Furthermore, most participants *(in stage one)* were not familiar with the Queensland P-12 Environmental Education Curriculum guide (Queensland Department of Education, 1993), as typified in the following comment:

> Nope. Never read the document. So we're all just stumbling along doing what we can (20).

Only several participants (2, 12, 16) in *stage one* were familiar with the terminology of 'education *about* the environment, education *in* the environment and education *for* the environment'. As Figure 2. demonstrates, **50.0%** of the pilot survey sample had never heard of the approaches education *about* the environment, education *in* the environment and education *for* the environment. **22.2%** of the sample had heard of these approaches, but had never actually practiced them.

'FIGURE 2. ABOUT HERE'

Nonetheless, only **11.5%** of the total 'pilot survey' sample considered 'lack of knowledge' as a significant barrier impeding environmental education practice. One participant (2), who was identified earlier as a committed teacher of environmental education, saw 'lack of knowledge' on the part of primary school teachers as a significant barrier impeding the implementation of environmental education:

> First and foremost there is not enough knowledge… Understanding of concepts such as sustainability. They wouldn't have the background we would like them to have… I don't see the issues being addressed (2).

When asked about personal background the above-mentioned participant (2) indicated a former occupation as a wildlife carer. The participant also noted that environmental education requires 'a personal interest':

> My parents had a concern for wildlife and I have been brought up in an environment where we cared for it (2).

Most participants *(in stage one)* displayed some level of interest, although clearly admitted that it was not a priority in their classrooms, as indicated in the following comments:

> I don't think it is a priority anymore because there is so much else you are dealing with. You have kids that have emotional and social problems. Kids that have shocking upbringings… I know from my point of view, just covering literacy and numeracy every single day is a struggle (11).

> I wouldn't say I treat it as a priority. It is just one of those things that if it can be done, it might be (22).

> It is not my priority. I am more inclined to make sure the children have the basics under their belt (20).

The pilot survey results confirmed such findings, with the majority of teachers (**39.2%**) stating that they *"occasionally (from time to time)"* make it a priority in their teaching. According to the majority of the *stage one* participants, reasons as to why environmental education is not a *"specific"* priority in schooling is because, as one informant explains:

> It is not pushed as a priority. Literacy and numeracy are pushes… But teachers will also go down the road that principals' push and very few are focused on the

environment because they are just as overworked. If a principal has a passion the whole school follows it. So it is not just the teachers (12).

The participants *(in stage one)* also proclaimed that 'personal choice' dictates what is taught, as two participants clearly state:

I can do that [environmental education] if I wanted to. That's if I wanted to personally. No-one is making me do anything. They leave it very open for us to interpret so it depends on how keen I am to teach it (1).

I don't see too much of anything being pushed at me to teach. I see things put in front of me and say this is what you have to teach but really you go away and you teach what you teach. There's still not a lot of checks and balances (20).

In this regard, the participants expressed varying levels of environmental education practice with some teachers saying "no I don't teach it" (1, 18, 13, 20), others saying "no I haven't this year at all" (11, 7, 17), with many saying "I build it [environmental education] into other units… it's incidental" (3, 4, 5, 6, 8, 10, 12, 14, 15, 16, 19) and only one staying "a lot" (2).

As Table 3. illustrates the pilot survey results confirm such findings with the majority of teachers in the sample indicating that they teach environmental education incidentally (**69.2%**), integrated throughout the curriculum (**65.4%**), and included with Social Studies (**64.1%**) and Science (**62.8%**).

'TABLE 3. ABOUT HERE'

21

Most teachers *(in stage one)* indicated that they had witnessed effective environmental education during their professional experience by some individual teachers, as typified in the following comment:

> Those few who are interested in it keep doing it, and the rest of us just go with the flow. Until something happens that impacts us directly, we just keep going the way we are (4).

Robottom et al. (2000, pg.157) have also raised this issue and concluded that "behind every successful environmental education program is a committed teacher". Such findings indicate that individual commitment to environmental education is a vital component with respect to the implementation of environmental education.

With this in mind, the pilot survey revealed that the sample ranked *time constraints* (**32.8%**) as the 'number one' constraint impeding the implementation of environmental education. The sample then ranked *over-crowded curriculum* (**31.1%**), *constant change* (**14.8%**), *lack of knowledge* (**11.5%**), *resource constraints* (**4.9%**), *on-going professional demands* (**3.3%**) and *not prioritised by school/department* (**1.6%**) as the major barriers preventing or limiting the implementation of environmental education. The *stage one* teachers also identified such concerns, although these teachers were particularly concerned with the issues of *'constant change'* and *'on-going professional demands'* as one participant explains:

> Teachers are not reading and discovering and discussing professionally. There are too many changes and demands. I can't think of a week where something hasn't impinged dramatically on me trying to teach. We lose days and days. Our knowledge and skill base is dropping, but it is not necessarily our fault (12).

These pressures and their effect in Queensland were also reported by Andrews (1997). To this extent, many teachers *(in stage one)* indicated that "there is no motivation and no reward" to implement environmental education. Indeed, environmental education appears to be caught in a larger set of historical circumstances exemplified by the comment that there is a lack of "self-motivation" and "professionalism" in teaching itself. This same participant explained that the only way in which environmental education could be improved is through teacher education and recognised professional status:

> Nobody should get out of teacher training unless they are bloody good. No flick and tick stuff. It is whether they can teach. In environmental education, we need a foundation to start building on. A mentor in the school. There needs to be some level of professionalism (12).

While we are sympathetic with this view, it collapses teachers' content knowledge into teachers' pedagogical knowledge in a way that prioritises teaching processes over what is taught. As such, it is clear that the majority of the participants (in stage one and stage two) have low levels of understanding in environmental education according to the criteria illustrated in Table 1. At the same time, these primary school teachers generally expressed concern for the environment and varying levels of interest in the environment. So that these issues can be properly understood, we now present data about teachers' beliefs (and knowledge) in relation to the environment and environmental education content.

Section Three: *Teachers' Beliefs (and Knowledge) about the Environment & Environmental Education Content*

In order to gauge the stage one and stage two participants' environmental (eco) philosophies, all participants were presented with four different statements which were representative of the four different philosophies (*cornucopian, accommodation, eco-socialist and Gaia)* (see Table

1.). Participants were then asked to indicate which statement they agreed with *most*.   As such, the majority of the stage one and stage two participants agreed *most* with the eco-socialist perspective. More specifically, **61.1%** of the pilot survey sample agreed most with this perspective *(the environment should be protected, even if it results in a reduction in economic growth).*   **66.6%** of the female sample and **50.0%** of the male sample agreed *most* with this statement.

Interestingly, **20.8%** of the sample agreed most with the Gaia perspective *(the environment should be preserved and protected, no matter what the cost).* **20.0%** of the female sample and **22.7%** of the male sample agreed most with this statement.

15.3% of the sample agreed most with the Cornucopian Technocentric perspective *(the environment is a resource to be used by human beings).* Significantly, **12.0%** of the female sample and **22.7%** of the male sample agreed most with this statement.

Furthermore, as shown in Table 4. the pilot survey data revealed that **56.0%** of the sample indicated that the environment is *'probably'* in a state of crisis.   **34.7%** of the participants indicated that the environment is *'definitely'* in a state of crisis. **38.5%** of the thirty-one to forty age group and **40.9%** of the fifty-one (+) age group (both female and male participants) indicated that the environment is *'definitely'* in a state of crisis. In contrast, only **23.1%** of participants aged twenty to thirty indicated that the environment is *'definitely'* in a state of crisis. **76.9%** of this age group (twenty one to thirty) indicated that the environment is *'probably'* in a state of crisis. Furthermore, **15.4%** of the thirty-one to forty age group were *'unsure'* if the environment is in a state of crisis, and **13.6%** of the fifty-one (+) age group indicated that environment is *'not'* in a state of crisis.   As such, such variances between age groups were statistically significant at *0.05 (Pearson Chi-Square).*

'TABLE 4. ABOUT HERE'

24

Notwithstanding, many of the participants *(in stage one)* revealed a concern for the environment, although it was clearly stated that such concerns do not amount to a belief that there is a 'crisis' (at this time), as one participant indicates:

I don't know about a crisis. I try to be optimistic. But I am personally fearful what we have done to the environment. But I don't know about crisis, as there is a lot of awareness out there (4).

The majority of the participants *(in stage one)* said that they did not know much about the idea of an environmental crisis as typified in the following two comments:

I don't have enough in depth knowledge. I don't know enough to give an opinion (16).

I wouldn't have a clue to be totally honest. I wouldn't know how bad it is. I don't know how serious the logging situation has become. I don't know about the destruction of the Amazon rainforest. I know it happens and I know where it is, but I don't know the impact it's having (11).

To gauge the *stage one* participants' knowledge in more depth, we asked the participants if any particular environmental issue/s concerned them. In response, all participants identified at least one environmental issue. The majority of these participants identified the greenhouse effect, ozone layer depletion, pollution and biodiversity as issues that concerned them.

The authors sought to understand the participants' comprehension of such environmental issues/concepts. Most of the participants openly admitted that they could not explain the various issues/concepts in any detail. Some teachers attempted to define a concept/issue and

in doing so often revealed a low level of understanding, as typified in the following comment about the greenhouse effect:

> The greenhouse effect is to do with the ozone layer around the earth and gases emitted by various industries and cars. It rises into the ozone layer and concentrates over the poles. I read up on the greenhouse effect when I taught it and it was slightly different to this, but it has made holes over the artic and Antarctic and the suns rays penetrate through the holes in the ozone and the heat comes under the ozone layer and is not able to escape because of the gases (15).

Clearly this particular participant confused elements of ozone depletion with the greenhouse effect. In fact, we queried the participant about possible confusion between the two terms:

> I probably do [confuse them] and in the past I may have mixed them up but as I go on I am learning. The information is always changing (15).

Two participants (2, 16) revealed a better understanding of the greenhouse effect, as typified in the following comment:

> The greenhouse effect is where a number of gases are given off from industry, and the environment itself. And [the gases] are caught in the earth's atmosphere and they can't escape and this causes a build-up of heat in the atmosphere (16).

Once again, as mentioned earlier, **88.8%** of the pilot survey sample rated their knowledge about environmental education (including environmental concepts) as '*average*' to '*very low*'.[viii]

The authors sought to determine the various teachers' views about content knowledge and its significance in environmental education. The majority of teachers felt that content knowledge was not overly important, as displayed in the following comments:

> I don't think the content knowledge is vital. It would be really difficult to fill their heads with all this information and figures. You need hands on stuff rather than filling their heads with all the information (11).

> No, I don't think so. But again it's attitude. Whereas some teachers will only teach about the things that they know about. The priority is learning and that includes me… I want to learn with the kids, so I don't need to know in advance… I don't plan to have any sort of environmental issues and knowledge and content pushed with young children (26).

> Content is not important… I don't think it is the be all and end all (8).

> Not a huge content, I think they need to make sure they are not misinformed. I can walk my children along the beach and pick up things and use descriptive words to describe the shapes of things, without having to tell them… I am not into names of shells or trees and names of habitats, but I would rather say, this is interesting and I wonder why the shell is this shape? (5)

There is an implicit assumption here that 'knowledge' means transmission, the 'empty-vessel' notion of 'teaching'. This is perhaps a reflection of the teacher education theories learned by these participants during pre-service teacher education (Wilson, 1998). Accordingly, it is not surprising that many participants *(in stage one)* indicated that "knowledge would come much later and was not needed at the primary school level". Many participants *(in stage one)* indicated that knowledge is more about "knowing how to access information" (16).

Furthermore, the majority of participants revealed that "a positive attitude" towards the environment is *"definitely"* the most important characteristic to develop, as one informant explains:

> Definitely attitude. If the world is going to be made better it will be made better by good people not clever; the attitude that the world is important (18).

Such a view suggests that these primary school teachers were primarily concerned with feelings and attitudes. As shown in Figure 3. the majority of the pilot survey sample considered that the essential aim of environmental education should be to develop either *'attitudes and values'* **(46.1%)** or *'action'* **(25.0%)**. Only **21.1%** of the sample considered that environmental education should essentially aim to develop knowledge, and only **2.6%** of the sample consider that environmental education should (essentially) aim to develop 'attitudes/values, action and knowledge'.

'FIGURE 3. ABOUT HERE'

The *stage one* informants also felt that teachers did not need to have a significant content knowledge base, as one informant describes:

> I don't think as a teacher you need a huge content base, as such. Possibly a little bit more than what our teachers are graduating with. There are opportunities for teachers to catch up on that content-base knowledge as time goes on.

Further, stage two participants were asked *"do you feel that teachers need advanced knowledge of environmental education concepts, theories and teaching approaches"?* As illustrated in Figure 4. **45.3%** of teachers felt that such knowledge was *'needed'* and **37.3%**

of teachers felt that such knowledge was *'not needed'*. A further **17.3%** stated that they were

'unsure'. Thus, the latter findings indicate that there is a clear divide between this sample of

teachers as to the apparent 'value' of knowledge in primary school education.

'FIGURE 4. ABOUT HERE'

This apparent abandonment of knowledge among a significant proportion of these participants

is also consistent with the findings of 'The Queensland School Reform Longitudinal Study'

which maintains that "teachers themselves actually rate basic skills as the highest of their

priorities, and intellectual engagement and demand as the lowest"(Education Queensland,

2001, pg.15).

We now discuss and synthesise such data in the context of the literature review and

theoretical framework presented earlier.

Data Synthesis

Based upon the data presented, we contend that the majority of current primary school

teachers are likely to be functioning at a 'knowledge' level of ecological illiteracy and/or

nominal ecological literacy according to Table 1. We further contend that the majority of

current primary school teachers maintain various environmental (eco) philosophies,

particularly cornucopian (technocentric) and eco-socialist (ecocentric) philosophies. Such

contentions are evident through six key findings:

One, both *stage one* and *stage two* participants indicated that had received no or very little in-

service and / or pre-service training in environmental education. Spork (1990; 1992) also

reported in her study that primary school teachers receive little professional preparation to

teach environmental education. In comparison to Spork's (1990; 1992) study, the findings of

this study indicate that teachers are receiving (slightly) more professional preparation in environmental education. The benefits of such training are yet to be fully explored.

Notwithstanding, the *stage two* results of this study revealed significant differences between female and male participants' levels of in-service and pre-service training in environmental education. More specifically, significantly more male participants had participated in in-service environmental education training than their female counterparts. Further, participants aged twenty-one to thirty and thirty-one to forty had undertaken the *most* amount of pre-service training, and participants aged forty-one to fifty and fifty-one (+) had undertaken the *least* amount of pre-service training. Such variances were statistically significant.

Two, the *stage one* and *stage two* participants displayed limited and simple understandings of environmental education. The majority of the participants openly expressed their lack of knowledge about environmental education. However, once again, there were significant differences between female and male participants, with female participants rating their knowledge as significantly lower than their male counterparts which may be linked to differences in in-service and pre-service training. Further, the majority of participants in *stage one* and *stage two* were not familiar with (nor implemented) the environmental education approaches 'education *about* the environment, education *in* the environment and education *for* the environment'. They were neither aware of environmental education curriculum nor policy documents. Such findings confirm that environmental education as a curriculum area, including education *for* the environment, is failing in many Queensland primary schools.

Three, most *stage one* participants displayed some level of interest for environmental education, although such informants clearly admitted that it is not a priority in schooling. Once again, the pilot survey results confirmed such findings, with the majority of teachers stating that they *"occasionally"* make it a priority in their teaching. Thus, similar to the

apparent declination of concerns for the environment in society generally (OECD, 2001), it appears that interest has declined in environmental education also when compared to previous stated interest levels (see Spork, 1990; 1992).

Four, the pilot survey revealed that the majority of teachers perceived *time constraints, over-crowded curriculum, constant change* and *lack of knowledge* of environmental education as the major barriers preventing or limiting the implementation of environmental education. The *stage one* participants also identified such concerns, although these teachers were particularly concerned with the issues of 'constant change' and 'on-going professional demands'. Such issues of constant change, on-going professional demands and lack of knowledge of environmental education have not been specifically researched in the field of environmental education, although existing research (Andrews, 1997) identified these pressures in Queensland schools.

Five, many of the participants *(in stage one)* revealed a concern for the environment, although it was clearly stated that such concerns do not constitute a 'crisis' (at this time). Notwithstanding, the majority of the participants *(in stage one)* said that they did not know much about the idea of an environmental crisis. In contrast, the *stage two* participants were of the belief that the environment is 'definitely' or 'probably' in a state of crisis. Furthermore, both *stage one* and *stage two* participants maintained various environmental (eco) philosophies, with the majority of teachers displaying eco-socialist *(ecocentric)*, Gaia (ecocentric) and cornucopian *(technocentric) perspectives*. Such beliefs about the environment may also be connected to teachers' beliefs about the significance of *'attitudes'* in the teaching and learning of environmental education.

Six, the *(stage one)* participants held many misconceptions and simple understandings of various environmental concepts. Most of the participants openly admitted that they could not explain the various concepts in any detail. Furthermore, a significant proportion of teachers

felt that content knowledge was not overly important and that "a positive attitude" towards the environment is *"definitely"* the most important characteristic to develop. Once again, such trends were confirmed in the *stage two* data. Moreover, a significant proportion of both *stage one* and *stage two* participants indicated that primary school teachers do not require substantive content knowledge. Many participants were of the view that it is more important to know how to access information.

This final point indicates that the majority of participants in this study neither obtained sufficient content knowledge of environmental education nor were particularly concerned about that fact. Such findings can be placed in wider theoretical arguments, as discussed earlier, to do with knowledge and its apparent lack of focus in education over the past thirty years (Wilson, 1998). Wilson (1998, pg.3) states that "filling up people's minds with a lot of stuff" is considered to be a 'bad' model of education. He further states that content knowledge is "what fills the bucket wielded by teachers" (Wilson, 1998, pg.3). Based upon the findings of this study, *'the bucket is empty'* for many teachers in the case of environmental education.

Concluding Comments

It is apparent that the majority of the participants, in *stage one* and *stage two*, maintain low levels of ecological literacy in accordance with Table 1. Such findings are important because if these levels of ecological literacy are widespread, it is unlikely that the current Queensland education system will produce an ecologically literate citizenry. Such conclusions will be further confirmed by the *stage two* state-wide mail survey.

Furthermore, it was apparent that the participants of this study maintain various environmental (eco) philosophies. However, the majority of participants agreed 'most' with the eco-socialist (communalism) perspective. Such beliefs about the environment may also

be connected to teachers' beliefs about the significance of 'attitudes' in the teaching and learning of environmental education. This issue is discussed further in Cutter-Mackenzie (2003a; 2003b) and Cutter-Mackenzie and Walker (2003c).

We conclude that the introduction of ecological literacy (eco-literacy) in educational policy may advance the goals of environmental education, although such initiatives are unlikely to significantly change the current status of environmental education unless there is a system-wide commitment to environmental education and knowledge production and dissemination on the part of governments, education departments, pre-service teacher education providers, primary schools and teachers themselves.

REFERENCES

ANDREWS, C. (1997) Teacher' Work: An Analysis of Teachers' Work in a Context of Change, *Unpublished PhD* (Gold Coast, Griffith University).

BERNSTEIN, B. (1996) *Pedagogy, Symbolic Control and Identity: Theory, Research, Critique.*, (London, Taylor & Francis).

BERRY, R. (1999) *Collecting data by in-depth interviewing*, British Educational Research Association Annual Conference, (Brighton, University of Sussex).

BUETHE, C., & SMALLWOOD, J. (1987) Teachers' environmental literacy: Check and Recheck, *Journal of Environmental Education*, **18**, 39-42.

CHEONG, Y. (2002) *Query (Email Correspondence) - Personal Communication*, Email Message (Brisbane, Author).

CLACHERTY, A. (1993) Environmental Literacy and the Technicist Worldview: Towards A New Conceptualisation, *The International Journal of Environmental Education and Information*, **12**, 107-120.

CLARK, J., & HARRISON, T. (1997) Are educational outcomes relevant to environmental education addressed by primary school teachers, *Australian Journal of Environmental Education*, **13**, 27-36.

CUTTER, A. (1998) Integrated Pre-Service Environmental Education: The Abandonment of Knowledge, *Unpublished Honours Thesis* (Gold Coast, Griffith University).

CUTTER, A., & SMITH, R. (2001a) A Chasm in Environmental Education: What Primary School Teachers 'Might' Or 'Might Not' Know, in: B. Knight, & Rowan, L. (Ed) *Researching in Contemporary Educational Environments* (Brisbane, Post Pressed Flaxton).

CUTTER, A., & SMITH, R. (2001b) Gauging Primary School Teachers' Environmental Literacy: An Issue of 'Priority', *Asia Pacific Education Review*, **2**, 45-60.

CUTTER-MACKENZIE, A. (2003a) Eco-Literacy: The "Missing Paradigm" in Environmental Education, *Unpublished PhD (In Submission)* (Rockhampton, Central Queensland University).

CUTTER-MACKENZIE, A. (2003b) *Quality versus Quantity: Primary School Teachers' Ecological Literacy*, American Educational Research Association Conference, (Chicago, AERA).

CUTTER-MACKENZIE, A., & TILBURY, D. (2002) Meeting Commitments for a Sustainable Future: Environmental Education in Pre-Service Teacher Education, in: B. Knight (Ed) *Reconceptualising learning in the knowledge society* (Flaxton, Post Pressed).

CUTTER-MACKENZIE, A., & WALKER, K. (2003c) *Disparities Between Theory and Practice: Unveiling the Rifts in Environmental Education*, American Educational Research Association Conference, (Chicago, AERA).

DILLMAN, D.A. (1978) *Mail and Telephone Surveys: The Total Design Method*, (New York, John Wiley & Sons).

EDUCATION DEPARTMENT OF VICTORIA. (1981) *Environmental Education: Statewide Survey Report*, (Melbourne, Education Department of Victoria).

EDUCATION QUEENSLAND. (2001) *The Queensland School Reform Longitudinal Study: A Strategy for Shared Curriculum Leadership*, (Brisbane, The State of Queensland, Department of Education).

FIEN, J. (1992) Education for the Environment: A Critical Ethnography, *Unpublished PhD* (Brisbane, Australia, University of Queensland).

GOOD, T. (1990) Building the Knowledge Base for Teaching, in: D. Dill (Ed) *What Teachers Need to Know* (San Francisco, Jossey-Bass).

GREENALL, A. (1981) *Environmental Education In Australia: Phenomenon of the Seventies: A case study in National Curriculum Development*, (Occasional paper No.7. Canberra, Australia, The Curriculum Development Centre).

GROSSMAN, P.L. (1995) Teachers' Knowledge, in: L. Anderson, W. (Ed) *International Encyclopaedia of Teaching and Teacher Education* (New York, Pergamon).

GROSSMAN, P.L., WILSON, S.L., AND SHULMAN, L.S. (1989) Teachers of Substance: Subject Matter Knowledge for Teaching, in: M.C. Reynolds (Ed) *Knowledge Base for the Beginning Teacher* (Oxford, Pergamon Press).

HARVEY, G.D. (1976) Environmental Education: A Delineation of Substantive Structure, *Unpublished PhD* (Southern Illinois, University of Carbondale).

HOLBROOK, A., AINLEY, J., BOURKE, S., OWEN, J., MCKENZIE, P., MISSION, S., & JOHNSON, T. (2000) Mapping educational research and its impact on Australian schools, in: Department of Education Training and Youth Affairs (Ed) *The Impact of Educational Research: Research Evaluation Programme* (Canberra, Commonwealth of Australia).

HURRY, L.B. (1982) Directions in Environmental Education and Their Implications for the Training of Primary School Teachers in the Transvaal: Towards a Synthesis, *Unpublished Doctoral Thesis* (Pretoria, University of South Africa).

JICKLING, B. (1992) Why I don't want my children to be educated for sustainable development, *Journal of Environmental Education*, **23**, 5-8.

JICKLING, B. (1994) Why I don't want my children to be educated for sustainable development, *Trumpeter*, **11**, 114-116.

JICKLING, B., & SPORK, H. (1998) Education for the Environment: A Critique, *Environmental Education Research*, **4**, 309-327.

LINKE, R. (1980) *Environmental Education in Australia*, (Sydney, George Allen & Unwin).

LOFLAND, J. (1971) *Analyzing Social Settings*, (Belmont, Wadsworth).

LOFLAND, J. (1995) *Analyzing social settings : a guide to qualitative observation and analysis*, (Belmont, Wadsworth).

MARSHALL, C., & ROSSMAN, GRETCHEN. (1995) *Designing Qualitative Research*, (Thousand Oaks, SAGE Publications).

MCMENIMAN, M., CUMMING, J., WILSON, J., STEVENSON, J., AND SLIM, C. (2000) Teacher knowledge in action, in: Department of Education Training and Youth Affairs (Ed) *The Impact of Educational Research: Research Evaluation Programme* (Canberra, Commonwealth of Australia).

MURDOCH, K. (1989) Environmental Education in Primary Schools, *Investigating APSJ*, **3**, 6-9.

OECD. (2001) *How highly should the environment rank as an international policy issue?*, (OECD Observer, http://www.oecdobserver.org/poll/poll_display.php/poll=58).

O'RIORDAN, T. (1981) *Environmentalism*, (London, Pion Limited.).

ORR, D.W. (1990) Environmental Education and Ecological Literacy, *The Education Digest*, 49-53.

ORR, D.W. (1992) *Ecological Literacy: Education and the Transition to a Postmodern World*, (Albany, State University of New York).

ORR, D.W. (1994) *Earth in Mind: On Education, Environment, and the Human Prospect*, (Washington DC, Island Press).

PALONSKY, S., B. (1993) A Knowledge Base for Social Studies Teachers, *THe International Journal of Social Education*, **7**, 7-23.

PHIPPS, S. (1991) Towards Excellence in Environmental Education: An Investigation into Teacher Preparation as Environmental Educators, *Unpublished Honours Thesis* (New South Wales, Australia, University of Wollongong).

POTTER, J. (1996) *An Analysis of Thinking and Research about Qualitative Methods*, (Santa Barbara, Lawrence Erlbaum Associates).

QSR. (November 2000) *NVIVO: NUD*IST for qualitative research*, Computer Software (QSR).

QUAMMEN, D. (1994) E is for Ecosystem: Ecological Literacy in the Wonder Years, *Outside*, **19**, 35-42.

QUEENSLAND DEPARTMENT OF EDUCATION. (1993) *P-12 Environmental Education Curriculum Guide*, (Brisbane, Publishing Services for Studies Directorate).

REYNOLDS, M. (1989) *Knowledge Base for Beginning Teachers*, (New York, Pergamon).

RICHARDS, L. (2000) *Using NVIVO in Qualitative Research*, (Melbourne, QSR International Pty. Ltd.).

ROBOTTOM, I., MALONE, K., & WALKER, R. (2000) *Case Studies in Environmental Education: Policy and Practice*, (Geelong, Deakin University Press).

ROTH, C.E. (1992) *Environmental Literacy: It Roots, Evolution and Direction in the 1990s*, (Columbus, OH, ERIC Clearinghouse for Science Mathematics and Environmental Education).

SHULMAN, L.S. (1986a) Paradigms and Research Programs for the Study of Teaching, in: M.C. Wittrock (Ed) *Handbook of Research and Teaching* (New York, Macmillian).

SHULMAN, L.S. (1986b) Those Who Understand Knowledge: Knowledge Growth in Teaching, *Educational Researcher*, **15**, 4-12.

SHULMAN, L.S. (1987) Knowledge and Teaching: Foundations for Educational Reform, *Harved Educational Review*, **57**, 1-22.

SKAMP, K. (1996) Environmental Education: Implementation in a NSW Department of School Education Region., *Australian Journal of Environmental Education*, **12**, 61-70.

SPORK, H. (1990) The classroom practices, professional preparation, attitudes and concerns of state primary classroom teachers in Brisbane North Region, Queensland, regarding environmental education, *Unpublished Masters Thesis* (Brisbane, Griffith University).

SPORK, H. (1992) Environmental Education: A Mismatch Between Theory and Practice, *Australian Journal of Environmental Education*, **8**, 147-166.

STAPP, W.B., & STAPP, G.L. (1983) A Summary of Environmental Education in Australia, *OZEENEWS: Australian Association of Environmental Education*, 4-6.

STURDAVANT, D.W. (1993) From Thinking Like A Machine to Thinking Like A Mountain: Educational Restructuring Or Ecological Literacy, *Unpublished PhD* (Oregon, United States of America, University of Oregon).

TODT, D. (1995) An Investigation of the Environmental Literacy of Teachers in South-Central Ohio Using the Wisconsin Environmental Literacy Survey, Concept Mapping and interviews, *Unpublished PhD* (Ohio, The Ohio State University).

UNESCO-UNEP. (1989) Environmental Literacy for All, *Connect*, **XIV**, 1-2.

WALKER, K. (1995a) Improving the Learning and Teaching of Environmental Education in the Primary School Curriculum: A Problem-Based Approach, *Unpublished PhD* (Sydney, University of Technology).

WALKER, K. (1995b) The Teaching and Learning of Environmental Education in NSW Primary Schools: A Case Study., *Australian Journal of Environmental Education*, **11**, 121-129.

WILSON, B. (1998) *Keynote Speaker (No Title Provided)*, ASCD Conference, (San Antonio).

WISCONSIN CENTER FOR ENVIRONMENTAL EDUCATION. (1997) *Are we walking the talk?*, (Wisconsin, Wisconsin Center for Environmental Education).

WORLD COMMISSION ON THE ENVIRONMENT DEVELOPMENT. (1987) *Our Common Future*, (Oxford, Oxford University Press).

Table 1. Eco-Literacy Levels (Adapted from the works of Fien, 1992; O'Riordan, 1981; Orr, 1990, 1992, 1994; Roth, 1992)

ECO-LITERACY			
Ecological Literacy	**COMPLEX KNOWLEDGE**	**BELIEFS**	*Eco Philosophy*
Ecological Illiteracy	Little understanding of environmental issues and/or the idea of an environmental crisis. Many misconceptions about environmental issues.	Believes that environment is a resource to be used by human beings. Science and technology will solve/manage any problems. All economic growth is good. Suspicion that environmental education and social change are necessary.	*Technocentric (Anthropocentric) Perspective*
Nominal Ecological Literacy	Can recognise some basic terms used in communicating about the environment. May possess misconceptions about and provide naïve explanations of environmental systems. Is beginning to identify environmental problems and the issues surrounding proposed solutions.	Is developing awareness and sensitivity towards the importance of natural systems and the human impacts on them. Reformist belief that economic growth and resource exploitation can continue. Provision of effective environmental management agencies at national and local levels. Raising environmental awareness and concern is necessary within society/education.	*Accommodation perspective*
Functional / Operational Ecological Literacy	Regularly uses environmental vocabulary with the correct definitions and in the appropriate context. Understands the organization and functioning of environmental systems and their interaction with human systems. Possesses the knowledge and skills to act on local problems and be involved with environmental concerns at the education level.	Is personally committed to environmental quality. Belief in the intrinsic importance of nature for defining and sustaining humanity. Rejection of materialism. Lack of faith in large-scale technology and continued economic growth. Personally committed to environmental education and the production of an environmentally literate and committed citizenry.	*Communalist (Eco-Socialist) Perspective*
Highly Evolved Ecological Literacy	Possesses a thorough understanding of how people and societies relate to each other and to natural systems, and how they might do so sustainability. Possesses a thorough understanding of the dynamics of the environmental crisis which includes a thorough understanding of how people (and societies) have become so destructive. Possesses an understanding of models of sustainability and associated environmental perspectives. Is able to synthesise environmental information and act upon that synthesis in ways that lead to environmental sustainability through environmental education.	Faith in cooperative capabilities of societies to establish self-reliant communities base on sustainable resource use. Belief in the intrinsic importance and preservation for defining nature and sustaining humanity. A belief that humanity should live simply, so that others can live. A passionate and committed belief in the production of an ecologically literate, committed and active citizenry.	*Gaia Ecocentric Perspective*

Table 2. Participants' Ratings of 'Environmental Education' Knowledge (Gender)

Gender	Measurements	Very High	High	Average	Low	Very Low	Total
Male	Expected Count	.6	1.9	10.2	7.4	1.9	22.0
	% within Gender	4.5%	9.1%	54.5%	18.2%	13.6%	100.0%
	% within Please rate your knowledge about environmental education concepts, theories and teaching approaches.	50.0%	33.3%	36.4%	16.7%	50.0%	31.0%
	% of Total	1.4%	2.8%	16.9%	5.6%	4.2%	31.0%
Female	Expected Count	1.4	4.1	22.8	16.6	4.1	49.0
	% within Gender	2.0%	8.2%	42.9%	40.8%	6.1%	100.0%
	% within Please rate your knowledge about environmental education concepts, theories and teaching approaches.	50.0%	66.7%	63.6%	83.3%	50.0%	69.0%
	% of Total	1.4%	5.6%	29.6%	28.2%	4.2%	69.0%
TOTAL	Expected Count	2.0	6.0	33.0	24.0	6.0	71.0
	% of Total	**2.8%**	**8.5%**	**46.5%**	**33.8%**	**8.5%**	100.0%

Table 3. Environmental Education Teaching Methods

Teaching Approaches in Environmental Education	Taught EE Using this Approach (%)
Incidental (When it Comes Up)	69.2%
Integrated throughout Curriculum	65.4%
Included with Social Studies	64.1%
Included with Science	62.8%
Other	9.0%
Stand-Alone Subject (Taught Separately)	5.1%
Focus of Entire Curriculum	2.6%
Do Not Teach Environment Education	1.3%

Table 4. Participants' Perceptions of the Environmental Crisis (Age Groups)

Age Groups	Measurements	Definitely	Probably	Not	Unsure	Other	Total
21-30	Expected Count	4.5	7.3	.5	.5	.2	13.0
	% within Age Groups	23.1%	76.9%	.0%	.0%	.0%	100.0%
	% within As a teacher, do you believe that the environment is in a state of crisis?	11.5%	23.8%	.0%	.0%	.0%	17.3%
	% of Total	4.0%	13.3%	.0%	.0%	.0%	17.3%
31-40	Expected Count	4.5	7.3	.5	.5	.2	13.0
	% within Age Groups	38.5%	38.5%	.0%	15.4%	7.7%	100.0%
	% within As a teacher, do you believe that the	19.2%	11.9%	.0%	66.7%	100.0%	17.3%

	environment is in a state of crisis?						
	% of Total	6.7%	6.7%	.0%	2.7%	1.3%	17.3%
41-50	Expected Count	9.4	15.1	1.1	1.1	.4	27.0
	% within Age Groups	33.3%	63.0%	.0%	3.7%	.0%	100.0%
	% within As a teacher, do you believe that the environment is in a state of crisis?	34.6%	40.5%	.0%	33.3%	.0%	36.0%
	% of Total	12.0%	22.7%	.0%	1.3%	.0%	36.0%
51+	Expected Count	7.6	12.3	.9	.9	.3	22.0
	% within Age Groups	40.9%	45.5%	13.6%	.0%	.0%	100.0%
	% within As a teacher, do you believe that the environment is in a state of crisis?	34.6%	23.8%	100.0%	.0%	.0%	29.3%
	% of Total	12.0%	13.3%	4.0%	.0%	.0%	29.3%
Total	Expected Count	26.0	42.0	3.0	3.0	1.0	75.0
	% within Age Groups	34.7%	56.0%	4.0%	4.0%	1.3%	100.0%
	% of Total	**34.7%**	**56.0%**	**4.0%**	**4.0%**	**1.3%**	100.0%

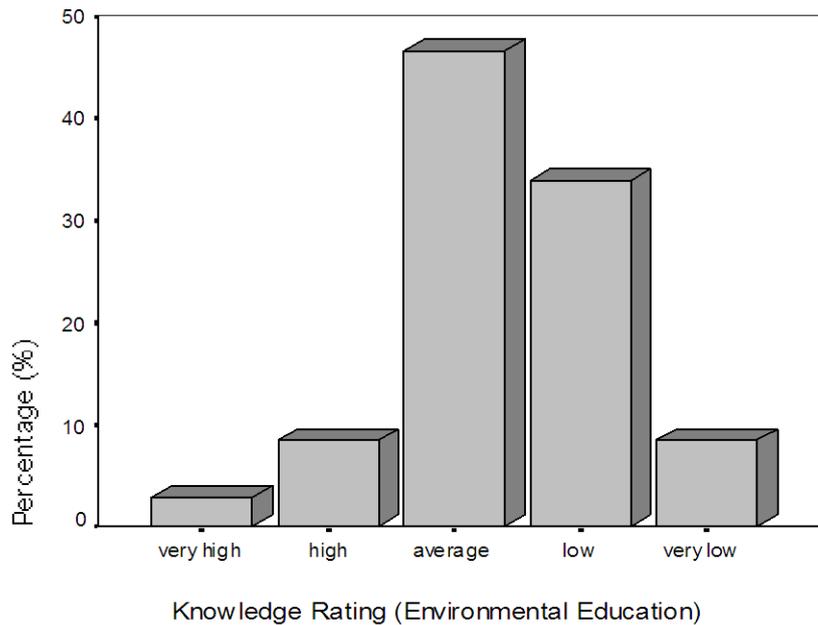Figure 1. Participants' Ratings of 'Environmental Education' Knowledge

Figure 2. Participants' Knowledge and Implementation of Environmental Education Approaches (Education *about*, *in* & *for* the Environment)
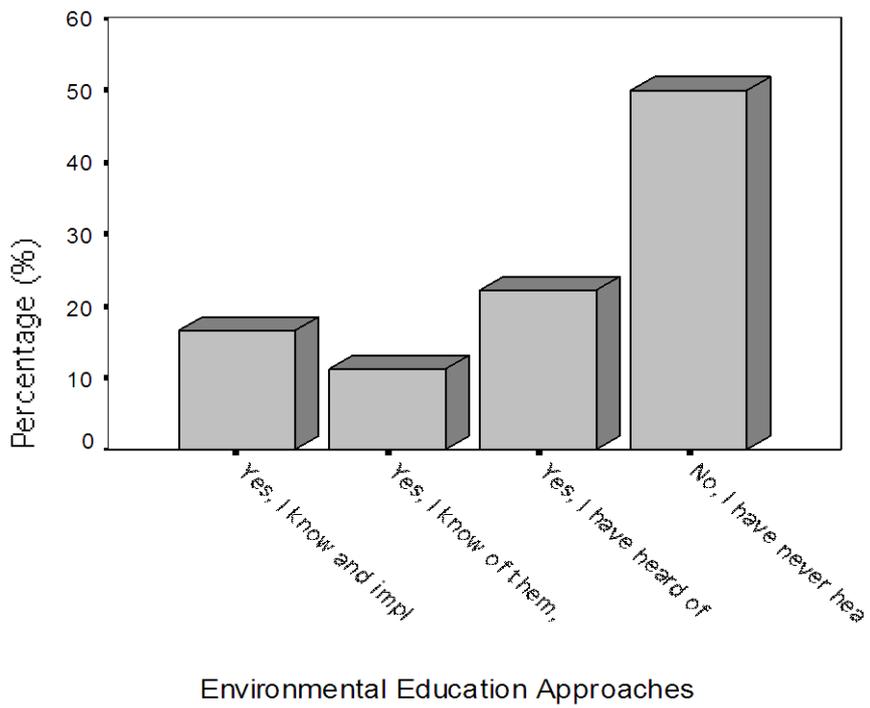
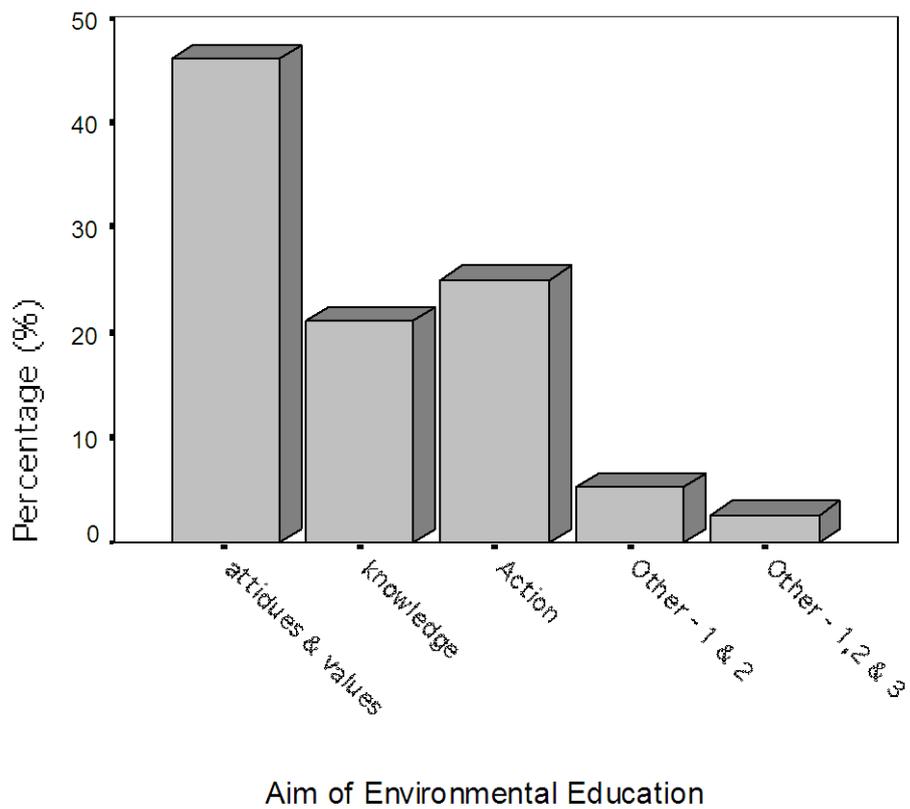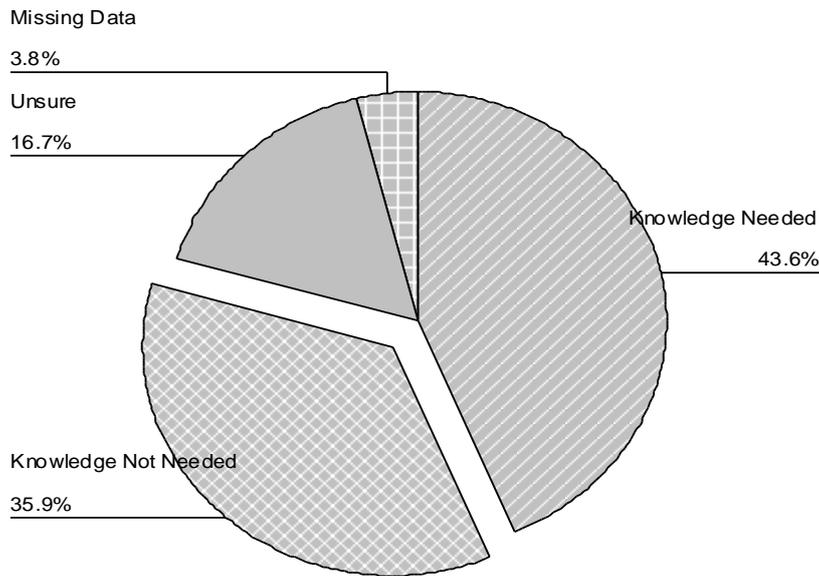Figure 3. Participants' Perceived Aim of Environmental Education

Figure 4. Participants' Perceived Need for Knowledge

Missing Data
3.8%

Unsure
16.7%

Knowledge Needed
43.6%

Knowledge Not Needed
35.9%

[i] It must be noted that the existence of an environmental crisis is not universally accepted, with commentators such as Kahn et al. (1976), Manes (1990), Ray et al. (1992) and Lomborg (2001) contending that the predictions of catastrophe arising out of research identifying changes to various environmental indicators are ill-conceived and overly pessimistic.

[ii] It is important to verify that there is no more known about the teaching of environmental education in primary schools than secondary or tertiary education. However, this paper only focuses upon primary school level environmental education.

[iii] Environmental education approaches such as education *for* the environment have been criticised in a similar vein (see Jickling, 1992, 1994, 1998).

[iv] Participant observation is also a technique commonly applied in ethnographic research. Ethnographic interviewing was only used to collect data for stage one of this study because an interpretative approach was adopted for the research design. The central premise of interpretative research is understanding human experiences. According to Berry (1999), in-depth or intensive ethnographic interviewing as a stand-alone method is a legitimate means of understanding human experiences about any given subject or issue. Adding to this, participant observation was also not utilised in this study for reasons to do with teacher access and teacher confidence.

[v] An unstructured ethnographic interview guide was prepared for the interviews. As Potter (1996, pg.97) suggests, the ethnographic interview guide is structured in relation to its direct, indirect and open-ended questions, but unstructured in that each interview is "responsive to the situation rather than standardized". Thus, the interview guide could be described as "a list of things to be sure to ask about when talking to the person being interviewed" (1995, pg.76). The content of the interview guide was derived from the issues raised in the literature, which in turn formulated the impetus for the research problem and questions. The Theoretical Framework also directed a significant proportion of the content of the interview guide.

[vi] A dedicated paper about the state-wide survey data results is currently in progress *(Part Two)*.

[vii] All comments indicate a number (code) which allows the authors to check and identify data sources.

[viii] In the actual mail survey questionnaire, participants are requested to answer three multiple-choice questions about environmental concepts. This was the only item not included in the pilot questionnaire due to restricted time constraints requested by the individual schools.