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Pre-service Teachers' Conceptions of Education for Sustainability

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Abstract: Environmental education researchers argue that pre-service teachers have a limited understanding of education for sustainability. The research described in this article applies a phenomenographic approach to investigating variations in how a representative cohort of 30 pre-service teachers, at various stages of completing an education degree at a small regional Australian university, understands the concept of education for sustainability. The results distinguish four related but distinctive categories of descriptions: (1) education that is continuous; (2) education about ecological systems and environmental systems; (3) education that is active, hands-on, local and relevant; and (4) education for the future. This paper discusses the four categories of descriptions and their implications. Outcomes of the research were used to inform course content, structure and pedagogies with the intention of more adequately preparing pre-service teachers to implement education for sustainability.

Introduction

In Australia, as elsewhere, environmental and sustainability education, also known as education for sustainability and education for sustainable development, has had a slow start. Implementation in schools has, for the most part, been left to a few very dedicated teachers and principals (Cutter & Smith, 2001; Robottom, Malone & Walker, 2000; Tilbury, Coleman & Garlick, 2005), while most teacher education institutions have paid little attention (Firth & Winter, 2007; Greenwood, 2010; Nolet, 2009; Quinn, Littleddyke, Taylor & Davis, 2010). Environmental education researchers believe that through environmental and sustainability education teachers can play a crucial role in enhancing school level capacity for sustainability (Ferreira, Ryan, Davis, Cavanagh & Thomas, 2009; Ferreira, Ryan & Tilbury, 2006). However, enabling teachers to develop the necessary knowledge, skills and pedagogies to implement environmental/sustainability education requires specialist training (Ferreira et al., 2009).

It is argued that by including environmental/sustainability education in pre-service teacher education novice teachers will graduate with the capacity to embed environmental/sustainability education into their day-to-day work and, hence, enable widespread implementation (or mainstreaming) in schools (Ferreira et al., 2006; Tilbury et al., 2005). To date, however, few teacher education institutions integrate this body of knowledge into pre-service teacher education courses. At best initiatives to do so are in the developing stages (Beckford, 2008; Miles, Harrison & Cutter-Mackenzie, 2006). As a consequence, most new teachers graduate with limited understanding, capacity and confidence to implement environmental and sustainability education (Miles et al., 2006).

The research described in this paper was situated at a regional Australian University where environmental and sustainability education has been included in pre-service teacher education since 2001. However, because no formal evaluation has been undertaken, little is known about the effect of the initiatives. We decided to undertake a small-scale phenomenographic study to begin to explore how a representative cohort of pre-service teachers at various stages of completing an education degree at this university understands the concept of education for sustainability. Directly below we explore a range of literature and understandings relevant to environmental, sustainability and pre-service teacher education, before explaining the research context, methods, findings, and implications.

Furthering Understanding of Pre-service Teachers' Conceptions

There is mounting international pressure for teachers to embed sustainability education into the curriculum. International support for teacher preparation to teach environmental education can be traced back to the 1971 European IUCN conference (Tilbury, 1992), at which its importance was first publicly highlighted. Later in the decade, the *Belgrade Charter* (Unesco-UNEP, 1976) and *Tbilisi Declaration* (Unesco-UNEP, 1978) recommended that environmental education be compulsory in pre- and in-service teacher education (Unesco-UNEP, 1990). In 1990 Unesco reemphasised the importance of teacher training in environmental education by labelling it the 'priority of priorities' (Unesco-UNEP, 1990). This was reinforced ten years later under the United Nations-declared *Decade of Education for Sustainable Development* through direct strategies to enhance capacity building and training to embed education for sustainable development across all education sectors (Unesco, 2007).

In Australia there is explicit support for environmental/sustainability education (Department of the Environment, Water, Heritage and the Arts [DEWHA], 2009; Department of the Environment and Heritage (DEH, 2000). Most recent is the inclusion of Education for Sustainability (EfS) as a cross-curriculum perspective in the new National Curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2010). The degree of top-level support is reassuring for Australian educators who support sustainability. Nevertheless, the research still indicates a need for more concerted efforts by pre-service teacher institutions and programs to prepare student teachers to implement environmental/sustainability education (Beckford, 2008; Esa, 2010; Ferreira et al., 2009). Consequently, we consider that furthering understanding about ways aspiring teachers think about environmental/sustainability education can inform inputs into pre-service teacher education courses. Apart from a small number of studies exploring pre-service teachers' disposition to and/or conceptions of environmental and sustainability education (Jenkins, 1999/2000; McCormack & O'Flaherty, 2010), little is known about prospective teachers' thinking on the topic.

In education, a teacher's personal disposition or attitude towards a content area is vitally important. We know from research that education is not a neutral process. Teachers have views that guide and interact with their practice (Hart, 1996, 2003; Sund & Wickman, 2008) and according to Nespor (1987), these beliefs, even more so than knowledge, play a major role in defining teaching tasks and organising relevant knowledge and information. Student teachers commence teacher education programs with concrete sets of experiences, assumptions and beliefs about education, teaching, learning and subject matter (Corney, 2000). These early attitudes influence student teachers' thinking about teaching and classroom practice (Corney, 2000), what they learn, and how receptive they are to the learning theories and approaches promoted in education courses (Leavy, McSorley & Bote, 2007). This is because what individuals believe strongly influences the way they make sense

of the world and learn from experience (Nespor, 1987), as well as the decisions they make and the actions they take in their work and personal lives (Pajares, 1992).

This study is underpinned by the premise that what teachers know, think and believe directly affects classroom content and pedagogy. Teachers are more likely to teach material they are interested in and knowledgeable about (Haney & McArthur, 2002; Roehrig & Kruse, 2005). In environmental/sustainability education, practices are shaped by teachers' personal and other theories, which are built into the institutions in which they work (Hart, 2003; Stevenson, 1987, 2007). In this way, a teacher's enthusiasm for implementing sustainability into everyday teaching and learning practices may be hampered by the traditional culture and purpose of schooling which, some researchers argue, is antithetic to environmental/sustainability education (Barrett, 2007). On another level, there is also the extent of policy and practical support available for teachers wishing to implement environmental/sustainability education, as well as school and local community preferences and expectations.

Research finds that most teachers are receptive to environmental/sustainability education, but many report not having sufficient support to reach the level of knowledge and skills necessary (Cutter, 2002; Miles, et al., 2006). Teachers who do have adequate backgrounds report structural barriers such as overcrowded curricula and a lack of resources such as money and time (Barrett, 2007).

Australia has well developed policy frameworks to guide implementation of EfS as well as monetary incentives in the form of modest competitive grants. Nevertheless, implementation still relies largely on individual teachers' commitment. If we accept that teachers' motivation and skills are central to engaging with EfS (Kennelly, Taylor & Maxwell, 2008) and that experiences during initial teacher training are enduring (Flores & Day, 2006), then it is conceivable that pre-service teacher education may be able to facilitate future teacher uptake of EfS. Investigation of the different ways in which pre-service teachers understand the concept of EfS provides an entry point for integrating sustainability education with teacher education programs.

Dominant Approaches to Environmental/Sustainability Education

The history of sustainability education can be traced back to the 1960s concept of environmental education (Gough, 2006). Since then, the concept has been theorised, practised and developed in a number of different ways through a trajectory that Gough (2006, P. 71) describes as 'A long, winding (and rocky) road'. The process has led to the emergence of three dominant interrelated approaches known as education **about**, **in/through**, and **for** the environment (Hart, 2004; Huckle, 1983; Palmer, 1998). Education **about** the environment emphasises the teaching of facts, concepts and generalisations about environmental patterns, processes and problems. Education **in** or **through** the environment uses the environment as a medium for education. Education **for** the environment takes a socially critical educational approach to integrate goals for conservation, social justice, appropriate development and democracy to promote informed and active concern for the quality and preservation of social-ecological systems (Fien, 2001, 2004; Huckle, 1983; Palmer, 1998). The three approaches embed an overlapping and blending set of knowledge, skills, attitudes and ideologies within elements of concern, experiences and action (Bennett & Heafner, 2004). However, it is considered that education *about* and *in* the environment provides knowledge, awareness and concern for the environment without necessarily generating action (Jenkins, 1999/2000; Robottom, 1987), whereas education *for* the environment focuses on values, ethics and problem-solving skills which that act as catalysts for action and social change (Fien, 2001).

Research Context

The university in which this research was undertaken has adopted the concept of education *for* the environment under the name of **education for sustainability** (EfS). Evidence of awareness of the value of including EfS in pre-service teacher education at this university can be traced back to the introduction of an EfS elective subject in 2001. At the same time, where individual lecturers had knowledge and interest, opportunities existed for pre-service teachers to engage with sustainability through science, studies of society and the environment (SOSE), technology curriculum, language and literacy curriculum, pedagogical subjects (Gooch, Rigano, Hickey & Fien, 2008; Hickey & Whitehouse, 2010) and a cross-faculty Masters of Education for Sustainability. Within the one-year GradDipEd, pre-service teachers were exposed to EfS through science and SOSE as well as focused projects run by individual lecturers. Lecturers reported applying a combination of engagement methods, including explicit teaching material on biophysical, social and economic systems in SOSE and science subjects; critical analysis of sustainability policies and initiatives in relation to teaching and learning contexts in pedagogy subjects; application of sustainability related scenarios and/or examples in lectures and tutorials to exemplify and extend understanding of concepts; and contextualisation of assignments and exam questions around sustainability issues.

Research Approach

Our research investigated how a group of 30 pre-service primary and secondary teachers understood the concept of EfS at a particular point in time, through a phenomenographic study. phenomenography is a qualitative research approach designed to investigate and describe the full range of ways (variations and commonalities) people think about or experience a concept or phenomenon (Åkerlind, 2005b; Marton, 1988; Svensson, 1997). We applied a developmental phenomenographic approach, where insights from the research were applied to inform, influence and improve practice (Bowden, 2000; Green, 2005). As researchers, we believed that developmental phenomenography provided us with a method to study the full range of ways in which pre-service research participant teachers understood the concept of EfS.

Understandings from this research aimed to inform teaching and learning practices in the undergraduate and postgraduate teaching courses. Findings would be applied to comment on ways the Bachelor of Education (BEd) and Graduate Diploma of Education (GradDipEd) course content, structure and pedagogies could be adapted to more adequately prepare pre-service teachers to implement EfS. Data was collected via interviews, during 2009, with 30 volunteer pre-service teachers through a series of 10 group interviews. Participants represented each year of the four year BEd, and one stage of the one-year GradDipEd course and as wide a range of gender, age groups and cultural backgrounds (see Table 1) as possible, to maximise the likely range of thinking about EfS that could be revealed.

Year of study	No of students	Gender		Age groups			Cultural backgrounds		Specialist area of study	
		Male	Female	18-25	26-35	36-45	European Australian	Indigenous American	Primary education	Secondary education
First year	7	2	5	4	3	-	7	-	7	-
Second year	6	-	6	1	2	3	3	-	6	-
Third year	7	-	7	3	4	-	5	1	7	-
Fourth year	7	2	5	2	3	2	3	-	7	-
GradDip Ed	3	1	2	-	2	1	3	-	-	3
Total	30	5	25	10	14	6	29	1	27	3

Table 1: Participant demographic variation

The aim of the interviews was for participants to reveal the range of ways in which pre-service teachers understood and experienced EfS during the course of the BEd or GradDipEd courses. Interviewees were asked to speak about their EfS conceptions and experiences at university and during teaching practicums. We wanted pre-service teacher participants to offer their own explanations and definitions, rather than relying on the literature or our understanding. Therefore, we designed open ended and flexible interview questions that would allow participants to speak freely. Pre-service teachers' explanations were built upon through negotiated dialogue between the interviewer and interviewees.

Participants were invited to register to participate in the research through a short presentation by the first author during tutorial sessions. Each was contacted via email by the same author to negotiate interview times and locations. The research was approved by the university's Ethics Committee. Participants' welfare dictated that interviews be confidential, not linked to assessment and anonymous. Further, all responses were de-identified and all participants signed an informed consent form. They were made aware of the purpose of the interview and the types of questions they were going to be asked prior to agreeing to participate.

In following Åkerlind (2005a), we analysed the interview transcripts as a whole first before reducing data to large chunks of text that related to the research questions. Data interpretation was grounded on participants' self-reported understandings. Data analysis developed categories of description which were not determined in advance, but were emergent from the data itself (Bowden, 2000).

Findings

We found pre-service teachers understood EfS in the following ways:

- (1) education that is continuous (long term);
- (2) education about ecological systems and environmental issues;
- (3) education that is active, hands-on, local and relevant; and
- (4) education for the future.

We discuss these below as a set of four distinct categories of descriptions.

1. Education that is Continuous

Pre-service teachers in this category interpreted EfS in a general sense, meaning “to keep going” continuously into the future. EfS was linked to continuity (sustainability) of education. Unlike the other categories, EfS was not linked to ecological systems, environmental issues or teaching and learning:

First year female pre-service teacher: I’m not really sure what it means, but I think it has got something to do with education stuff that we can learn that will continue us through our whole life ... So, continuity, making education long term and sustainable for students and teachers.

First year female pre-service teacher: Making education and developing it in a way that it can be sustained for our society and that sort of thing, like the on-going of it ... so that it [education] can be a key part of society and can be developed in a way in which it can be sustained.

First year male pre-service teacher: Education that is going to be able to be added to or carried on and it is going to take us into the future ... I would say education methods that sustain education now and into the future

The first year of the BEd focuses heavily on developing historical and theoretical understanding of education, teaching and learning, which could explain these conceptions.

2. Education about Ecological Systems and Environmental Issues

Many pre-service teachers in this study described EfS as education *about* the environment (Huckle, 1983). The approach is based on the assumption that teaching facts, concepts and generalisations about environmental patterns, processes and problems leads people to willingly and independently take actions to mitigate adverse ecological deterioration (Fien, 2004; Huckle, 1983). Pre-service teachers in this category mostly focused on teaching about ecological systems, including environmental or resource issues on the assumption that increased levels of knowledge will stimulate action:

Second year female pre-service teacher: My understanding of the term ‘education for sustainability’ is to educate the future generations about the importance of keeping our Earth healthy. By educating them they will be equipped to contribute effectively to the sustainability of the Earth

Second year female, pre-service teacher: To me the term refers to teaching and learning about the environment and what we can do to protect it from harm. By doing this we can ensure that future generations know how to protect the environment

Emergent in this category is an ideology of sustainability education that Fien (2004) labels ‘conservative’ and Robottom (1987) calls ‘technocratic’. The conservative/technocratic ideology centres on rationality, objectivity, truth and control and promotes the belief that humans can control nature so and that the effects of environmental degradation can be overcome through technical and scientific approaches, regardless of social, political or economic contexts:

Fourth year male pre-service teacher: Teaching and learning about sustainability of the environment. So for example, mining, resources, water, land, reef, etc. I’m actually unsure if it refers to anything other than protecting and preserving the environment, but I assume that the term education for sustainability probably thus refers to the different curriculum subjects and how education can be used to encourage sustainability and overcome problems

Fourth year female pre-service teacher: Teaching students about the problems that affect the environment now and inform them of the problems they face in the future and allowing students to learn how to address or repair the environmental issues as these students will be future politicians, policy makers, etc.

3. Education that is Active, Hands-on, Local and Relevant

In this category, pre-service teachers maintained the previous foci on teaching and learning about ecological systems and environmental issues from a futures perspective, but also included features captured within the education *in or through* the environment approach referring to EfS as active, hands-on, local and relevant.

Third year female pre-service teacher: Educating students on the issues surrounding sustainability, for example, ecosystems and threats to them, then getting students involved in hands-on activities or experiences related to sustainability and their environment. It should also be related to their immediate and localised environment and relate to the future

Fourth year female pre-service teacher: Educating students in ways that help them see the importance of protecting the environment. For example, creating units of work that focus on sustainability issues as well as taking hands-on sustainability practices in the classroom such as recycling white paper, changing incandescent light bulbs to energy efficient ones in order to provide students with active learning. Ultimately, students would then transfer this learning into their future trajectories to overcome problems

Pre-service teachers in this third category move beyond an education *about* the environment approach by introducing a hands-on, local component; however, the ideology driving the approach still traces an uncritical form of pedagogy which falls within a conservative (Fien, 2004) or technocratic (Robottom, 1987) framework. The rationality is technical in that it promotes a belief in the right of humans to control nature and the capacity of science and technology to manage the effect of environmental degradation. These pre-service teachers do not acknowledge either the environment as a social construct or the social contexts or implications of changes in people-environment relationships (Fien, 2004).

4. Education for the Future

This category represents the most sophisticated understanding. Pre-service teachers' explanations included a futures and local perspective, but exposed EfS as broader than teaching and learning about ecological systems and environmental issues. EfS was described within a context of cross-curricular integration, higher-order thinking skills and linkages between ecological and other systems, including teaching and learning a set of transferable skills to equip students to manage for the future. This type of understanding lies within what Fien (2004) calls *liberal education about the environment*. The approach still represents a technocratic worldview, but recognises the social context of sustainability, is socially-critical and engages learners in inquiry-based, multidisciplinary learning as a basis for the development of higher-order thinking and problem-solving skills.

Fourth year female pre-service teacher: Education for sustainability is incorporating sustainable practices across all KLAs [key learning areas] to enable students to think about how their actions and the actions of people around them affect the world's natural resources and infrastructure for future generations. This involves higher-order thinking skills, evaluating different values and perspectives of all stakeholders and interested parties. Making informed choices/decisions about a particular topic/problem objectively

Fourth year female pre-service teacher: I think of lifelong learning, education of the future and for the future, embedding sustainability in the classroom, preparing students to live in a sustainable world, skills and attributes of a sustainable person, linking learning to the real world as well as children's situation. I think maybe even in a whole school context

GradDipEd female pre-service teacher: I understand the term education for sustainability to mean active participation in sustainable practices, a community understanding of the impact

that people have on the environment and to consciously think of how actions cause consequences and effects. And, I think definitely, linking it to their lives at home, things they can relate to their home lives so that it becomes really relevant to them.

Informing Teacher Education Courses

The different ways in which pre-service teachers in this study understood EfS were related but distinctive. All categories included a futures (continuity) perspective, prompted by the element *sustain*. However, conceptions in category one were qualitatively different from all other conceptions because pre-service teachers were unfamiliar with EfS as an educational approach and interpreted the term in a general sense, outside the context of the scholarly tradition. They did not relate EfS to environmental or social systems. Pre-service teachers in category two showed a limited understanding of EfS as a subject or a set of knowledges to be passed on to students, assuming that knowledge leads to action. Those in the third category were also limited to understanding EfS as teaching students about ecological systems and environmental issues but intended to follow explicit teaching with active, hands-on, locally relevant actions. They demonstrated a specific pedagogical awareness. Pre-service teachers in the fourth category demonstrated a more sophisticated understanding of the components of EfS, including cross-curricular integration, transferable higher-order thinking skills and linkages between ecological and other systems. Pre-service teachers in the second and third categories, and to some extent those in the fourth, interpreted EfS through a technocratic worldview, typically promoted by the education *about* the environment approach. All categories were anthropocentric in nature – humans were positioned as individual agents of change at the centre of the system (Haste, 2004) and the second and third, in particular, were driven by a technical rationality. All pre-service teachers also presented an unproblematic view of EfS. This is another consequence of the technocratic worldview, which creates a false impression that environmental problems are free of values, interests, tensions and contradictions (Robottom, 1987). Nevertheless, those in the fourth category did provide evidence of understanding that EfS is best developed through interdisciplinary, inquiry and critical approaches to education (Robottom, 1987).

The aim of this research was to use our understanding of pre-service teachers' conceptions of EfS with the aim of informing the BEd and GradDipEd courses. We recognise the limitations to this study are the small number of research participants, who cannot fully represent all students studying to become teachers. Nevertheless, the sample size should be sufficient to reveal most of the possible viewpoints within this university and allow a defensible interpretation. The deliberate process of selecting participants to allow for as much demographic divergence as possible has resulted in variations in pre-service teachers' conceptions of EfS. We are, therefore, able to draw some insights and conclusions based on our findings. So what are the implications for this regional university's BEd and GradDipEd course design: its content, structure and pedagogies with regards to preparing pre-service teachers to implement EfS?

The first is that most pre-service teachers in this study demonstrated a limited understanding of EfS. The implication for course design is to plan for development of EfS conceptions to aid progression from category one's naïve response to the term *sustain* towards category four's sophistication. The majority of pre-service teachers displayed a one dimensional view of EfS centred on teaching about ecological systems and environmental issues. We know from research that increased levels of environmental knowledge and awareness do not necessarily provoke action for sustainability (Hungerford & Volk, 1990; Jenkins, 1999/2000; Shallcross & Robinson, 1999). While knowledge about environmental patterns, processes and problems is vital, an important component of EfS involves approaches to teaching and learning that integrate and expose the complex interplay between the

ecological, social, economic and political spheres of sustainability (Fien, 2001). Notable also, as a second implication for course design, is the technocratic ideology and anthropocentric worldview underlying some pre-service teachers' conceptions. Recognition of this view, as widely held, is an appropriate inclusion in course design, when viewed as a position from which pre-service teachers' conceptions can, and should, progress.

For the most part, pre-service teachers with the more limited understanding were in the first year of the BEd, while those with more developed explanations were in the third and fourth years. We interpret this to mean that when exposed to EfS, pre-service teachers can and do develop informed and sophisticated understandings. One question this research raises is why some fourth year students had developed advanced understanding while others appeared not to have done so. For teaching and learning, the inference to be drawn is the pre-service teachers are not necessarily able to develop deep and sustained EfS knowledge, theories, practices, ideologies and pedagogies. Why this is so is beyond the scope of this study. Many different variables can affect learning outcomes. However, we do speculate whether this is a reflection of an ad hoc approach in which implementation of EfS is left to individual lecturers' interests.

One more obvious consequence of an unstructured approach is the perpetuation of EfS as an add-on rather than a practice that is embedded in teachers' everyday work. If we consider that an important outcome of EfS in teacher education is to produce students with informed conceptualisations of environmental and sustainability education (Bennett & Heafner, 2004; Jenkins, 1999/2000), then it seems imperative that teacher education critically expose pre-service teachers to different ways of seeing, understanding and believing and unpack the philosophical traditions that underpin different worldviews. Experts argue that sustainability requires a shift from an anthropocentric to an eco- or bio-centric worldview (Stevenson, 2006). However, ideological and philosophical understandings and assumptions are deep rooted and complex and difficult to unpack. Critical and sustained exposure to different EfS-related ideologies and worldviews through formal, embedded and connected structures over the length of the degree (rather than through discreet subjects or individual lecturers) may enable pre-service teachers to identify, reconcile and develop more informed and sophisticated understandings.

As part of a whole university curriculum refresh (a review and renewal process) carried out in 2008, the School of Education identified a need to integrate EfS within course offerings in order to prepare emerging teachers for current and future social and environmental issues, challenges and demands. This study was a component of the curriculum refresh project which took place concurrently. At the time of this research, a formal curriculum structure and school commitment to EfS was in the developing stages. Pre-service teachers' exposure to EfS was recognised to be ad-hoc and resultant from individual lecturer interest.

For the BEd at this university, understandings from this research informed the curriculum refresh process in two significant ways. Firstly, two compulsory subjects dedicated to EfS now form part of the core structure of the BEd – one first-year subject which aims to lay the foundations for embedding EfS into teacher practice and a fourth-year subject that promotes experiential learning. Secondly, the BEd has additionally been subject to a broad scoping and sequencing exercise to embed the concept of sustainability across the four-year course. This ensures that the EfS concepts, pedagogies, values and beliefs are sustained throughout the pre-service teachers' training at this university. For the one-year GradDipEd course, the inclusion of EfS concepts were formally interwoven throughout the year-long course, to provide extensive opportunities for pre-service teachers to build conceptions which embraced EfS pedagogy, concepts and practices.

In conclusion, while we recognise top-level support – through government policies and university-level course redesign – is crucial for the success of any initiative for EfS, we are equally aware that widespread and meaningful change requires active participation at the

grass-roots level. That is, through the individual teaching choices made by well-informed pre- and in-service teachers.

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