University of Strathclyde

Faculty of Education

Department of Sport, Culture and the Arts

Unearthing the Complexities in Teachers' Commitment to Environmental Education: A Social Psychological Perspective

by

Edward M. Sosu

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ABSTRACT

This study investigates the social psychological factors that determine why some teachers are more committed to teaching environmental education (EE) than others. A mixed methods approach was adopted to explore and test these determinants and to offer an insight into the meanings of these determinants as perceived by teachers.

In the quantitative phase, a revised Model of Environmental Education Commitment (MEEC; Shuman & Ham, 1997) which is largely based on the Theory of Planned Behaviour (Ajzen, 1991; 1988) was explored using structural equation modelling techniques. Data were obtained from a sample of 182 primary school teachers in Scotland. The hypothesised model was tested to identify the significant determinants of commitment, relationship between these determinants and the utility of the MEEC in explaining teachers' commitment to EE. The qualitative phase involved in-depth interviews with 8 primary school teachers based on a framework of Soft Systems Methodology (Checkland & Scholes, 1990) to expand understanding and explore strategies for increasing teachers' commitment to EE.

The results confirmed that the MEEC provided a significant explanation for why some teachers are more committed to teaching EE than others. Overall, teacher autonomy and perceived control in terms of the flexibility or inflexibility of the curriculum appeared to be the most significant influence on commitment. However, the findings showed a complex interrelationship between the factors that influence commitment. Teacher autonomy for instance was significantly dependent on the influence of referents and life experiences connected to environmental issues. The study recommended that these interrelationships should be taken into account in any attempt to improve the level of commitment. Findings from the study contribute significantly to understanding teacher commitment to EE by providing theoretical and statistical support for previous qualitative findings on the significant life experiences that influence commitment to environmental issues. Recommendations for future research are also discussed.

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CHAPTER ONE

Introduction

1.1. Statement of the Problem

Teaching about environmental issues and the preservation of the environment to children has become a major issue around the globe. This is because it is at this stage that attitudes and knowledge that shape later thinking in adolescence and adulthood are developed (Leeming, Dwyer & Bracken, 1995). Studies have shown that environmentally related experiences during childhood influence latter commitment to environmental issues and actions (Chawla, 1999; Palmer & Suggate, 1996). Thus, a good environmental education (EE) at an early stage of life would increase the chances of pupils developing commitment to environmental issues and actions in later life. More so, the future quality of our planet depends on children developing an understanding which will guide their decision making about the environment (Summers, Kruger, Childs, & Mant, 2001). Orr (1994; 1992) argued that education is the most important mechanism needed to address the world's environmental problems and no student should graduate from any institution without acquiring what he termed a 'syllabus of environmental literacy'. This knowledge according to him is what will make people ask 'what then?'

Comprehensive national and international policy guidelines have therefore been produced over the years to promote the implementation of EE (Lavery & Smyth, 2003; Scottish Environmental Education Council [SEEC], 1998). However, the extent to which these EE policies have been successfully implemented in schools is small (Stevenson, 2007; Palmer, 1998; SEEC, 1998). This is against the backdrop that most teachers generally support the goals of EE and hold the belief that teaching EE is important (Barrett, 2007; Ko & Lee, 2003). This discrepancy between comprehensive policies and what actually goes on in schools has been termed the rhetoric–reality gap. Studies have suggested that the gap between policy and practice is due to barriers that teachers face in an attempt to engage in EE (Barrett, 2007; Ernst, 2007; Kim & Fortner, 2006; Ham & Sewing, 1988). An example of this is the

incongruence between EE policy guidelines and what teachers are told to do by education authorities. For instance, while EE is to be taught through a cross curricular approach in Scotland, school guidelines provide teachers with specific time slots within which to teach subjects (Scottish Executive, 2004; Condie, 2003). Based on the fact that EE is not a stand-alone subject in most countries, its success is left to the "whims, enthusiasm and motivation of individual teachers and school" (Palmer, 1998, p. 98). The SEEC (1998) identified that the success of EE in Scotland largely depended on the commitment of individuals rather than on policy. A recent evaluation of the Eco Schools programme also confirmed that the success of the programme in most schools depended on the enthusiasm of a few committed teachers (Pirrie, Elliot, McConnell, & Wilkinson, 2006). Robottom, Malone and Walker (2000, as cited in Cutter-Mackenzie & Smith, 2003) found that behind every successful EE program they observed was a committed teacher. The question therefore is what makes these teachers committed to teaching EE. Understanding the social and psychological factors which influence commitment is therefore important as this may lead to the development of effective strategies that would encourage other teachers to be committed to teaching EE. Commitment to teaching EE in this study is defined behaviourally. It is the teaching of environmental education issues within the primary school curriculum in ways that are likely to enable pupils to acquire awareness, knowledge, attitudes, skills and experiences that would enable them to take informed and responsible decisions affecting the natural and built environment (Shuman & Ham, 1997). The term 'commitment to EE' is sometimes used interchangeably in the thesis with commitment to teaching EE, which represents a more specific behavioural definition.

1.2. Aim of the Study

The aim of this study was to understand what makes some teachers in Scotland more committed to teaching EE than others. The primary objective and specific research questions guiding each of the two phases of the thesis are provided in subsequent chapters. Several factors have been identified in the literature to influence teachers' commitment (e.g. May, 2000). However, very few studies have attempted to put

these factors into a comprehensive theoretical framework. This study aimed to explore and present a framework that captures the major theoretical and empirical determinants of commitment. This is important because it provides a holistic perspective within which commitment can be examined. To achieve this goal, a mixed methods approach which incorporates both quantitative and qualitative procedures was used. The quantitative phase employed the technique of structural equation modelling (SEM) to explore the utility of a revised model of environmental education commitment (Shuman & Ham, 1997) in explaining the determinants of teachers' commitment. The qualitative phase on the other hand was based on a framework of soft systems methodology (Checkland & Scholes, 1990) to further explore in-depth the influences of teachers' commitment. These findings were then integrated to get a better understanding of why some teachers are more committed to teaching EE than others by highlighting any converging and diverging issues from both methods. It is the belief that a mixed methods approach is useful in uncovering the different levels of understanding and relationships among the variables that influence teacher commitment.

1.3. Research Questions

The following broad research questions were addressed during the study. More specific and detailed questions guiding each phase are provided in the quantitative and qualitative procedure chapters.

1. To what extent are teachers in Scotland committed to teaching environmental education?

2. Why are some teachers more committed to teaching environmental education than others?

3. What are the relative strengths and relationships among the factors influencing commitment to environmental education?

4. How can teachers' commitment toward environmental education be increased?

1.4. Importance of the Study

As mentioned above, the success of most EE programmes depends on the commitment of individual teachers. Hence, by understanding the factors that make some teachers more committed to EE, it may be possible to nurture such essential characteristics in new and existing teachers and to provide the necessary opportunities that support teachers' commitment. Knowledge of barriers to commitment may also bring about appropriate policy interventions that would reduce such inhibiting factors. Particularly, findings from this study provide an important source of information and a framework for improving pre-service and in-service educational programs focused on EE. This would help to train a new generation of teachers who are more committed and in a position to effectively teach about the environment to their pupils (Shuman & Ham, 1997).

The study provides findings that fill the knowledge gap in research on EE. Firstly, although most studies aimed at understanding teacher commitment to teaching EE have acknowledged the complexity of commitment, they do not provide a theoretical framework that captures these relationships. Recommendations from these studies do not offer the structure within which interventions that consider multiple interacting factors can be carried out. This study therefore fills this knowledge gap by providing a framework within which a holistic intervention can be planned. Secondly, EE in Scotland has been given a statutory position within the primary school curriculum for over a decade and various programmes have been introduced to improve the teaching of EE. However, with the exception of the recent publication of the evaluation of the Eco Schools programme (Pirrie et al., 2006), next to no comprehensive study exists on the implementation of EE. Additionally, there is no known study that has attempted to evaluate the social psychological factors influencing teachers' commitment to EE in Scotland.

The methodological framework in this study is of scientific importance to the EE research community as it opens the door to embracing other methodological perspectives. By adopting a mixed methods approach, this study demonstrates the effectiveness of bringing together different approaches in unearthing the complexity of teacher commitment, hence bringing about a more holistic understanding of the phenomenon. The focus on understanding the complexity in teacher commitment has received limited attention as most studies mention the need for its consideration as an afterthought. To understand this complexity requires the adoption of different methodological perspectives. As pointed out by Phelps and Hase (2002) "the study of complexity cries out for mixed method approaches" (p. 517). A careful perusal of methods chosen for environmental education research shows it has become skewed in favour of qualitative approaches. A recent paper reviewing publications in *Environmental Education Research* indicate a 'low showing' of mixed method approaches, and only 1 in 10 papers published in the journal used any form of quantitative analysis at the multivariate level (Reid & Scott, 2006). This according to the authors shows an absence of methodological pluralism and a need to consider more integration of both quantitative and qualitative methods in EE research.

1.5. Structure of the Thesis

The subsequent chapters of this thesis aim to provide answers to the research questions outlined earlier in this introduction. The broad context within which the study is situated is presented in chapter two. This chapter discusses the development of EE in Scotland and presents the argument for the significance of understanding the determinants of teacher commitment. It also discusses the importance of developing a framework within which to understand commitment. Chapter three reviews theoretical and empirical social psychological determinants that provide insight into why some teachers are more committed to teaching EE than others. This chapter concludes with a revised Model of Environmental Education Commitment which is adopted as the framework for understanding commitment. A brief philosophical discussion and justification of the chosen methodology for the study is presented in Chapter four. The first phase of the empirical study starts with chapter five with the

presentation of the quantitative procedure for the study. This is followed by analysis and results of the quantitative phase in chapter six. The second phase of empirical study begins with a discussion of the qualitative procedure in chapter seven. This is followed by the qualitative analysis and results in chapter eight. Finally, an integration, discussion and conclusions of the findings from both phases are presented to elucidate our understanding of teacher commitment in chapter nine. This final chapter also presents the implications and contributions of the study, and recommendations for future research.

CHAPTER TWO

Complexity of Environmental Education

2.1. Introduction

The initial section of this chapter traces the development of environmental education in Scotland and its relationship to other international initiatives in the field. It continues with a discussion of the gap between comprehensive environmental education policy initiatives and what actually pertains. This rhetoric–reality gap points out the significance of individual teachers' commitment in ensuring a successful environmental education programme in schools. This is followed by a brief overview of the current curriculum review in Scotland which has implications for the teaching of environmental education. The section concludes with a discussion of systems theory and how it can help bring about a comprehensive understanding of issues relating to teacher commitment.

2.2. General Overview of Environmental Education in Scotland

The development of EE in the UK goes back to the 1920s at which time the focus was on nature studies, through to the 1940s where it expanded to include rural studies out of which 'environmental studies' was born. These developments set the groundwork for the formation of the National Association for Environmental Education in 1970. However the first use of the terminology 'environmental education' in the UK was in 1965 at a conference in Keele University, Staffordshire, which was attended by educationists and conservationists. The purpose of the conference was to promote the conservation of the countryside and the implication of this for education (Palmer, 1998).

The initial link between environmental quality and peoples' quality of life has been attributed to the Scottish Professor of Botany, Sir Patrick Geddes (1854-1933) who is said to have prepared minds and attitudes for what was to come over half a century later (SEEC, 1998). Environmental Education however developed in the late 1960s

mostly against the background of major international initiatives at the time. Significant among these are the Stockholm (1972), Belgrade (1975), Tbilisi (1977) and Moscow (1987) conferences which in addition to other policy strategies defined environmental education worldwide. Other international events which had significant effects on the development of environmental education in terms of defining its scope were the *Brundtland Report* (1987) and the Earth Summit in Rio de Janeiro (1992) from which Agenda 21 became a major blueprint for introducing the concept of sustainable development. A comprehensive chronology of these events and how they shaped environmental education internationally have been well documented (see e.g. Palmer, 1998) and so will not be repeated here. What is of importance is how these initiatives influenced or pre-empted the development of environmental education in Scotland and their implications for teachers and how they should teach the subject. It is important to bear in mind that the international initiatives listed above were in response to worldwide concerns about rapid adverse changes that were, and still are affecting the planet earth. Education was among the remedies proposed to deal with these problems and educators, in this case school teachers, were expected to carry out these policies, which only rarely they had been involved in designing (SEEC, 1998).

The evolution of environmental education in Scotland has been summarised in an article by Lavery and Smyth (2003). According to this paper, the attempt to promote environmental education in Scotland started in the 1970s when a group of Her Majesty's Inspectorate (HMI) of schools in Scotland produced an *HMI Report on Environmental Education* in (1974). Known as the *Gilbert Report*, it contained radical and individual statements about what the subject matter of environmental education should be. Since the report was quite early in the field, it generated much international interest and commendation. Although, the report did not have any lasting direct effect on Scottish school education due to absence of political interest, it stimulated various unofficial initiatives which kept the original aims alive (Lavery & Smyth, 2003). Notable among this was the Strathclyde Environmental Education Group which was an unofficial gathering of teachers, teacher educators, local authority advisors, HM inspectors and academics from a wide range of background. The environmental inspiration of the group was based on urban issues, regional

planning and inner city renewal in line with the Belgrade/Tbilisi concept of environmental education in which humans were an integral part of the environmental system. This was different from other countries where support for environmental issues came from rural studies. This development in Scotland took place at the same time and was presumably influenced by the Belgrade (1975) and Tbilisi (1977) conferences which provided an agreed comprehensive definition for environmental education. The Strathclyde Environmental Education Group initiated the development of a module, based on issues affecting the local environment for use by the secondary education sector (SEEC, 1998). This initiative was however short lived as changes in the structure of secondary examination meant little time was made available for such projects. Nevertheless, it proved to be a useful model for subsequent initiatives and led finally to the formation of the Scottish Environmental Education Committee (SEEC), later known as Council in 1977 which took on the role of promoting and supporting environmental education nationally (Lavery & Smyth, 2003). SEEC adopted the viewpoint of the Strathclyde Group that, environmental education should be an approach to education and not a separate subject. Through the actions of the SEEC, environmental education expanded to be included in primary, tertiary and informal education (SEEC, 1998).

Following the publication of the *World Conservation Strategy* by the IUCN in 1980, a UK Conservation and Development Programme was launched in 1983 with dedicated sections on education including special consideration of the situation in Scotland. This brought sustainable development as an agenda into environmental and education policy. The development was given further impetus by the *Brundtland Report* (1987). At the same time as these developments, the SEEC continued to promote the Strathclyde experience in schools through a wide range of avenues. For instance SEEC published the *Learning for Living* (1985) and *Curriculum Guidelines for Environmental Education* (1987). In addition, it promoted the OECD Environment and Schools Initiative in Scotland as well as establishing Regional Environmental Education Forums throughout Scotland. Thus, through the efforts of the SEEC, environmental activities continued to flourish taking cognisance of international developments in the 1980s (Lavery & Smyth, 2003).

SEEC continued its drive for the inclusion of environmental education by encouraging the government to formulate a National Strategy for Environmental Education in Scotland. This led to the setting up of a broad based group by the Scottish Secretary known as The Secretary of State for Scotland's Working Group on Environmental Education. The working group's report, *Learning for Life* (1993), produced 94 recommendations, 12 specially for the secretary of state, 20 for wider range of implementers and 62 for specific target interests. The report called for an adoption of a statement of intent by stakeholders in environmental education and made recommendations that covered policy, school and post school education and training and so on (SEEC, 1998). This document remains the central reference for most environmental education planning in Scotland. Recommendations of the report appealed to a broad group of interest and fit well into the political climate of the time. This was just after the Earth Summit, 1992, in Rio de Janeiro and as such it made reference to the spirit of Rio and to the substance of Agenda 21. Financial and administrative difficulties of the time however did not allow this report to be immediately put into action until 1995 when the Secretary of State's response, *A Strategy for Environmental Education in Scotland*, was published (Lavery & Smyth, 2003). However, this response did not state how EE policies and practices would be strengthened and extended giving the impression that there was nothing more to be done. Thus, no provision was made to include EE as part of the core curriculum. Also, there was no allocation of extra resources for promoting EE and no effort was made to bring together the fragmented government agencies dealing with EE (SEEC, 1998). In general, the recommendations of *Learning for Life* were not implemented and EE issues were not embedded in Scottish education (Lavery & Smyth, 2003). Despite these problems, a number of government agencies, teacher training institutions and non-governmental organisations (NGOs) took a variety of initiatives proposed in the report. One result from these initiatives was the development of environmental education modules for initial and in-service teacher education (SEEC, 1998).

A new group, the Education for Sustainable Development Group was established in 1995 with a clear remit of reviewing and reporting on education for sustainable

development. Prior to devolution in 1999, this group was charged to prepare a report for the new Scottish parliament to base its Sustainable Development Education (SDE) policy. The group's report known as *Scotland the Sustainable: The Learning Process* was released in 1999 and was similar in most respects to the earlier *Learning for Life* report. This report made a case for a sustainable development education and provided practical recommendations for achieving these goals. However, like previous reports, this one also faced political and administrative difficulties and the implementation of its recommendations was not comprehensive. The group that wrote the report was dissolved shortly before the establishment of the new parliament in 1999. Although an Interministerial group on sustainable development took over, the aspect related to environmental education was not taken care of (Lavery & Smyth, 2003). The new environment department also withdrew from its involvement with SDE and SEEC leaving the function of promoting environmental education to government agencies and NGOs.

A range of publications following devolution have been produced to raise the profile of environmental education. A practical guide (*Our World Our Future*) that gave advice to schools regarding the development and implementation of EE was published by the Scottish Consultative Council on Curriculum and the Royal Society for the Protection of Birds with support from Coca-Cola in 1999. In the same year there was the review of the *Environmental Studies 5-14 curriculum guidelines* which focused on the integration of science, society and technology. This was followed by the introduction of national priorities in 2000 and the subsequent adoption of the *Eco-School Programme* by the Scottish Executive Education Department as a measure of *National Priority Four* – Values and Citizenship (Learning and Teaching Scotland [LTS], 2004). This is a whole-school programme for environmental education which encompasses other curricular areas like education for citizenship and sustainable development. The programme encourages participating schools to focus on local concerns relating to litter, waste minimisation, energy, water, health and well-being, and school grounds. Thus the Eco-School project is now the main focus for practical EE in schools and local authorities are required to report on the number of schools in their jurisdiction that are participating in the Eco-School award.

A recent review identified different ranges of practice across local authorities. For instance while some local authorities provide enough support for schools engaging in the waste management programme, there was no recycling scheme in others to support schools engaging in such activities (Pirrie et al., 2006). Two other publications that have reinforced EE in schools are '*Living and learning in a time of change: education for sustainable development*' and '*Education for citizenship in Scotland*'. The former provides a strategy for expanding EE to cover the current broader perspective of Sustainable Development Education (SDE) through the 5-14 curriculum. The latter emphasises the value of providing understanding of global citizenship and sustainable development among pupils (LTS, 2004).

The Scottish Executive in 2003 set up a Curriculum Review Group whose work will lead to a redesign of the existing curriculum. Known as *A Curriculum for Excellence*, one of its objectives is to create a broad framework that will enable teachers to engage in cross curricular teaching. This is likely to have implications for the teaching of environmental education in schools. In 2006, the Scottish Executive published *Learning for Our Future* which is Scotland's first action plan in response to the UN Decade of Education for Sustainable Development. Key action points within this document that have implications for EE include a continuous financial support for the Eco Schools programme, raising the uptake of outdoor education and the provision of good quality materials for teaching staff (Scottish Executive, 2006a).

Most aspects of environmental education taught in Scottish primary schools are described in the *Environmental Studies 5-14 curriculum guidelines*, which is one of the five broad areas of the curriculum within the 5-14 development programme. The term, 'environmental studies' as noted earlier, dates back to 1965 where it was defined to integrate history, geography and nature studies. Generally, 'Environmental Education' and 'Environmental Studies' are differentiated within the Scottish curriculum with environmental education focusing on those areas concerned with society's responsibility for the health of the environment, such as pollution and conservation (Condie, 2003). Unlike environmental studies which has a subject status, environmental education is expected to permeate the whole curriculum. In

other words, whilst the aims of environmental education are described within the environmental studies guidelines, it is also expected to be delivered in other curriculum areas. The first version of the 5-14 Environmental Studies guidelines appeared in 1993 consisting of science, social subjects, technology, health education, and information technology components. A revision of the 5-14 guidelines took place in 1998 by Learning and Teaching Scotland at the instance of the minister responsible for environmental education. The revised guideline was narrowed to only science, social subjects and technology with the other components removed (Condie, 2003).

2.3. Goals of Environmental Education - The Rhetoric Reality Gap

The different initiatives and reports discussed above have helped to keep the interest in environmental education alive after the 1974 report, engaged government interest in the 1990s, developed and disseminated clear environmental education objectives, and provided a broad base approach of initiating environmental education policies in Scotland (Lavery & Smyth, 2003). However, the initiatives and reports have not always been successfully implemented in the formal education sector in Scotland and worldwide. Most researchers have termed this difference between environmental education policies and what actually goes on in schools as the 'rhetoric–reality gap' (Palmer, 1998; Stevenson, 2007). What all these documents have in common is that they set out the goals, objectives, scope and strategies for teaching environmental education. As lamented in the *Learning to Sustain* report, most of these policies are drafted without the involvement of teachers who are the final implementers (SEEC, 1998). To understand the nature of the task that teachers are expected to carry out, it is useful to examine some of the goals and strategies of environmental education.

The 'classic' definition of environmental education as formulated in 1970 at the IUCN/UNESCO 'International Working Meeting on Environmental Education in the School Curriculum' states that:

> Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture and his biophysical surroundings. Environmental Education also entails practice in decision making and formulation of a code of behaviour about issues concerning environmental quality. (IUCN, 1970, as cited in Palmer 1998, p. 7)

This definition sets out the scope and goals to be achieved by environmental education. In other words, teachers are expected to engage in environmental education in such a manner that will not only develop pupils' knowledge, but bring about attitudinal and behavioural changes towards environmental issues. These goals and objectives were consolidated by subsequent international initiatives such as the Stockholm (1972), Belgrade (1975), Tbilisi (1977) conferences, the *World Conservation strategy* (1980) and the *Brundtland Report* (1987), where special emphasis was placed on resolving the global environmental crisis by increasing understanding, changing attitudes and behaviours through environmental education:

> We call for a common endeavour and for new norms of behaviour at all levels in the interest of all. The changes in human attitudes, in social values and in aspirations… will depend on [*a*] vast campaign of education, debate and public participation. (WCED, 1987, p. xiv)

Thus, education is recognised as one of the most important means of resolving the global crisis:

> Education, in short is humanity's best hope and most effective means in the quest to achieve sustainable development. (UNESCO, 1977, as cited in SEEC, 1998, p. 40)

> Education, raising of public awareness and training are linked to virtually all areas of Agenda 21… Education is critical for promoting sustainable

> development and improving the capacity of the people to address environment and development issues. (UNCED, 1992, p. 221)

Most significant of all, these reports and initiatives recognise the importance of teachers in bringing about the education they are calling for:

> 'The world's teachers will have a crucial role to play…' *in bringing about the necessary extensive social changes needed for addressing environmental crisis*. (WCED, 1987, p xiv. *My italics*)

> Schools should involve school children in local and regional studies on environmental health, including safe drinking water, sanitation and food and ecosystems and in relevant activities… (UNCED, 1992, p. 223)

These documents thus place emphasis on the need to develop teachers in order to take up the challenges of global environmental crisis through environmental education. The Tbilisi conference which was the first Inter-governmental Conference on Environmental Education also set out the approach of teaching the subject, that is, it was not to be seen as a separate subject but as an approach to education which takes an inter-disciplinary perspective. According to Palmer (1998) environmental education was to be seen as "an embodiment of a philosophy which should be pervasive, rather than a 'subject' which might be separately identified" (p. 9). In order to achieve this goal, it is important that conditions that favour a cross-curricular approach exist. This idea of environmental education being cross-curricular means that it can crop up anywhere and teachers make the decision whether to teach it or not. Considering the above argument it can only take a motivated teacher to achieve these goals.

The principles set out by these international initiatives fed into the shape of environmental education in Scotland. Following from the Tbilisi conference it was decided that environmental education should be seen to permeate all disciplines rather than been seen as a stand-alone subject. Comprehensive guidelines in the

Environmental Studies 5-14 curriculum guidelines have set out environmental education as an example for cross-curricular activities and given it a recognised place in the formal curriculum. For instance, the key objective of the 5-14 curriculum guidelines is that learners should be helped to:

- Develop informed attitudes to the care and conservation of the environment
- Gain an understanding of issues relating to resources and sustainable global development
- Become aware of the importance of active citizenship in a democratic society. (LTS, 2004)

Key skills that need to be gained by learners with respect to environmental education are:

- Awareness, understanding and sensitivity to their local and global environment using an approach that allow pupils to research, analyse and find solutions to environmental issues
- Ability to take informed stance on environmental issues, develop concern for such issues and make a personal commitment to resolving issues
- Acquire the necessary skills based on solid knowledge that will make them confident in resolving environmental problems. (Scottish Executive, 2000)

Given these comprehensive policies and guidelines, one would expect environmental education to flourish in Scottish Schools. However, despite all these developments, findings in the UK indicate EE is not planned or taught comprehensively in schools (Palmer, 1998). SEEC (1998) observed that even though there was a flurry of initiatives in Scotland in the early 1990s, there was a decrease in the same period, in the number of urban and outdoor centres for school use. This was against the backdrop that education '*IN*' the environment is vitally important for a growing urban population. The implementation of the 5-14 guidelines has also posed serious challenges for schools in terms of preparation and finding time to teach all its required aspects. A report by the Her Majesty's Inspectorate of Schools (HMI) in 1980 for instance showed only 25% of schools in Scotland displayed a high standard

in the teaching and learning of environmental studies. The report identified scepticism among many teachers that an integrated approach to teaching would work, due to problems of planning, organising and managing topics (SED, 1980, as cited in Condie, 2003). A plethora of constraints were identified to be hindering the implementation of the environmental studies guidelines and by extension environmental education:

> ...the growing political emphasis on accountability, attainment and quality assurance has led, in turn, to increased prescription by education authorities on what is to be taught, when and how. In science for example, several authorities have invested in subject-oriented 'units of study', sometimes with boxes of apparatus and materials to support these. The units are designed to be completed in a specific time period for example twenty hours, and consist of a series of teaching sessions on specific concepts and skills writing a more structured, subject-oriented timetable of teaching and learning in primary schools. (Condie, 2003, p. 388)

Whilst both international initiatives and those in Scotland all called for a cross curriculum approach to teaching, even the model subject, environmental studies, where environmental education could flourish has been sub-divided into science, social science and technology components with some guidance provided to teachers on how to integrate them. Teachers are also given strict time allocations for subjects and pressured to show attainment against national benchmarks which may mean that they will equally sub-divide environmental studies into its components to meet these expectations (Condie, 2003). In other words, the rhetoric of cross-curricular teaching is not matched with what is actually demanded of teachers in practice.

Another major reason for this rhetoric–reality gap is that teachers attempting to engage in environmental education face numerous barriers posed by the school system. Some of these barriers stem from an incompatibility between the goals of environmental education and the general goals of the school (Stevenson, 2007). Also, since environmental education is a cross-curricular subject, it is not described as a

'core' or compulsory subject, and as such left entirely to schools and teachers to decide how and where to incorporate it. Thus the success of environmental education is left to the "whims, enthusiasm and motivation of individual teachers and school" (Palmer, 1998, p. 98). To rely on teachers' motivation for its success presents a major limitation. Considering the numerous statutory requirements teachers need to fulfil, it is only personal commitment from teachers' that can make environmental education succeed. A report by the SEEC (1998) on the state of environmental education clearly identified this issue. It stated that:

> In general the documents have been most useful to activists and to those seeking support and encouragement for strategic ways forward. However, actual progress [*in environmental education*] has largely depended on committed individuals. (p. 11. *My italics*)

In other words, this identifies commitment as an important issue worth investigating. Since the success of EE in part depends on teachers' motivation, it is legitimate to ask the question: what makes some teachers more committed to environmental education in the face of these barriers? Increasing our understanding of this question may result in efforts to motivate teachers' interest in advancing the goals of environmental education as set out in the curriculum.

2.4. Current Curriculum Review - A Curriculum for Excellence

The curriculum in Scotland is currently under review which will have implications for the teaching of environmental education. A Curriculum Review Group was set up in 2003 tasked with identifying the purposes of education from 3 to 18 years and the principles upon which to design a curriculum. This review came about as a result of a national consultation on the state of education. One of the concerns raised about the current 5-14 curriculum was that its component parts were developed separately and when combined, did not provide a good basis for educating children. Thus the framework for the new curriculum review, know as *A Curriculum for Excellence*, is to develop a framework where the curriculum is not fragmented or overcrowded with

content, and to give teachers more freedom to decide appropriate learning outcomes for pupils. This it is hoped will enable teachers to teach beyond traditional subject boundaries. The purpose of the Curriculum for Excellence is to provide an opportunity for children and young adults to achieve the broad goals of becoming responsible citizens, effective contributors, confident individuals and successful learners (Scottish Executive, 2004). In other words, the curriculum review might create the opportunity to engage in cross-curricular activities, a phenomenon that underlies the philosophy and possible success of environmental education.

2.5. Environmental Education and Education for Sustainable Development

The name environmental education or at least the concept it stands for has been a subject of controversy over the years. As recounted earlier, environmental education came out of environmental studies following various international and national initiatives that gave it a statutory position. However, since the inception of the *Brundtland Report* in 1987 and the follow up issues at the Earth Summit in Rio, various attempts have been made at different levels to introduce the name 'sustainable development' into it or change its name all together. This led to the emergence of Education for Sustainable Development (ESD). The advent of ESD has engendered some controversies sometimes because of the reasons for its adoption, including those who see it as a superior version of environmental education (see e.g. Smyth, 1995) and those who see it as transcending the limited scope of environmental education (Tilbury, 1995). Broadly though, the goals of environmental education are not too different from those ascribed for ESD (McKeown & Hopkins, 2005). Within the conception of ESD however, environmental issues are seen as only one of the components in addition to social and economic issues. The worry is that environmental matters steadily lose their own vitality and relevance and are sometimes pushed to the background (González-Gaudiano, 2006) with economic issues prevailing (Stevenson, 2002). Whatever the conceptions or misconceptions there are about ESD, what is true is that it has opened up other broad perspectives in the environmental discourse and this must be

acknowledged. In Scotland, the name ESD has appeared in most official documents since 1994.

Whilst the change of name from environmental education to ESD in some quarters of the Scottish curriculum is recognised, environmental education has been adopted throughout this study for a number of reasons. Firstly, to ensure that the focus of the study is kept within the domains of environmental issues rather than the broad and sometimes ambiguous nature of issues captured in ESD. Secondly, the name environmental education is what is known by majority of educators and policy makers all over the world and this has evolved over four decades (Palmer, 1998 p. 22) unlike ESD which although have been here for a while is comparatively new and does not resonate the same meaning for all people. For instance, there have been suggestions to use either sustainable development education (SDE) or environmental education for sustainability based on philosophical grounds (see e.g. Lavery & Smyth, 2003; Tilbury, 1995). In Scotland, both SDE and ESD are sometimes used interchangeably in government documents although SDE is currently the official name. Since these conceptual debates fall outside the realms of this study, it was thought that adopting the more traditional name of environmental education would steer the study clear of such debates. However, it should be noted that the use of environmental education in this study captures a broader perspective including elements of sustainability which are already within the original goals of environmental education.

2.6. Systems Perspective of Education and Teacher Commitment

The discussion so far has shown that issues connected to environmental education are complex and one way of understanding this complexity is to use a framework such as Systems Theory which focuses on understanding complexity. Systems theory suggests that the real world is complex and stratified and we continuously discover complex layers of reality that help us explain other layers (Capra, 1996). The theory argues that systems are integrated wholes and can only be understood in terms of properties of the whole. It is contextual thinking where behaviour is understood only

within the context of the larger whole or environment, rather than solely in personal terms (Grosch & Olson, 2000). Consequently, to understand behaviour requires not only understanding the factors that determine it, but how these factors interact with each other, and with the larger environment to shape the behaviour. Systems theory therefore provides the framework for ensuring a comprehensive understanding of the phenomenon under study (Bernard, Paoline, & Pare, 2005).

Relevant to this study are the concepts 'complexity' and 'systems thinking'. The term complexity assumes that a systems' behaviour is the result of interrelationships existing among a combination of elements and groups of elements. Thus, to adequately understand the behaviour of a system, one must focus on the interrelationships between multiple elements and reflect upon the emerging patterns to gain a big picture of the system (Hoban, 2002). 'Systems thinking' reflects the application of systems theory in problem solving. It is "a mindset focussing on interrelationships that helps to understand the dynamics of complexity" (Hoban, 2002, p. 22). Senge (1990, p. 69) views "systems thinking as a discipline for seeing the 'structures' that underlie complex situations… systems thinking offers a language that begins by restructuring the way we think". The assumption behind this study is that systems thinking can serve as a useful tool in understanding the complexity that underlies teacher commitment.

Teaching like all other social phenomena is a complex venture and the need to consider this complexity in educational research has been advocated (see e.g. Hoban, 2002; Banathy, 1991). It is a dynamic relationship that changes with different students and context (Hoban, 2000) and is complex requiring a high standard of professional practice in order to perform it well (Hargreaves & Goodson, 1996). Biggs (1993) argued that every class is 'a set of interacting ecosystem' composed of teachers, teaching context and curriculum. When an element say curriculum is changed, it affects other aspects of the classroom such as assessment and teaching strategies. This can be likened to a 'spider web' with each element being interconnected. Teachers' commitment to classroom work is therefore influenced by a combination of elements including the curriculum, personal dispositions, school

and societal culture, facilities available and how students respond to instruction at any particular time. The traditional conception of teaching however is consistent with a mechanistic paradigm which emphasises the analysis of independent parts. Thus, our knowledge of teaching tends to be itemized into knowledge and skills. This approach misrepresents the complexity that is evident in real school and classroom situations (Hoban, 2002). Viewing teacher commitment as a complex system is therefore useful for understanding the dynamics of teaching as this highlights the multidimensionality of the nature of teaching. Systems theory therefore should present a useful framework for unearthing this complexity in teachers' commitment.

Systems theory has been applied to wide range of problems in the field of biology, engineering and social science. In the social sciences, complex phenomena occurring in human systems have led to the use of systems approach in such areas as sociology, economics and political science (Mesjasz, 1988). Foremost application of systems approach in the study of human behaviour is connected to Gestalt psychology in the 1920's who asserted that people do not perceive things in terms of isolated elements but as integrated perceptual patterns (Capra, 1996). Specific applications of systems theory in the social sciences have spanned the areas of peace research, clergy burnout and criminal justice (Bernard et al., 2005; Grosch & Olson, 2000; Mesjasz, 1988). Systems theory has also led to the development of numerous new methodologies and applications for problem solving (Capra, 1996). However, application in educational literature is still in its infancy compared to other fields like science, engineering and economics. This according to Banathy (1996) is because the term is underconceptualized and underutilised, and often wrongly applied. Indeed, most applications of systems thinking in education have been at the macro-level describing the relationships among the layers and structures of education. Using it at the micro-level will help us understanding the dynamics of education in a school and classroom setting.

2.7. Conclusion

This chapter has examined the context within which the study is conducted. The development of EE in Scotland in relation to other international initiatives has been discussed. An examination of the nature of EE policies and what transpires in schools was then considered. This analysis revealed major rhetoric–reality gaps which mean that the success of EE in schools depends on the commitment of teachers. The chapter concluded with a proposal to examine teachers' commitment from a systems perspective. In the next chapter of the thesis, attention will be focused on the social psychological factors which influence teachers' commitment to EE.

CHAPTER THREE

Social Psychological Determinants of Teacher Commitment

3.1. Introduction

Social psychological theories of teacher commitment have generally focused attention on teachers' job satisfaction and commitment to stay in the teaching profession (Fresko, Kfir & Nasser, 1997). However, the social psychological theories of interest in this study are those concerned with explaining teachers' commitment to classroom activities in specific subject areas. Importance is particularly placed on theories that attempt to explain aspects of teachers' commitment to teaching and those that provide possible insight into the determinants of commitment to teaching EE. In addition, individual factors that have been empirically found to influence teaching behaviour are of interest to the study. The shape of this literature review adopts a general to specific approach. The section begins with a brief definition of teacher commitment followed by a discussion of general theories of teacher commitment found in the education literature. This is followed by a brief review of some of the theories of individuals' commitment to pro-environmental behaviours. The reasoning behind this is that, teaching of EE can be viewed as a kind of environmentally significant behaviour (Stern, 2000). Following from this, various empirical findings of factors influencing teachers' commitment to teaching specific subjects are discussed.

The next phase of the literature review includes the most important sections as they discuss the theoretical frameworks chosen for the current study. The first theory of interest is the quantitative social psychological theory of planned behaviour (Ajzen, 1991) and the second is the qualitative body of work which explores significant life experiences and their influence on pro-environmental behaviour (e.g. Chawla, 1999; Palmer & Suggate, 1996). The Model of Environmental Education Commitment (MEEC; Shuman & Ham, 1997) which integrates these two frameworks to understand teacher commitment to EE is then reviewed. The section ends with a

presentation of a revised version of the MEEC which is adopted in this thesis in order to understand the determinants of teachers' commitment to teaching EE.

3.2. Definition and General Models of Teacher Commitment

Different definitions and conceptions of teacher commitment exist in the literature (Reyes, 1990). Riehl and Sipple (1996) viewed committed teachers as 'exemplary teachers' who employ instructional strategies and interpersonal relationships that reflect a strong personal and professional investment in their work. Coladarci (1992) defined teacher commitment as the degree of psychological attachment to the teaching profession. This line of definition is quite narrow as it is mainly adopted to examine why teachers choose to stay or leave the teaching profession. A broader definition that captured the context of this study was provided by Reyes (1990) who maintained that teacher commitment was "a psychological identification of the individual teacher with the schools goals and values, and the intention of that teacher to maintain organisational membership and become involved in the job beyond personal interest" (p. 154). According to Reyes commitment works to activate, direct and maintain behaviour. The activating forces within commitment are assumed to be in the individual's psyche, and makes teachers either identify or not identify with their employing school. Commitment also provides goal orientation and directs teachers' behaviour towards attainment of school goals and objectives. Finally, commitment motivates teachers to maintain and sustain their behaviour. In a nutshell, commitment is a complex process that involves personal commitment to the school, activity or task. What is common to all the definitions is the psychological bond or identification of the individual teacher with the school's goals which is important to him or her. Thus a committed teacher has a strong belief in the goals and values of the school and willingly exerts a lot of effort in order to achieve these goals (Firestone & Pennell, 1993).

Theories of teacher commitment postulate that greater interest and effort of teachers is generally associated with higher quality teaching which inevitably can lead to greater student learning. Firestone and Pennell (1993) suggested that committed

teachers may have strong psychological attachment to their school, students and subject areas. Furthermore, the commitment of teachers affects students' attitude and effort although this may sometimes be reciprocal. Finally, in environmental education personal commitment of teachers has been found to be reported as the main reason behind successful environmental education programmes. For instance, a recent evaluation of Eco Schools in Scotland confirmed that the success of the programme in most schools depended on the enthusiasm of a few committed teachers (Pirrie et al., 2006).

The different perspectives of commitment have led to different research paths into teacher commitment in the literature. One prominent group has investigated teachers psychological attachment to the profession and whether they intend to leave the profession or not (e.g. Fresko et al., 1997; Coladarci, 1992). Another group of studies has looked at the extent to which teachers' are committed to classroom activity or task in order to achieve school goals (e.g. Riehl & Sipple, 1996). It is to this latter group of studies that this thesis falls into although much broader. In other words, the use of the term commitment to EE in this thesis reflect the degree to which teachers psychologically identify with environmental education goals and values and the extent to which these goals are actually implemented by the individual teacher in the classroom.

Different theoretical frameworks for teacher commitment can be found in the educational and organizational literature. The most popular ones are psychological models which generally emphasize the impact of personal and social psychological antecedents on teachers' commitment. These theories propose that commitment results from an appropriate match between the individual teachers' personality needs and the school values. Reyes's (1990) model of teacher commitment to an organisation for instance grouped the antecedent of teacher commitment under three main categories, namely, personal-demographic values, organisational values, and the strength of the person-organisational fit which represents the match between the school and the teachers' personal values. According to the model, when a teacher joins a school, his or her personal values interact with the school's values. This

represents an exploratory phase where the teacher discovers the characteristics of the school and matches the values of the school to his or her own values. The model postulates that a strong person-organisational fit means that a teacher's socialisation would lead to the development of specific beliefs, attitudes and behaviours that would enhance commitment to the school, its goals and mission. Support for this model was found in a study by Reyes and Pounder (1993) in which teachers' commitment to their schools was associated with how similar their value orientation was with the school's value orientations. Although this theory gives insight into why teachers are committed to the school or profession in general it is not useful in understanding the antecedents of commitment to specific subject areas.

Sociological theories conceptualise teacher commitment as a social phenomenon in which teachers are said to respond to structures and processes in a social institution – the school (Reyes, 1990). These theories posit that school conditions like teacher autonomy regarding classroom decisions, participation in school-wide decision making, opportunity to learn and adequate resources are strongly associated with teachers' commitment. This is because such conditions reduce uncertainty, promote autonomy, and provide teachers with the opportunity to learn to be successful (Firestone & Pennell, 1993). These studies are related to studies on barriers to teachers' commitment to environmental education (e.g. Ham & Sewing, 1988). Although this model is insightful in identifying barriers, it is limited in approach because it does not take into account the psychological factors like beliefs and attitudes which have been found to be instrumental in influencing teachers' commitment.

Another theoretical conceptualisation relevant to the current study, are the theories of commitment to work itself. An example of this is Hackman & Oldham's (1980) Job Design Theory which postulates that the core characteristics of the work task itself are vital for the creation of internal psychological states of meaningfulness, responsibility, and efficacy that motivates an individual toward high job performance and commitment. These characteristics relate to the skills and knowledge required of the individual to carry out the task, the scope of the task, how significant the task is,

the extent of autonomy of both the worker and the task, and availability of feedback on task performance. High levels of commitment are mostly associated with wider job scope, greater levels of autonomy, ability to use complex skills and availability of feedback on job performance. Since teachers working within the same school environment sometimes have different attitudes towards their work, this model therefore suggests that the work itself can influence commitment (Riehl & Sipple, 1996). In other words, the characteristics of environmental education (e.g. cross-curricular nature) are likely to make some teachers more committed to it than others. However, the strength of the relationship between work characteristics and the psychological state that leads to commitment have been found to be moderated by other variables like knowledge and skills (Hackman & Oldham, 1980). Although this theory is equally insightful to understanding teachers' commitment to teaching EE, its application is somehow limited in that it focuses too much attention on the characteristics of the task itself.

In conclusion, although these theories of teacher commitment are insightful and bring an understanding to what influences teachers' commitment to EE, they are either too broad and capture wider scopes of commitment in organisational context or too narrow in focus.

3.3. Theories of Pro-environmental Behaviour

Several social psychological theories have been developed in an attempt to explain antecedents of pro-environmental behaviour. Pro-environmental behaviour is also sometimes referred to as environmentalism or environmentally significant behaviour in the literature (see e.g. Stern, 2000). These concepts, although varying in definition, generally refer to behaviours undertaken by individuals with the aim of benefiting the environment (Kollmuss & Agyeman, 2002; Stern, 2000). Teaching of EE can be described as a form of pro-environmental behaviour and falls into one of the types of environmentally significant behaviour known as 'nonactivist' behaviours. These types of behaviours have an indirect effect on the environment as they operate by changing the behaviours of other people (Stern, 2000). An example of this according

to Stern is the support and acceptance of public policies related to environmental issues. Jensen (2002) contends that direct as well as indirect actions are important in environmental action and this can be individual or collective. He stated that, "demonstrating against traffic conditions is as valid an approach as cleaning up litter"... (p. 326). This identifies that all forms of behaviour that seek to reduce one's impact on the environment whether covert or overt can be considered as pro-environmental behaviour. Thus, the degree of compliance that teachers give to EE policies through teaching in order to develop children who would grow up to care for the environment can be seen as a form of environmentally significant behaviour. In other words, theories which explain pro-environmental behaviour can give insight into why some teachers are more committed to teaching EE more than others. Some of these theories are examined next.

The Value-Belief-Norm (VBN) theory builds on other theories of pro-environmental behaviour and is aimed at explaining the determinants of nonactivist environmentalism (Stern, 2000; Stern, Dietz, & Guagnano, 1995). Critical to the theory is the notion that a personal norm, which is an internalised sense of obligation to act in a certain way, is the main determinant of people's behaviour. According to the theory, the antecedents of personal norms for pro-environmental action (e.g. reducing energy use) stem from the belief that not carrying out such actions will damage things the individual values (awareness of consequences), and the belief that by taking action one can act to reduce the threat (ascription of responsibility). The development of these beliefs on the other hand is influenced by an ecological worldview about the human-environment relationship (New Environmental Paradigm) which is a product of certain personality structures and values (biospheric, altruistic, egoistic). A vital element of the VBN theory is that the effect of values on environmentalism depends on the individual's belief about the damage to be caused by environmental conditions and whether there are actions that the individual can undertake to reduce this damage. Thus, beliefs underlying environmental personal norms and a pre-disposition to pro-environmental action can be influenced by information about environmental issues. In other words, the model indicates how findings of environmental science (about consequences) and the publicity of those

findings may affect perceptions of personal responsibility. The model thus suggests that behaviour toward the environment can be influenced by making individuals aware of the consequences, in particular adverse ones, of the things they value, and by showing them that they can make a difference through their own behaviour. Generally, people who do not perceive any connection between their own behaviour and negative consequences or who believe that their actions are insignificant in the scheme of things will not be motivated to engage, by an internalised sense of obligation (Stern, 2005). With such people, external pressures are required to make them engage in a pro-environmental behaviour. From this theory it can be hypothesised that teachers who believed that there are dangers to the environment and that their teaching of EE will reduce those dangers would be more likely to teach EE. The criticism of some of the theories of pro-environmental behaviour is that they are built on an individual's intention to engage in behaviour and as such are insufficient for understanding how to change environmentally important behaviours (Stern, 2000).

The ABC theory (Guagnano, Stern, & Dietz, 1995) is an extension of the popular attitude-behaviour theories which postulates that individuals with positive attitudes towards the environment are more likely to engage in pro-environmental behaviour. Taking into consideration the limitation of these theories to only personal factors, the ABC theory postulates that pro-environmental behaviour is the result of a series of causally linked external (e.g. social institution, physical structures) and internal (e.g. attitude, beliefs, intentions) factors. That is, actions or behaviours (B) are associated with attitudes (A) and external conditions (C). According to the theory, A and C of any behaviour are distributed in the population, and the prevalence of the behaviour in the population depends on those distributions. When behaviour is difficult, expensive or inconvenient (negative C) for individuals, that behaviour is rarely performed, whereas if positive conditions exist (positive C) then the behaviour will be very common. Likewise, when most of the people in the population have a positive attitude toward the behaviour (positive A) that behaviour would be prevalent, whereas it would be scarce when most of the people have a negative attitude towards it (negative A). Critical to the model is the premise that the effect of

A and C on the behaviour depends on the combined values of A and C rather than their individual values. If A and C are both positive then behaviour is present however if they are both negative then behaviour will be absent. In other words, the impact of any intervention to change attitude (A) or an incentive to change the external condition (C) may have less to do with the intervention, than with the relative distribution of A and C in the population. For instance, if so many barriers to performing behaviour exist such that nobody in the population has a strong attitude to overcome the external barriers, or if the behaviour is so easy that everybody's attitude is strong enough, then changing A will have no predictive effect on B. However if A and C are neutral then changing attitude will have a predictive effect on the behaviour. This same logic applies if the aim is to change external conditions to a certain magnitude. The theory therefore presents the boundary condition for when attitudes can predict pro-environmental behaviour, in that, the predictive power of attitude depends on the nature of the constraints. Evidence for this theory was found in a study of curb-side recycling (Guagnano et al., 1995). Extending this to teachers' commitment to EE, it can be hypothesised that interventions to change teachers' attitudes towards EE would not increase their commitment if extensive barriers to teaching EE exist. Thus the ability of teachers with a high attitude toward EE to put this into action depends on the nature of constraint that is present in the school environment.

Grob's (1995) model of environmental behaviour proposes a set of four interrelated determinants of pro-environmental behaviour. These are environmental awareness, personal philosophical values, emotions and perceived control. According to the model, these factors have a direct influence on individuals' decision to engage in pro-environmental behaviour. In addition, personal-philosophical values which comprise post-materialist beliefs and readiness to adopt new attitudes directly influence an individual's environmental awareness, perceived control and emotions. Also, environmental awareness, which constitutes factual knowledge and recognition of environmental problems directly influences control decisions and individual's emotions. Deducing from this second path of influence, teachers who are

environmentally aware would be more likely to perceive control over their teaching than those who have less awareness.

Although these theories provide insight into understanding why some teachers are more committed to EE than others, they are limited by the fact that they do not account for other school specific factors which might affect teachers. Also, these theories are too narrow in focus compared to other social psychological theories (e.g. the Theory of Planned Behaviour to be discussed later) which are applicable to any social behaviour.

3.4. Determinants of Teachers Commitment to EE: Empirical Perspective

Several quantitative and qualitative empirical studies have identified factors that influence teachers' commitment in terms of classroom behaviour. This section reviews some of these empirical findings with a particular focus on teacher commitment to teaching specific subjects. Examples relevant to teacher commitment to teaching EE are cited where possible. The list of factors identified in this section is by no means exhaustive but focus on the common factors identified in the literature. Generally, the literature on teacher commitment to EE can be classified under two broad areas. Studies in the first group have focused on one or two factors which they consider to be influential in determining a teacher's commitment to teaching EE. The second category of research which recognizes the impact of multiple factors on teaching has tended to examine a range of possible factors likely to affect commitment. The latter view is taken in this thesis. Thus, although the factors are put in specific categories they should be interpreted as interacting factors that act together to affect teachers' commitment to EE.

3.4.1. Knowledge

The influence of teachers' knowledge on their commitment to teaching has received a lot of attention in the literature. This is because the way knowledge informs classroom practice is primary to those concerned with teacher training and

continuing professional development (Grossman, 1995). Although different forms of knowledge domains have been distinguished in the literature (see e.g. Grossman, 1995; Shulman, 1987), research has particularly concentrated on teachers' content knowledge. Content knowledge includes in-depth understanding of the subject being taught as well as pedagogical knowledge of the subject matter delivery. This knowledge is generally referred to as 'pedagogical content knowledge' (Grossman, 1995; Shulman, 1987). Shulman (1987) for instance maintained that 'pedagogical content knowledge' was the fulcrum of teaching because it represented how teachers blend academic content with teaching methods, organise instruction, and unite all these elements with the interests and abilities of the students in their class. Moreover, a teacher's content knowledge is the main source of students' understanding of the subject matter and the way in which this is taught coveys what is important or peripheral about the subject to the students. Grossman (1995) notes that teachers' grasp of content knowledge influences their commitment in terms of what they teach and how they teach it. Teachers have for instance been found to be more likely to emphasize subjects and topics they are knowledgeable in and to teach less in areas in which they have relatively little content knowledge (Carlsen, 1991; Smith & Neale, 1991). Knowledge of subject matter has also been found to influence teaching styles with teachers adopting less interactive approach when their knowledge of subject matter is low (Ball, 1991).

There have been various studies linking teachers' content knowledge, sometimes termed 'ecological literacy' (e.g. Cutter-Mackenzie & Smith, 2003), to their commitment to EE. Research indicates that teachers' ecological literacy strongly influences teachers' decision and ability to teach environmental education (Ernst, 2007; May, 2000). Cutter-Mackenzie and Smith (2003), in a study, assessed primary school teachers' knowledge about environmental education in Australia and how this affected classroom practice. The scope of their studies included knowledge of environmental concepts and issues. Using a combined-methods approach consisting of ethnographic interviews and a quantitative mail survey, they found that majority of the teachers were functioning at a low level of ecological literacy. Results from their survey indicated that 11.15% of participants considered lack of knowledge as a significant barrier impeding environmental education practice. Although the

proportion of teachers who considered lack of knowledge as a barrier was low, the result generally showed that an absence of ecological knowledge had an impact on teachers' commitment to EE. An analysis of the teachers' attitude toward EE clearly placed their results into perspective, in that, most of the teachers had concern for the environment and made personal commitment to teach about it. Thus individual commitment to EE was a vital component when it came to implementing EE. The teachers however mentioned time constraints, over-crowded curriculum and constant change as other barriers to them implementing EE. They therefore acknowledged that improving only teacher knowledge was unlikely to significantly change the current status if there was not a systems-wide commitment to EE. Summers et al. (2001) asserted that secure knowledge, which includes understanding, is desirable for effective teaching. Although acknowledging that knowledge was just one of the requirements for teacher effectiveness, Summers et al. noted it was a prerequisite for the most effective teaching. Results from their studies showed some underpinning concepts are well understood by teachers whilst others are not well understood. Kim and Fortner (2006) found out that although teachers usually perceive external logistic barriers to be more important to their teaching of EE, content pedagogical knowledge is more related to actual teaching.

However, like in other behavioural domains, teachers' knowledge of environmental issues is not always translated into classroom practice. In a study of the effect of teachers' knowledge of mathematics, Ernest (1989) concluded that two teachers with a similar knowledge base may end up teaching in different ways. According to Ernest, the difference in teaching between these teachers may be due to the powerful effect of beliefs in influencing how they make decisions.

3.4.2. Teacher Preparation

Pre-service preparation has a multiplier effect by impacting on many future teachers and by extension a greater number of students. Moreover, a high quality teacher preparation is a pre-requisite for teacher commitment. Particularly, using EE as an underlying philosophy in pre-service courses can play an important role in teachers'

future commitment to EE when they graduate (Powers, 2004). Research has found that lack of training in EE has been cited by teachers as a major reason for not incorporating EE in the school curriculum. This is because adequate training in environmental education can be related to teachers' perception of their own competence in teaching EE (Lane & Wilke, 1994). Individuals also develop beliefs about an object through previous episodes or events that colour the comprehension of subsequent events (Nespor, 1987). It has for instance been reported that vivid images experienced by teachers during pre-service training subsequently influenced their interpretation of particular courses and classroom practices, as well as played a powerful role in how they translated knowledge and their choice of future teaching practices (Calderhead & Robson, 1991). According to Nespor (1987), it is likely that a "crucial experience or some particularly influential teacher produces a richly detailed episodic memory which later serves the student as an inspiration and a template for his or her own teaching practices" (p. 320).

Plevyak, Bendixen-Noe, Henderson, Roth, & Wilke (2001) investigated the association between teacher preparation in EE and the level of EE implementation in elementary schools. They found a significant relationship between teachers' level of implementation of EE topics and the extent of exposure to EE topics during in-service and pre-service teacher preparation. Comparing two states, it was revealed that teachers who received more pre-service EE preparation implemented more EE than their counterparts who received no or very little preparation. Although attitude toward EE was similar for all groups, teachers with better EE preparation felt more confident about teaching EE concepts. Plevyak et al. (2001) concluded that for EE to be successfully implemented, teachers should be given adequate pre-service preparation as well as improving teachers' attitudes to EE. While they conceded that pre-service EE preparation alone was not sufficient, it adds to reinforcing teachers' beliefs that EE should be a priority in education. The level of teacher preparation therefore has an effect on future teachers by influencing their beliefs about the subject. Lane and Wilke (1995) in a study of Wisconsin teachers found that the amount of pre-service and in-service training that teachers received in EE was

positively related to teachers' perceived competences, attitude toward teaching EE and amount of class time devoted to teaching about the environment.

Although the benefits of adequate teacher preparation for EE are widely recognised, studies have shown that incorporating EE into pre-service training is the exception rather than the norm. McKeown-Ice (2000) in a survey of teacher training programs in the USA for instance found that students generally had limited access to EE content and methods during training. Although all schools required pre-service teachers to take courses in both the social and natural sciences, less than one-third gave students a background in EE. In Scotland, teacher preparation for environmental education was neglected until 1993 (SEEC, 1998). Several studies (e.g. Powers, 2004; Heimlich, McKeown-Ice, Braus, Barringer-Smith, & Olivolo, 2004) have identified a plethora of barriers to incorporating EE into pre-service curriculum. Notable among them are the numerous existing courses in general and professional education in pre-service curriculum which leaves little room and time for specialty areas like EE, absence of knowledge in all the domains covered by EE, EE not mandated by state for teacher certification, absence of teaching resources, controversial nature of EE topics and so on (Heimlich et al., 2004; Powers, 2004; Plevyak et al., 2001; McKeown-Ice, 2000). These studies have therefore proposed recommendations that will ensure a successful integration of EE into pre-service training. Heimlich et al. (2004) for instance called for EE not to be seen as an 'add on' but to be explicitly made part of the existing pre-service curriculum. Also, most lecturers in teacher training colleges called for an active campaign to integrate EE into the pre-service curriculum (Powers, 2004).

3.4.3. Teacher Autonomy

Autonomy according to Hackman and Oldham (1980) refers to a worker's freedom to schedule his or her own work and to determine the procedures for carrying it out. Deci and Ryan (1985, as cited in Firestone & Pennell, 1993) made the theoretical link between autonomy and commitment in their self-determination theory. According to their theory, autonomy was central to internal motivation and identified

that individuals become committed to their work when they experience responsibility for the outcomes of their work. Whilst experiencing responsibility for success may promote continuing successful practices, responsibility for failure can motivate individuals to change what they do. Deducing from this argument, Firestone and Pennell (1993) proposed that teacher autonomy is likely to breed commitment to successful instructional practice. This is because it allows teachers to attribute their success to themselves by identifying the way in which their own actions contributed to students learning and the mission of their school. May (2000) for instance identified flexible curriculum as one of the essential teaching conditions for successful implementation of environmental education. A qualitative study of teachers who were involved in a lot of EE activities in their school found that the absence of autonomy in the form of inflexibility in the curriculum and the uncertainty of whether teachers feel they have permission to carry out certain EE activities makes it difficult to incorporate EE into their lessons (Robertson & Krugly-Smolska, 1997). Condie, (2003) on the other hand identified strict time allocations for subjects and pressure to show attainment against national benchmarks as barriers to the implementation of environmental studies in Scotland. This absence of autonomy hinders the implementation of EE programmes because teachers sub-divide subjects into individual components to meet national expectations instead of engaging in cross curricular activities where EE can be integrated.

3.4.4. Resources

The availability of adequate resources is important as this provides the means through which teachers can successfully accomplish their task. This is because resource availability affects teachers' perception of control and the lack of it can hinder even teachers with a strong intention to teach EE from actually teaching EE (Zint, 2002). May (2000) found the availability of teaching resources to be one of the most desirable conditions that contribute to an effective environmental education. Studies have also indicated that teachers generally perceive resource barriers as more problematic to their implementation of EE than other personal barriers (Kim & Fortner, 2006). Common resource barriers identified in the literature include lack of

instructional materials, inadequate textbook coverage of EE, lack of funding, lack of transportation and inadequate time (Ernst, 2007; Kim & Fortner, 2006; Ko & Lee, 2003).

3.4.5. Prevailing Discourse

Barrett (2007) argues that the power of dominant discourses has the potential to disrupt the transfer of teachers' positive beliefs in teaching EE into actually teaching it. In her study with outdoor education teachers, she found that a significant gap still existed between the expressions of concern by teachers who are motivated and their environmental education practice. In other words, having strong beliefs, significant skills, and an ideal programme structure does not necessarily lead to the implementation of effective EE. Although, the presence of other structural barriers served as a hindrance to practice, Barrett suggested that it was rather the disciplining power of dominant discourses of what counts as legitimate knowledge that made it difficult or sometimes impossible for even motivated teachers to engage in EE. It appears from this finding that the discourse regarding which subjects are considered to be important influences teachers' teaching behaviour. Findings on barriers to incorporating EE into pre-service teacher preparation also show the political arena to pose the greatest challenge in terms of inability to institutionalise EE (Heimlich et al., 2004).

3.4.6. School Climate

There is a suggestion that the school environment within which teaching takes place has an effect on teachers' commitment. For instance reasonable teaching workload is said to be important in allowing teachers to do their work and to reap intrinsic rewards from it (Firestone & Pennell, 1993). Other significant school climate variables like strong administrative support, support from peers, protection from intrusion, availability of resources and autonomy with regards to school policy have been found to be associated with teachers' commitment to teaching in general and to school goals and values (Riehl & Sipple, 1996). Opportunity for learning and acquisition of skills and collaboration among teachers which fosters sharing has also

been found to increase commitment to teaching (Firestone & Pennell, 1993). Thus, a supportive school environment is likely to lead to greater commitment to the teaching of environmental education. May (2000) found varied forms of support as one of the desirable teaching conditions mentioned by teachers as responsible for their commitment to EE. Ernst (2007) identified receptivity to EE and supportive school climate as important in influencing commitment to EE.

3.4.7. Perceived Barriers

Barriers to teaching EE can broadly be divided into external logistic barriers (Ham & Sewing, 1988) or internal and personal barriers. Several logistic barriers such as lack of time, teaching learning materials, pursuit of curriculum standards, lack of funding, lack of planning time and lack of transportation have been identified as hindering the implementation of certain aspects of environmental education (Ernst, 2007; Kim & Fortner, 2006; Ko & Lee, 2003; Robertson & Krugly-Smolska, 1997). Internal personal barriers include lack of content and pedagogical knowledge, and inadequate training (Kim & Fortner, 2006; Ko & Lee, 2003; Lane & Wilke, 1994). Teachers have mostly been thought to recognise external logistic barriers as more problematic to their commitment to EE although this may not always be the case. Kim and Fortner (2006) investigated secondary science teachers' perceived current and preferred teaching levels of environmental issues and the barriers to doing so. They found that teachers generally perceive external logistic barriers to be greater barriers to addressing environmental issues than internal personal barriers, such as content knowledge. The results however indicate that although teachers perceive external logistic barriers as more important, personal internal barriers like content and pedagogical knowledge was more influential to the actual teaching of environmental education. However, there were barriers specific to certain environmental education topics especially those considered to be controversial (Kim & Fortner, 2006). Similar findings were also identified in a study by Ko & Lee, (2003).

3.4.8. Attitude and Teacher Belief

A number of studies have documented that most teachers believe teaching environmental education is important and have a generally positive attitude toward environmental education (Kim & Fortner, 2006; Ko & Lee, 2003). Ko and Lee for instance found a significant relationship between attitude toward environmental education and teachers' intention but not with actual commitment. On the other hand, Plevyak et al. (2001) found a positive relationship between teachers' attitudes toward environmental education and the extent to which they implement EE topics. However, these positive attitudes do not necessarily translate into classroom behaviour. In other words, there is a gap between teachers' positive attitude toward the teaching of environmental education and their actual commitment to teaching the subject. Some authors have found that this discrepancy between teachers' positive disposition toward environmental education and their classroom behaviour is due in part to 'barriers' to teaching EE (e.g. Ham & Sewing, 1988). On the other hand some teachers have been found to overcome these barriers in order to put their positive attitude toward EE to practice. These findings suggest that the ways in which teachers' positive attitude toward EE affects their actual commitment is complex and depends on the presence of other factors.

3.4.9. Nature of Environmental EE

Environmental education is characterised by issues that are controversial with various conflicting interests and values. This is because environmental issues are generally poorly understood and disagreements about the causes and means of averting further environmental problems are rife among the scientific community (Stevenson, 2007). One problem is the difference in opinion regarding how teachers should deal with controversial issues with most researchers calling for teachers to take a neutral stance. However, this call for teachers to stay neutral is problematic considering the fact that one of the goals of EE is to promote pro-environmental behaviour among pupils. This therefore makes EE a daunting task for some teachers with the challenge of how best to present such complex and sometimes emotional issues in a coherent and unbiased manner without imposing their views on pupils

(Cotton, 2006). Also, findings show that teachers are generally unprepared and feel constrained in their ability to teach such issues. For instance, Oulton, Day, Dillon and Grace (2004) found that 75% of primary schools teachers in their survey had no training or clear guidance on how to deal with controversial issues. It would appear however that the extent to which teachers feel prepared to deal with controversial issues is likely to affect their commitment towards EE. Thus teachers who feel capable that they have the knowledge and skills to deal with controversial issues should be more committed to teaching EE.

3.4.10. Multiple Influences on Teacher Commitment

Although the factors discussed above have been considered individually, it is generally acknowledged that the factors are multiple and act synergistically to influence teachers' commitment to environmental education. In a study to identify what lies behind successful environmental educators despite the numerous political, social and environmental challenges they face, May (2000) found 42 elements responsible for a successful implementation of EE. These element were later arranged in 3 categories: teaching conditions (e.g. support, resources, flexibility and climate), teacher competencies (e.g. knowledge and skills), and teaching practice (e.g. student directed, experiential and constructivist). The conclusion from the study was that teacher education which focuses purely on improving teacher competencies may fail to help teachers and teacher educators improve their commitment to EE. This was because the factors responsible for success in teaching EE are multidimensional and incorporates elements within and well beyond the classroom walls. May (2000) stated that although the elements were presented under discrete categories, they were highly interdynamic in their applications.

Ko and Lee (2003) investigated secondary school teachers' perceptions of and practices in environmental education through the teaching of integrated science. Using both quantitative and qualitative methods, they found out that teachers' attitude, skills of teaching, intentions of teaching and beliefs in the relevance of integrated science to EE were related to engagement in the actual teaching of EE.

Teachers who held more favourable attitude toward EE, had more skills in teaching EE, believed in the relevance of integrated science to EE and want to teach it, would actually teach it if few barriers to doing so existed.

Ernst (2007), in a quantitative exploratory survey which aimed to understand influences on teachers' decision to use and their abilities to implement environment-based EE found that environmental knowledge and skills, sensitivity to the environment, receptivity to EE, supportive school climate and positive environmental attitude were strongly associated with the teaching of EE. She found teachers' perceived emphasis on state testing, lack of funding, lack of planning time, emphasis on state standards and lack of transportation as major barriers to the implementation of EE although this did not influence the approach used in implementing EE.

Although the multidimensionality of factors influencing teachers' commitment to EE has been acknowledged, to this date, there are still very few studies aimed at constructing a theoretical framework of how these factors influence each other. Given that such frameworks bring about holistic and comprehensive understanding of the complexity of behaviour, it is surprising how little has been developed in the field. The effect is that mostly piecemeal interventions that do not take a holistic perspective are carried out in schools leading to failure of these interventions to bring about increased teacher commitment. As pointed out by Firestone and Pennell (1993) "too much attention to one direction without considering the others could be detrimental" (p. 519). In other words, having a comprehensive framework of teacher commitment to EE has huge implications for both pre-service and in-service training aimed at making more teachers committed to EE (Shuman & Ham, 1997). Subsequently, as noted by Gotch and Hall (2004), most environmental education programmes, and here reference is made to those carried out with teachers, are often based on collective wisdom, with little attention paid to the psychological mechanisms by which behaviour change comes about. The absence of a theoretical insight weakens the ability of such programmes to be successful. It is believed that the presence of a theoretical framework backed by empirical evidence that guides interventions is likely to produce more meaningful results. In the next phase of this

literature review the thesis will explore a possible theoretical framework that pulls most of the factors together in an attempt to understand the influences on teachers' commitment to EE.

3.5. The Theory of Planned Behaviour

The social psychological Theory of Planned Behaviour (TPB: Ajzen, 1991; Ajzen, 1988) was the main theoretical framework considered for understanding the influences of teacher commitment to EE. This is the most widely used theory for understanding and predicting social behaviours, and has received considerable attention in the literature (Armitage & Conner, 2001). The TPB is basically a theory of the factors that determine an individual's decision to adopt or maintain a particular behaviour. As the name of the theory implies, the behaviours being described are planned ones. Since teaching like most other social behaviours is a planned action, the TPB is appropriate for explaining the determinants of teacher commitment to teach environmental education. Moreover, the TPB and its counterpart, the Theory of Reasoned Action (Ajzen & Fishbein, 1980), have been used to some extent to understand different kinds of teaching intentions and behaviours.

The Theory of Reasoned Action and the Theory of Planned Behaviour (TPB) are essentially similar except for one significant addition, that is, perceived behavioural control made by Ajzen (1991). This addition was to cater for limitation in the theory of reasoned action in dealing with behaviours where people do not have complete volitional control. The theories assume that, human beings are rational. In other words, people consider the implication of their actions before deciding whether to engage in a particular behaviour or not. Based on these assumptions, the TPB postulates that people perform behaviour in accordance with their intentions (what they plan to do) and the perceived amount of control they have over the behaviour (perceived behavioural control). People's intentions on the other hand are influenced by their attitude towards the behaviour, normative pressure from others to engage in the behaviour (subjective norms) and perceived behavioural control. According to the TPB, the antecedent of attitude, subjective norm and perceived behavioural

control are various forms of beliefs, which reflect an underlying cognitive structure (Armitage & Conner, 2001). In all, there are five main constructs associated with the TPB: behaviour, behavioural intention, attitude toward the behaviour, subjective norm related to the behaviour, and perceived control over the behaviour (Figure 3.1).

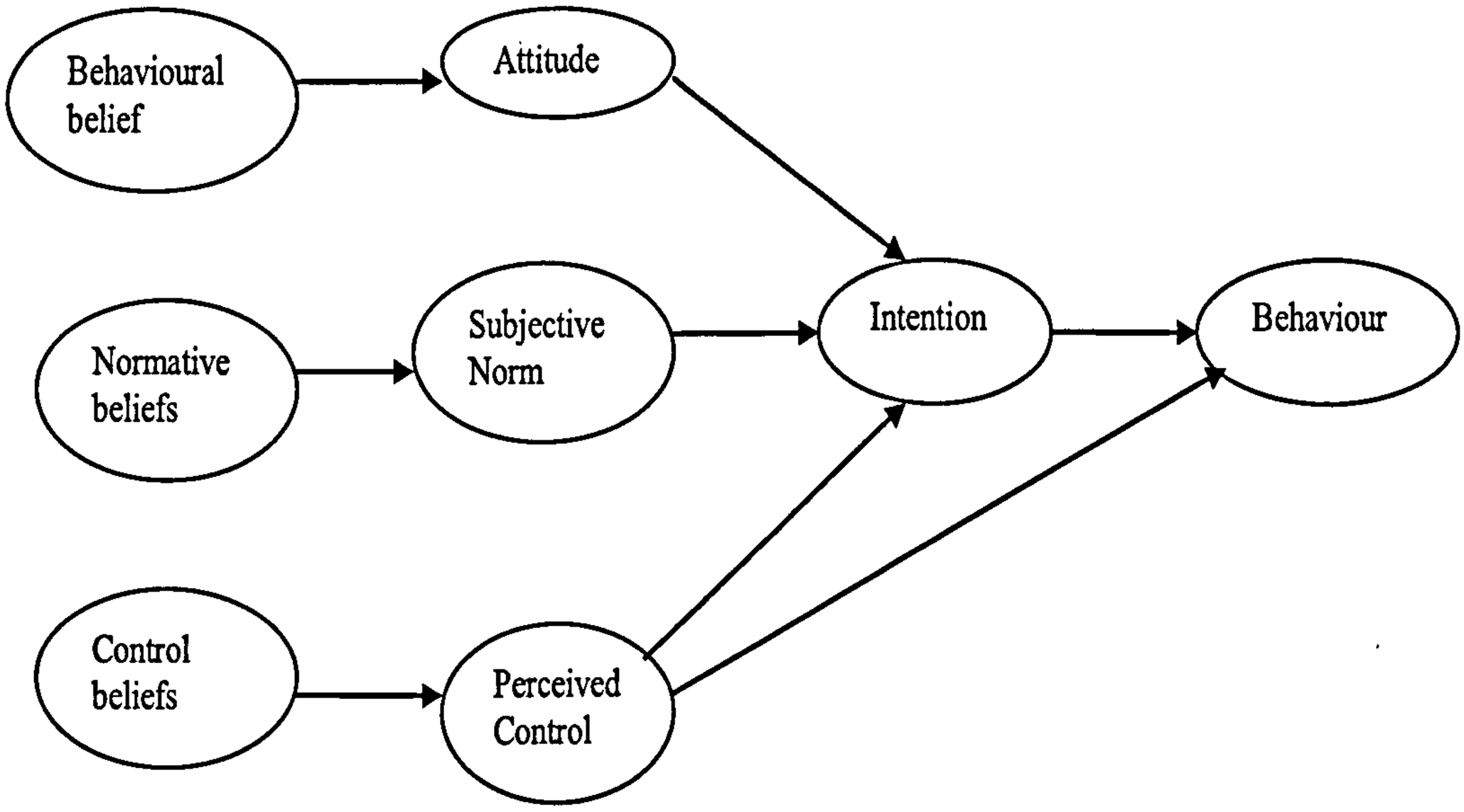


Figure 3.1: The Theory of Planned Behaviour (Ajzen, 1991)

From the perspectives of this theory therefore, teachers' commitment towards the teaching of EE is influenced by their intention to teach EE, the perception of control over teaching it, a positive attitude toward the teaching of EE and normative pressure to do so. What makes the theory of planned behaviour a powerful model is the extent to which it makes the theoretical connection between all the constructs that affect commitment. Equally, each variable in the model is comprehensively explained and has been well researched in different types of behavioural domains. The next section discusses the individual constructs in the model, their relationship with other constructs, and how they influence an individual's behaviour. Reference would be made to empirical evidence, where possible, of how the particular construct influences teachers' commitment to teaching.

Intentions

According to the TPB, behaviour can be predicted by simply asking individuals whether they intend to perform that behaviour or not. Barring unforeseen circumstances, people will usually act in accordance with their intentions (Ajzen & Fishbein, 1980). This measure of likelihood that a person will engage in the behaviour is known as *behavioural intention*. Intention takes into account the motivational factors influencing a behaviour and indicates how hard people are willing to try or how much effort they are willing to exert, in order to perform the behaviour (Ajzen, 1991). As a direct predictor of actual behaviour, intention also measures the likelihood that a person will or will not perform a given behaviour. As a general rule, individuals who hold strong intentions to engage in a particular behaviour are more likely to perform the behaviour.

Evidence for the efficacy of intention in predicting behaviour has been demonstrated in many studies. Reviews and meta-analysis of applications of the TPB shows that intention was generally the most significant direct predictor of behaviour (Armitage & Conner, 2001; Ajzen, 1991). A review of the application of the theory of planned behaviour also found intention to be the strongest predictor of teachers' actual teaching behaviour in the only study that measured actual behaviour (Zint, 2002). Ko and Lee (2003) found that science teachers' intention to teach environmental education was a powerful predictor of their actual teaching behaviour. In other words, teachers who intended to teach EE actually taught more EE. The strength of intention in predicting behaviour however depends on the extent to which the behaviour in question is under volitional control, that is, whether individuals can decide at will to perform or not to perform the behaviour. Intention is generally a strong predictor of behaviour in situations where the behaviour is perceived to be under high volitional control. In such a situation, the behaviour is thought to be straightforward and the potential obstacles for performing the behaviour are few (Armitage & Conner, 2001). A review by Ajzen (1988; 1991) has for instance shown that when the behaviour under consideration poses no serious problems of control, intentions predicts behaviour with a considerable level of accuracy. On the other

hand, under conditions where potential obstacles are plenty, the predictive power of intention is reduced.

Although intentions clearly play a significant role in guiding human action, research shows that there are complexities involved in translating intentions to actual behaviour (Ajzen, 1991). According to the TPB, the determinants of intention include personal factors (attitude), social influences (subjective norms), and certain internal and external factors (perceived behavioural control). As a general rule, individuals with a more favourable attitude, a strong normative pressure to perform the behaviour, and a greater perception of control over the behaviour should have a stronger intention to perform the behaviour under consideration (Ajzen, 1991).

Attitude toward the Behaviour and Behavioural Beliefs

Attitude reflects the individual's global positive or negative evaluations of performing the behaviour. According to Ajzen and Fishbein (1980), it is a person's favourable or unfavourable feeling toward performing the behaviour in question. In a general sense individuals with a more favourable attitude towards a particular behaviour, would have a stronger intention to perform it. The attitude described in the theory refers to the person's *own* performance of the behaviour and not general performance of the behaviour. In the TPB, attitude is an indirect predictor of behaviour through intention. Thus attitudes are first translated into desires (e.g. 'I want to perform behaviour x'), which then develops into intentions to act, which drives action (Bagozzi, 1992).

Meta-analysis and reviews of general application of the TPB, including teacher commitment, shows attitude to be the strongest predictor of intentions (Zint, 2002; Armitage & Conner, 2001; Ajzen, 1991). Thus for most behaviours, personal considerations tended to overshadow the influence of perceived social pressure and perception of control (Ajzen, 1991). An examination of two of these reviews (Zint, 2002; Ajzen, 1991) however shows that when the behaviour under consideration requires a high level of individual control, the strength of attitude in predicting intention is low. In other words, the influence of attitude on intention depends on

whether individuals can easily engage in the behaviour in the presence of barriers. The influence of teachers' attitude and belief on commitment to EE has probably been the most researched area. Result of the influence of attitude has been mixed. While some studies have established that teachers with positive attitude to environmental education tend to be committed to teaching it (Ernst, 2007), others have found that positive attitude is not always accompanied by more teaching of environmental issues (Fortner & Corney, 2002; Fortner & Meyer 2000). Some studies have suggested that this discrepancy between attitude and commitment to EE is due to lack of content knowledge by teachers on the issues they deem important (Summers et al., 2001, Ham & Sewing, 1988).

The TPB postulates that individuals' attitudes are a function of their beliefs. That is, people's attitude towards a particular behaviour is determined by their beliefs about the behaviour. Beliefs are acquired by associating the object with its qualities, characteristics and attributes. People develop favourable attitudes toward objects they believe to have positive attributes and unfavourable attitudes toward objects they believe have negative attributes. Beliefs are developed through life experiences resulting from direct observation, accepting information from outside sources or are self-generated through inference processes (Ajzen & Fishbein, 1980). Over time, people learn to favour behaviours they believe have largely desirable consequences and form unfavourable attitudes towards behaviours they associate with mostly undesirable consequences (Ajzen, 1991). Although people may hold many beliefs about any given object, they can only attend to a few *salient beliefs* at a given time. Assessment of these salient beliefs will help to determine the person's attitude. However, salient beliefs are subject to change and may be strengthened or weakened or replaced by other beliefs. Generally, these beliefs are known as behavioural beliefs.

The literature on teacher belief and its influence on teaching is colossal. This stems from the assumption that for a better understanding of teaching behaviours, one must focus on the things that teachers believe in (Nespor, 1987), as beliefs are the best indicators of the decision individuals make throughout their lives (Bandura, 1986).

The extent to which teachers believe environmental education to be relevant have for instance been found to be significantly correlated with their current and intended emphasis on teaching environmental education although the extent of the correlation is moderate (Ko & Lee, 2003). It has been suggested that, the amount of effort teachers expend on teaching a course depends on the value they place on the course content itself (Pajares, 1992). In other words understanding these beliefs offer the best opportunity for improving teachers' professional preparation and teaching practices (Nespor, 1987). A problem with the belief construct is that there are varied definitions in the literature and the appropriate way in which it can be measured is not clear. Pajares (1992) for instance in an attempt to address this problem, identified about twenty one conceptualisations of belief in the literature and therefore rightly termed it a 'messy construct.' Ajzen and Fishbein (1980) differentiate between different types of beliefs in their model. To them, beliefs about the positive and negative benefits associated with performing a certain behaviour constitute an attitudinal belief. They also discuss what they termed normative beliefs with Ajzen (1991) latter adding control beliefs. These other two beliefs are discussed in subsequent sections.

Subjective Norm and Normative Beliefs

Subjective norm represents individual's perceptions of general social pressure to perform or not to perform the behaviour. They indicate the particular behaviours that a person perceives to be prescribed by significant others (Ajzen & Fishbein, 1980). Thus, individuals are more (or less) likely to intend to perform the behaviour depending on their perception of whether significant others endorse (or disapprove) of the behaviour. Subjective norms are formed when an individual uses the normative expectations of significant others in the environment. These significant others may include a person's parents, spouse, close friends, co-workers and sometimes known experts depending on the nature of the behaviour (Ajzen, 1991). This contrasts with sociological use of the term "norm" which refers to broad and permissible behaviours that are not necessarily required. It is important to note that subjective norms may or may not reflect what significant others actually want the individual to do. According to the TPB, subjective norms affect behaviour indirectly

through intentions. Thus, the perceived pressure from significant others to perform a particular behaviour motivates people to make a plan towards performing the behaviour, a situation that drives actual behaviour.

Evidence from the teacher commitment literature indicates that teachers with greater administrative support from their principals and instructional support from peers and other persons are more likely to be committed to teaching in general as well as to school goals and values (Riehl & Sipple, 1996). However, results from the general application of the TPB have found the subjective norm component to be the weakest component of the theory (Zint, 2002; Armitage & Conner, 2001; Ajzen, 1991) with some authors (e.g. Sparks, Shepherd, Wieringa & Zimmermanns, 1995) deliberately removing it from analysis. In general, the subjective norm construct seem to be the most problematic for the TPB. Nevertheless, some researchers have discovered that certain behaviours and people are more influenced by normative control than others (Trafimow & Finlay, 1996). This study suggests that the influence of subjective norms depends on the strength of individuals' collective self. In other words, strong identification with a group (or groups) can make individuals weigh subjective norms more heavily when making behavioural decisions. Findings on the strength of subjective norms in predicting teachers' intention has been mixed. In a review, Zint (2002) observed that although subjective norm was not as frequent a significant predictor of intentions, when significant, subjective norm was of some greater importance in TPB studies focused on teaching behaviour than those investigating other behaviours, for example exercise behaviour (Hausenblas, Carron, & Mack, 1997). The general review of studies on teachers shows that subjective norm was often a strong predictor of teachers' intention (Zint, 2002).

Like attitude, subjective norm is also a function of beliefs. These normative beliefs are individuals' belief that specific salient referents or groups think they should or should not perform the behaviour. People who believe that their significant others think they should perform the behaviour will perceive social pressure to do so whilst those who believe that their significant others do not approve of them performing the behaviour will perceive social pressure to avoid the behaviour. Although an

individual's belief in engaging in the behaviour may involve referents, only the individual's belief that the referents think the behaviour should or should not be performed is a normative belief (Ajzen & Fishbein, 1980). In other words, only salient referents influence a person's subjective norm.

Armitage and Conner (2001) claimed that the poor prediction of intentions by subjective norms is due to the way in which it is measured. Findings from their meta-analysis revealed that the commonly used single-item measurement produced lower correlations than more reliable multi-item measures (e.g. Nunnally, 1978) which produced a significantly stronger correlation. However, on the whole, subjective norm was still the weakest predictor of intention (Armitage & Conner, 2001). These authors therefore called for an alternative conceptualisation of the construct. Another reason cited for the weakness of the subjective norm variable is that the conception of the construct is narrow, hence its weak predictive capability (Conner, Martin, Silverdale, & Grogan, 1996). There have been several suggestions for improving measurement of subjective norms with most researchers calling for an investigation of different types of norms (see for e.g. Conner & Armitage, 1998; Conner et al., 1996; Sparks & Shepherd, 1992). Prominent among this is the call for an investigation of other kinds of norms. One of this is injunctive and descriptive norms (Conner et al., 1996; Conner & McMillan, 1999). According to these views, injunctive norms represent the original conceptualisation of subjective norm in the TPB which is concerned with the approval or disapproval of the behaviour by significant others. Descriptive norms on the other hand represent individual's perception of whether or not their significant others perform the said behaviour. Studies employing descriptive norms have reported that perception of others' behaviour contributes to the prediction of intentions independently of perceived injunctive norms (e.g. Conner & McMillan, 1999; Conner et al., 1996; Grube, Morgan & McGree, 1986). This view is based on the pertinent theory that individuals develop normative beliefs by observing the actions and attitudes of other individuals (Corral-Verdugo & Frias-Armenta, 2006). For instance in some circumstances, perceived normative pressure may fail to influence pro-environmental behaviour where individuals believe a behaviour to be important but do not perceive others to

be carrying out the behaviour (Schultz, 2002, as cited in Corral-Verdugo & Frias-Armenta, 2006). Thus, it may appear from these findings that the addition of descriptive norms to assess a global subjective norm construct is warranted. However, on the whole, this construct is the part of the TPB that needs further study in order to increase the predictive power of the model (Armitage & Conner, 2001).

Perceived Behavioural Control

The perceived behavioural control construct was introduced by Ajzen (1988) into the Theory of Reasoned Action to form the TPB in order to allow for an adequate prediction of behaviours that are not under complete volitional control. Perceived behavioural control is an individual's perception of the ease or difficulty of performing the behaviour of interest. In other words, it represents the individual's perceived confidence in their own ability to perform the behaviour in question. According to Ajzen (1991), certain internal (knowledge, skills and abilities) and external (availability of resources, opportunity to perform a behaviour or dependence on others to do so) factors have been found to facilitate or interfere with ones ability to perform behaviour. That is, even if people hold very strong intentions to implement a particular behaviour, it is still subject to personal and environmental barriers. Perceived behavioural control is thus assumed to be a reflection of past experiences and anticipated impediments and obstacles. In other words, the construct taps individuals' perceptions of the factors that may facilitate or inhibit their performance of the behaviour. Generally, the successful performance of an intended behaviour depends on the extent to which individuals have control over the various unforeseen circumstances that can prevent it. Perceived behavioural control is assumed to have motivational implications for intentions, in that, people are unlikely to form a strong intention to perform behaviour if they feel that they lack enough resources or opportunity to perform the behaviour even if they hold strong attitude and their referents want them to perform the behaviour (Ajzen, 1991, p.134). In a nutshell, individuals are more likely to perform the behaviour if they are confident in their capability to perform the behaviour in question.

According to the TPB, the perceived behavioural control construct directly influences both intention and behaviour. In other words, it facilitates the implementation of individuals' intentions into action as well as predicts behaviour directly. This specification of perceived behavioural control as a direct influence on intention and behaviour provides information about perceived potential barriers to performing the behaviour, and explains why intentions do not always predict behaviour (Armitage & Conner, 2001). Perceived behavioural control together with intention directly predicts individuals' behaviour. The rationale for this direct link between perceived behavioural control and behaviour is that, in situations where individuals have the same intention to perform a given behaviour, those who are more confident that they can perform the behaviour are more likely to persevere than those who doubt their own ability to do so. Apart from directly predicting behaviour, perceived behavioural control also influences behaviour through intentions. According to Ajzen (1988), the path between perceived behavioural control and behaviour can be taken to represent actual control over the behaviour, whilst that between perceived behavioural control and intention to act represents peoples' perceived control over the behaviour.

There is evidence in the teacher commitment literature that teachers who have enough resources, are protected from intrusions on their teaching, and have autonomy regarding classroom decision are more likely to be committed to teaching in general and to the goals and values of their school (Riehl & Sipple, 1996). In testing the theory of planned behaviour however, it has been realised that the strength of perceived behavioural control in predicting behaviour depends on whether the behaviour in question is under volitional control or not. In situations where barriers to performing the behaviour exist (absence of volitional control), perceived behavioural control is more predictive of behaviour (Armitage & Conner, 2001; Ajzen, 1991). The rationale for this is that, an increase in individuals' perception of control increases the extent to which they are willing to exert more effort in order to perform the behaviour (Armitage & Conner, 2001). The strength of perceived behavioural control – intention relationship on the other hand depends upon the type of behaviour and the nature of the situation. Generally, where attitudes are strong and

normative influences are powerful, perceived behavioural control is less predictive of intentions (Ajzen, 1991). Examination of results from reviews (Zint, 2002; Ajzen, 1991) also shows that perceived behavioural control is a strong predictor of intentions when the behaviour is under low volitional control. Ko and Lee (2003) however did not find any relationship between teachers perceived barriers and the intended and actual emphasis on environmental education. They therefore concluded that the difference between intention and actual commitment cannot simply be explained by teachers' perceived barriers.

Ajzen argues that the perceived behavioural control concept is similar to Bandura's (1977; p. 193) self-efficacy concept which is "the conviction that one can successfully execute the behaviour required to produce the outcome". This is because self-efficacy, like perceived behavioural control, is concerned with the belief that people have in their own ability to perform a given behaviour (Ajzen, 1991). Efficacy refers to one's beliefs rather than observable behaviours. A teacher's self-efficacy therefore reflects the confidence that he or she is personally capable of teaching, and possesses the necessary requirements for the task of pedagogy (Coladarci, 1992). Teachers' self-efficacy is considered to be integral to effective teacher performance because it indicates how teachers rate themselves concerning pedagogical and interpersonal abilities. Subsequently, teachers with higher levels of self-efficacy, related to self-image, have been found to be more commitment to their teaching profession (Fresko et al., 1997; Coladarci, 1992). Studies in environmental education have also confirmed a relationship between teachers' self-efficacy with their intended and actual commitment to teaching environmental education (Ko & Lee, 2003).

However, several authors including Bandura (1986) have suggested that these two constructs are different. While self-efficacy concerns the cognitive perceptions of control, perceived behavioural control on the other hand reflects more general, external factors (Bandura, 1986). Armitage and Conner (2001) in a meta-analysis of studies that employed both constructs found a difference between measures of self-efficacy and perceived behavioural control. Although both constructs were

significantly correlated with intention and behaviour, their findings showed that self-efficacy accounted for the most additional variance in intention while perceived behavioural control and self-efficacy accounted for equivalent proportions in behaviour. This is probably because the formation of intention is based on the confidence of the individual to enact the behaviour (i.e. those they perceive self-efficacy over), and the translation of that intention into action is probably made possible by both the self-efficacy and an evaluation of external factors tapped by perceived behavioural control (Armitage & Conner, 2001). These findings suggest that both self-efficacy and perceived behavioural control (external factors) are useful predictors of intention and behaviour and should be taken into account in measuring a global perceived behavioural control. There has also been a suggestion to distinguish between 'perceive difficulty' and 'perceive control' in measuring perceived behavioural control (Sparks, Guthrie, & Shepherd, 1997). This is because items which tap perceived difficulty are more similar to the original conceptualization of perceived behavioural control by Ajzen (1991). However, Armitage and Conner (1999) have argued that asking individuals about perceived difficulty of a behaviour does not allow discrimination between ease or difficulty in relation to external factors, as for example availability of resources.

Like the other two predictors of intention, perceived behavioural control is determined by *control beliefs*. It is based on the premise that there are beliefs that deal with the presence or absence of required resources and opportunities. These beliefs may be determined by past experience with the behaviour, second-hand information about the behaviour, observing the experiences of others or by factors that increase or decrease the perceived difficulty of performing the behaviour (Ajzen, 1991). It is the perceived power of specific factors to facilitate or inhibit performance of the behaviour. Individuals who think they have more resources and opportunities to perform the behaviour and anticipate fewer obstacles would have a greater perceived control over the behaviour.

3.5.1. Predictive Power of the Theory of Planned Behaviour

The TPB and to a lesser extent its predecessor the theory of reasoned action, have informed a substantial body of study in the prediction of behaviour. It has been used to understand different kinds of health behaviours (Armitage, Conner, Loach & Willets, 1999; Conner et al, 1996; Sparks et al., 1995), and pro-environmental behaviour (Taylor & Todd, 1997; Boldero, 1995; Stutzman & Green, 1982). The model's usefulness in providing insight into teaching intentions has also been demonstrated in different aspects of education (Czerniak, Lumpe, Haney & Beck, 1999; Lin & Wilson, 1998; Astrom & Mwangosi, 2000) and to a limited extent in determining teachers' intention and commitment to EE (Ko & Lee, 2003; Zint, 2002). Several reviews and meta-analysis have also provided support for the efficacy of TPB in predicting and explaining different kinds of behaviour (e.g. Armitage & Conner, 2001; Ajzen, 1991; Hausenblas et al., 1997). Results from these reviews and meta-analyses suggest that intentions to perform behaviours of different kinds can be predicted with high accuracy from attitude, subjective norms and perceived behavioural control; and this intention together with perceived behavioural control account for a considerable explanation of behaviour (Ajzen, 1991). However, the exact nature of the relationships of the beliefs underlying constructs in the model and the appropriate mode of measurements are still uncertain.

In a review of 19 data sets that applied the TPB, Ajzen (1991) found that the three predictors in the TPB (attitude, subjective norm and perceived behavioural control) accounted for a considerable amount of variance in intention. The combination of intention and perceived behavioural control permitted a significant prediction of different kinds of behaviours in 17 of the studies. The general trend in the review indicates that when behaviour was under volitional control, intention was the most significant predictor while perceived behavioural control was the most significant predictor when there was less volitional control. In terms of intentions, the results showed that perceived behavioural control was a significant predictor of intention in all 19 studies and attitude toward the behaviour in all but 1 (5%) of the data sets. The subjective norms construct on the other hand was a significant predictor in only 10 (53%) of the 19 studies. Overall, attitude was the most significant predictor of

intention in 10 of the 19 studies, followed closely by perceived behavioural control in the remaining 9 studies, and then subjective norm which was not the most significant in any of the studies.

These findings were supported by a meta-analysis of 185 studies that employed the TPB (Armitage & Conner, 2001). Result from this meta-analysis showed that attitude, subjective norm and perceived behavioural control explained about 39% of the variance in intention, with an average multiple correlation of .63. In terms of behaviour, the TPB variables were found to explain a significant 20% of variance in observed behaviour and 31% of variance in self-reported behaviour. Although the significant difference in the two measurements of behaviour was of concern, the authors observed that the medium to large effect size accounted for in actual behaviour provides further evidence of the efficacy of the model. On the whole, intention accounted for the most significant amount of variance (22%) in behaviour while perceived behavioural control accounted for 13% of total variance in behaviour. With regards to the relative strength of the predictive variables on intentions, the findings confirmed attitude to be the most significant predictor explaining 24% of variance of intentions, followed by perceived behavioural control (18% of variance) and subjective norm (12% of variance). The trends reported in this meta-analysis were similar to those reported in Ajzen's (1991) review.

Studies of teachers have equally demonstrated the efficacy of the TPB. Zint (2002) reviewed 13 studies that used the TPB to understand and predict various aspects of teacher intentions and behaviour. Overall findings indicated that the TPB variables (attitude, subjective norms and perceived behavioural control) provided a significant explanation of the variance in intention ranging from 7% to 64%, with an average of 34%. Although the mean multiple correlation was lower than previous reviews of other populations, the findings were in line with general trends (e.g. Armitage & Conner, 2001; Ajzen, 1991). In terms of understanding behaviour, only two studies in the review reported actual behaviour data with only one predicting behaviour based on perceived behavioural control and intention. The amount of variance explained in behaviour reported in the single study that employed the full TPB

variables was 11%, smaller than the mean reported in previous studies although within the range (e.g. Armitage & Conner, 2001; Ajzen, 1991). The predictive power of individual variables showed attitude and perceived behavioural control significantly predicted teachers' intentions in all but 2 (17%) of the 12 data sets. Subjective norm on the other hand was only a significant predictor of teachers' intentions in 4 (33%) of the 12 data sets. However, unlike in findings of reviews of other populations, when determinants were significant, attitude was the most important predictor of teachers' intention followed by subjective norm and then perceived behavioural control. Thus, as observed earlier, subjective norm was a more significant predictor of teachers' intention than with other populations (see e.g. Hausenblas et al., 1997). The one study reporting behaviour also indicated intentions to significantly predict behaviour more than perceived behavioural control.

Ko and Lee (2003) found that the selected variables of the TPB they used did not provide a significant explanation in the amount of variance of intention to teach EE. In terms of predicting actual commitment, intention, attitude and self-efficacy significantly explained 25% of the variance in teachers' actual commitment to EE although the explanatory power was small. However, it should be noted that Ko and Lee did not apply the full TPB in their study and some specifications in their model also differed. For instance they left out the subjective norm component and separated self-efficacy from perceived barriers. Additionally, while self efficacy was specified to predict intention it was not specified as a direct predictor of commitment. Likewise, perceived barriers were only specified to predict commitment and not intentions. Zint (2002) found that the theory of planned behaviour provided a significant explanation (28%) in science teachers' intention to implement environmental risk education into their science lessons. Zint however, did not measure teachers' actual commitment.

Even though evidence for the efficacy of the TPB to explain a range of behaviours including that of teacher behaviour have been established, very few studies to date exists that uses this theoretical framework in understanding primary school teachers'

actual commitment to EE. To the knowledge of this thesis, no such study exists in either Scotland or the United Kingdom as a whole.

3.5.2. Criticisms and Adequacy of the Theory of Planned Behaviour

The TPB is however not without its critics. The main criticisms that are considered here regard the sufficiency of the model in predicting behaviours, its unidirectional linear assumptions and certain measurement limitations. Several studies have questioned the sufficiency of the TPB with Ajzen (1991) calling for further investigation into other behaviour specific factors which might influence a specific behaviour. Based on this, several authors have made modifications to the original theory by adding new variables. The inclusion of past behaviour as a predictor of current behaviour is particularly common in the literature (See e.g. Conner & McMillan, 1999; Ajzen, 1991). Various alternative theoretical frameworks (e.g. Bagozzi & Warshaw's (1990) Theory of Trying) have been written to accommodate these subsequent variations in the TPB. Another criticism levelled at TPB is that it fails to take into consideration possible interactions between the theoretical components (attitude, subject norm and perceived behavioural control) influencing behaviour (Eagly & Chiaken, 1993). Several studies (e.g. Umeh & Patel, 2004; Conner & McMillan, 1999) have investigated and found possible interaction effects between some of the theory's components. Practical consideration of these interactions leads to a more precise prediction of current behaviour (Grube & Morgan, 1990). The final criticism of the model is related to the way some of the constructs are measured and Ajzen and Fishbein's (1980) proposition for using multiplicative composites. Some of the theory's constructs (e.g. subjective norms and intention) have in the past relied on the use of single-item measures. However, these measures do not ensure reliability when compared with multi-item measures (Nunnally, 1978). Also, the relationship between some of the beliefs and their underlying constructs in the model has still not been fully resolved (Ajzen, 1991). Moreover, the actual dimensionality of the constructs has still not been fully explored. Thus, one should bear in mind these measurement limitations when using the TPB. The proposition for a multiplicative composite has been criticised by Evans

(1991). This issue is discussed in detail in the quantitative methodology chapter. Despite these limitations, the TPB is still the choice for the current study due to its clarity, simplicity and efficacy as a powerful tool for understanding and predicting behaviour.

3.6. Significant Life Experiences

Investigation into significant life experiences that influence individuals' commitment to environmental issues (Chawla, 1999; Palmer, Suggate, Robottom & Hart, 1999; Palmer & Suggate, 1996) is probably one of the most influential qualitative bodies of knowledge to provide an insight into the development of teacher commitment to EE. These studies provide a framework that links individual commitments to EE to certain significant life experiences. Generally, these studies sought to identify the influences and experiences of environmental educators that led to their development of understanding and concern for the environment. The rationale for this is that if educators were aware of the significant experiences that motivate commitment to environmental action, then they will be better placed to design learning experiences that foster the development of active and informed minds.

These studies interviewed practicing environmentalists and found that certain significant life experiences contribute to the development of values and beliefs that makes one committed to environmental issues. Palmer (1993, as cited in Palmer 1998) investigated categories of influence and formative life experiences of environmental educators. The study aimed to highlight the life experiences that are responsible for producing adults who are informed about and actively promote pro-environmental behaviour in the UK. Data were collected from 232 environmental educators who were asked to provide autobiographical statements of the significant life experiences that they thought influenced their concern for the environment. To verify the environmental commitment of participants, Palmer provided a list of practical environmental activities and participants were asked to identify which of the activities they engaged in regularly. The activities included recycling, membership of organisations that are actively engaged in environmental issues,

curriculum development in EE, buying environmentally friendly goods and living a green lifestyle. The overall result indicated that participants could be characterised as actively engaging in pro-environmental behaviour. For instance about 90% of the participants read about environmental concerns and tried to lead a 'green lifestyle.' By analysing the autobiographical statements of participants, Palmer identified categories of past experiences which appeared to influence respondents concern for the environment. Thirteen refined categories of experiences, each with sub-categories, emerged in the final analysis (Table 3.1). A more detailed analysis of the categories and sub-categories was provided in Palmer and Suggate (1996).

Generally, outdoor related activities, education courses and parents appeared to have been the most influential experiences influencing participants concern for the environment. What the findings also indicate is that participants mostly mentioned more than one experience as influencing their current concern for the environmental issues. These findings have been replicated in similar studies around the world (see for e.g. Palmer et al., 1999).

Table 3.1: Significant life experiences: Categories of response (Palmer, 1998)

Category of Influence	**No. and (%) of Response**
Outdoors	211 (91)
Education courses	136 (59)
Parents/close relatives	88 (38)
Organisations	83 (36)
Television/media	53 (23)
Friend/other individuals	49 (21)
Travel abroad	44 (19)
Disasters/negative issues	41 (18)
Books	35 (15)
Becoming a parent	20 (9)
Keeping pets and animals	14 (6)
Religion/God	13 (6)
Others	35 (15)

Subsequent support for these findings has been provided by Chawla (1999) who interviewed environmentalists in Norway and the United States. To ensure that participants were active environmentalists, Chawla employed a kind of snowballing approach. That is participants had to be recommended more than once by others as someone who was a well-known environmental figure. Like previous studies, autobiographical data was collected and analysed to identify significant influential factors. An important finding from this study was that each participant identified an average of four experiences as influencing his or her commitment to pro-environmental behaviour. In other words, multiple experiences were responsible for influencing commitment. Most frequent life experiences identified were nature related, family influences, membership of environmental organisations, negative environmental experiences and education.

A common thread in all these findings is that nature related experiences are influential in making people develop concern for environmental issues. Also, the time of influence of such experiences ranged from childhood to adulthood. Knowledge of these life experiences may provide insight into teachers' commitment not only because some of the studies were carried out on environmental educators but because they shed light on what life experiences are likely to make one teacher more committed to teaching EE than another. They also indicate the experiences which could be provided in both pre-service and in-service training programs in order to make more teachers committed to EE.

Since these studies have mainly focused on those who can be classified as active environmentalist, it would be useful to investigate the extent to which these life experiences are important in influencing the general population of teachers who teach subjects other than EE. The next section discusses a theoretical framework proposed by Shuman and Ham (1997) in which the life experience variables were incorporated into the Theory of Planned Behaviour in order to understand the influences on teachers' commitment to teaching EE. This approach is significant because it provides an opportunity to determine the extent to which the life experience construct influences commitment to EE among the general population of

teachers. Moreover, since most of the studies on life experiences have used a qualitative approach, its inclusion in the TPB allows for a quantitative analysis of the construct. This quantitative analysis will help to complement existing qualitative studies and expand our knowledge of the life experience variable.

3.7. Towards Integration: The Model of Environmental Education Commitment

The model of environmental commitment (Shuman & Ham, 1997; Shuman 1995) is largely influenced by the TPB. This model integrates the significant life experience construct into the TPB in order to provide a framework that captures teachers' commitment to teaching EE in the face of existing barriers. Shuman and Ham (1997) proposed that findings from studies on significant life experiences (e.g. Palmer & Suggate, 1996) provide a theoretical support for understanding events that may influence the development of teachers as well as an understanding of why they are committed to teaching EE. The model postulates that different types of life experiences connected to environmental issues influence the development of beliefs that underlies teachers' commitment to teaching EE. The significant life experiences according to the model provide an explanation of why some teachers are more committed to teaching EE than others even if barriers exist. The premise was that although most teachers for instance have positive attitudes to teaching environmental education it does not necessarily reflect their actual behaviour because of barriers to engaging in EE. Thus the deciding factor for a teacher to follow through his or her positive attitude in the face of barriers can be explained by their life experiences. According to the model, the life experiences that influence teachers' commitment can occur during childhood, college and adulthood which may be combined to form a life experience construct. For instance, a teacher may have engaged in outdoor activities as a child, read nature related books, and continued to engage in environmentally related activities as an adult which may have an influence on his or her current commitment. Likewise, another teacher may have had college classes or in-services EE workshop that serves to stimulate his or her commitment to EE. In

other words, both life experiences and the life stage at which the experience occurred are important in determining teachers' commitment to EE.

The impetus for including the life experience variable in the model is based on Ajzen and Fishbein's (1980) proposition that other external variables might have an effect on beliefs hypothesised in their model although this was not directly included in their theory. In developing the Model of Environmental Education Commitment (MEEC) therefore, Shuman and Ham (1997) presumed that these external variables might well include significant life experiences. Shuman (1995) emphasised this point stating that: "...theoretically, teacher development may be seen as consisting of a series of life events that may influence teacher's development of beliefs and attitudes, intentions and actual behaviour" (p. 14).

The life experience variables directly influence the development of teachers' attitudinal beliefs, subjective norms and perceived behavioural control towards EE. A teacher might for instance develop a positive attitudinal belief toward teaching EE after observing an environmental disaster, be normatively influenced to teach EE by family members who are themselves interested in environmental issues, or develop self-efficacy in teaching EE as a result of membership of an environmental organisation. There is some empirical support for the hypothesised relationships between life experiences and beliefs that underlie commitment to environmental issues. Studies have for instance shown that taking part in pro-environmental behaviours can lead to the development of positive attitudes towards environmental issues (Kaiser, Oerke, & Bogner, 2007; Leeming, Porter, Dwyer, Cobern, & Oliver, 1997). In other words, teachers who have had experiences connected to environmental issues should have a more positive attitude toward the teaching of EE. Furthermore, attending courses focused on environmental issues has been shown to influence teachers' perceived competences, attitude and the amount of class time devoted to EE (Lane & Wilke, 1995). The relationships between significant life experiences and the TPB constructs are therefore theoretically plausible.

Within the model, commitment is however akin to intentions in the TPB. The model thus demonstrates the relationship between life experience variables and teachers' intention to teach EE. It proposes that teachers with a strong intention to teach have a greater probability to overcome barriers and carry out their intended behaviour. A diagrammatic representation of the model is presented in Figure 3.2.

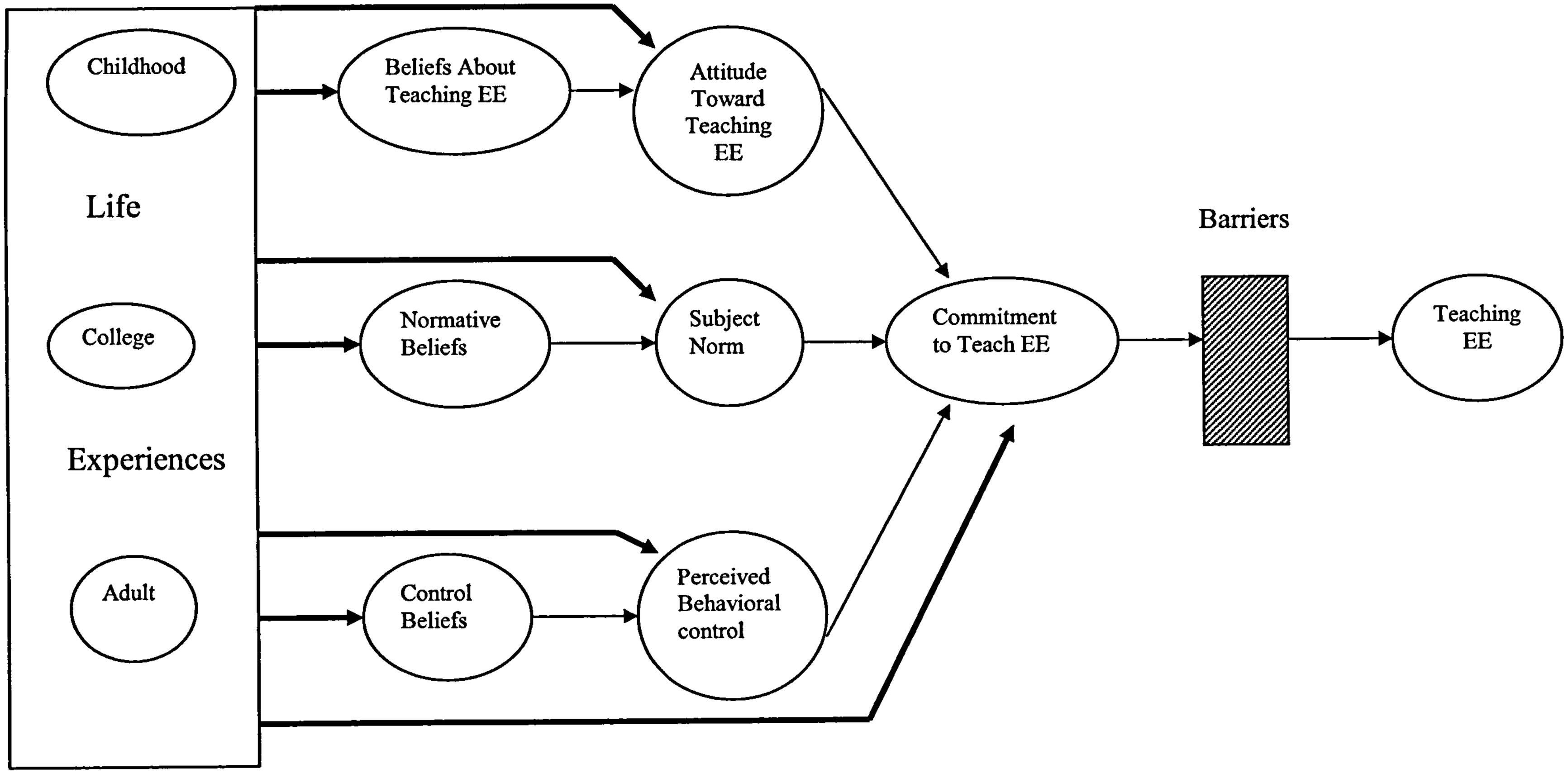


Figure 3.2: The Model of Environmental Education Commitment (MEEC). Adapted from Shuman (1995)

Shuman and Ham (1997) proposed that measurement of the life experience variable could be based on an existing list of experiences related to teaching, or by sampling experiences of committed teachers to generate a pool of items to compose a life experience scale. They also proposed that the hypothesised relationships between the variables in the model be tested using a multivariate approach such as structural equation modelling. This approach would also allow a determination of the explanatory power of the entire model in providing understanding about the antecedents of teacher commitment to teaching EE.

3.7.1. Testing of the Model of Environmental Education Commitment

A preliminary test of the MEEC was carried out by Shuman (1995). She developed a scale for measuring life experiences at key stages of the individual (childhood, college and adulthood) and incorporated it in the Theory of Planned Behaviour to evaluate the MEEC. Using structural equation modelling, the interrelationships among the variables within the model were also evaluated. The result revealed the survey data fitted certain aspects of the model better than others. This led to the model being modified and re-tested for goodness-of-fit. The final MEEC showed that subjective norm, perceived behavioural control and informal nature related life experiences had the greatest effect on teachers' intention to teach EE. Surprisingly, attitude was found to have no effect, in contrast to most studies applying the TPB or studying teacher behaviour which report the attitudinal factor as the strongest variable influencing teacher intention (e.g. Zint, 2002). The model was generally a poor fit to the data and did not provide an adequate explanation of teachers' intention. Shuman (1995) reasoned that this might have been due to the inability of the scale to capture the underlying construct of attitude toward teaching EE. Also, the questionnaire used in the study was too long and tedious for the respondents leading to many missing variables and large measurement error characteristics.

In spite of the inconclusive statistical support for the MEEC, it still provides a comprehensive and useful framework for understanding teacher commitment to teaching EE. It is therefore the aim in this thesis to modify and retest the MEEC in

order to determine the extent to which this can provide an adequate explanation for teachers' commitment to EE. The next section discusses the reasons for choosing this theoretical framework as well as the various modifications made to Shuman and Ham's (1997) original model. It concludes with a presentation of the revised model for the current study.

3.8. Theoretical and Measurement Framework for the Current Study

After a careful review of the theoretical and empirical influences on teachers commitment to teach EE, Shuman and Ham's (1997) model of environmental education commitment was adapted as the framework for examining the determinants of teachers' commitment to EE. As briefly stated in the introduction, the current thesis adopted a mixed methods approach. The framework of the MEEC was mainly used for guiding the quantitative phase of analysis although certain aspects were incorporated into the qualitative phase. The choice of MEEC as a framework for this thesis was based on the following reasons:

Firstly, the predictive power of the theory of planned behaviour in explaining different kinds of social behaviour (see e.g. Ajzen, 1991) and teacher intentions in particular (e.g. Zint, 2002) has been demonstrated. The TPB has well tested theoretical underpinnings and evidence from narrative and meta-analytic reviews points that it is a useful model for predicting a wide range of behaviours and behavioural intentions (Armitage & Conner, 2001). In other words, it is a useful model that can bring a clear and comprehensive understanding of the influences that shapes teachers' commitment to EE.

Secondly, the inclusion of the significant life experience variable offers a potential for exploring the life experiences that might help develop a new generation of teachers committed to teaching EE. It is also based on the premise that if teaching of EE is seen as a form of pro-environmental behaviour, then the MEEC provides a useful framework for examining determinants of this behaviour. In addition, as evident from the reviews above, different influences and motivations account for

teachers' commitment to EE. A common message from all these studies is that, the factors affecting teachers are multi-dimensional and complex. It is believed that the MEEC takes this multi-dimensional perspective into account and could bring about a better understanding of commitment than when only one or a few factors are selected. Finally, although several studies have been carried out on the influences of teacher commitment, very little research on a theoretical model for teacher commitment to EE exists.

The MEEC for the current study was modified in various ways. Firstly, the term commitment in the modified model differed from the usage provided by Shuman and Ham (1997) whereby commitment was akin to intentions to teach EE. In this study however, commitment was specified as teachers' actual teaching behaviour rather intended behaviour. In other words, the degree to which teachers currently teach EE constitutes commitment. Secondly, in the original specification of the MEEC (Shuman, 1995), perceived behavioural control was specified to directly influence intentions but not actual behaviour and barriers to teaching EE was specified to mediate between intentions and actual behaviour. This is somehow different from Ajzen's (1991) conceptualisation of how perceived behavioural control influences intention and behaviour. In the modified model, Ajzen's original conceptualisation was followed in that perceived behavioural control was specified to directly influence both intentions and behaviour. Also, perceived barriers to EE were specified as perceived behavioural control in line with the original theory of planned behaviour. Finally, the modified model for the current study did not include a separation of life experiences into the various life stages as proposed by Shuman (1995). This is because the life experience variable was seen as a unified construct which taps into participants' experiences without being repetitive about when the experience occurred. The absence of such repetitions also helps eliminate potential problems associated with lengthy questionnaires (e.g. Shuman, 1995). The revised model for the current study is presented in Figure 3.3.

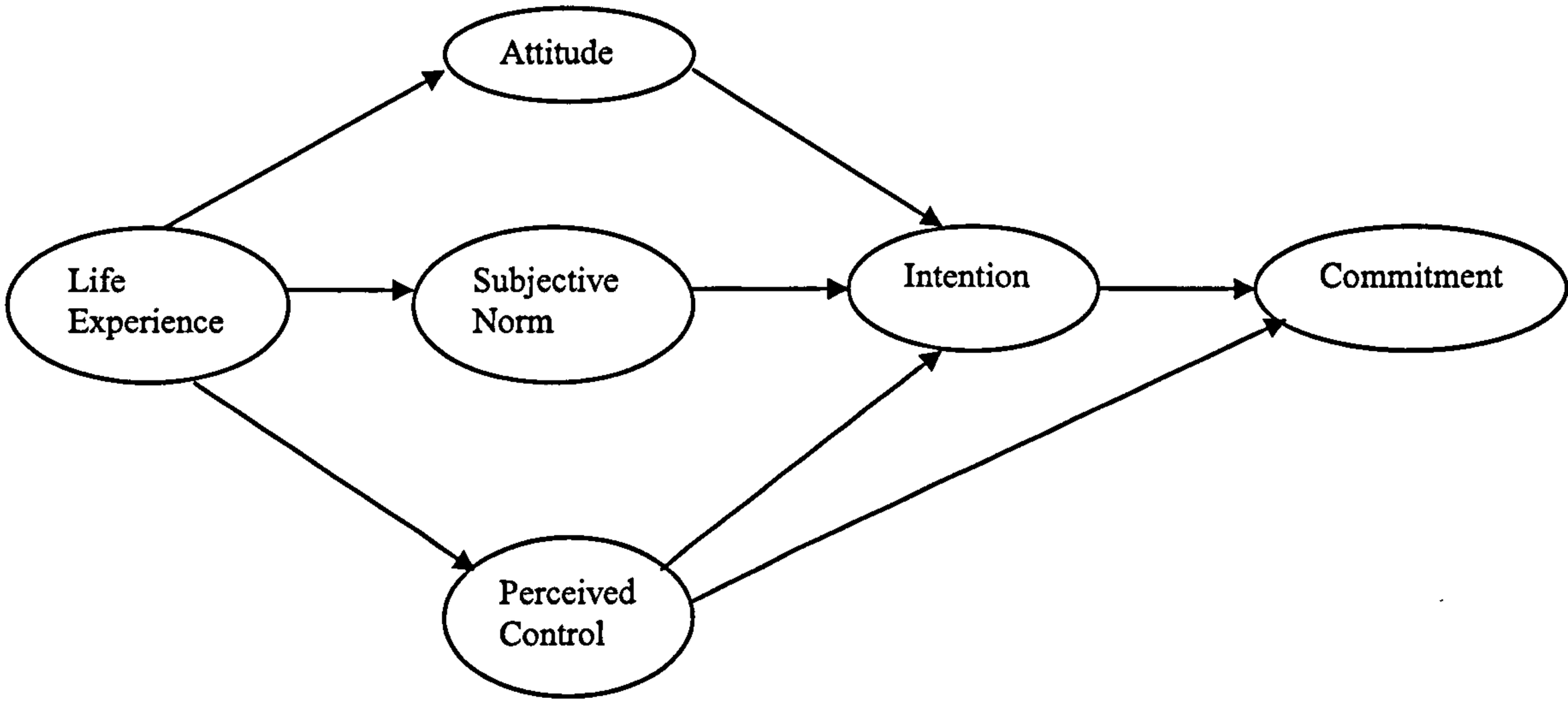


Figure 3.3: Revision of Shuman and Ham's (1997) Model of Environmental Education Commitment

In the context of this thesis, the model suggests that primary school teachers will be committed to teaching EE if they have a strong intention to do so, have a positive attitude toward teaching EE, if they perceive social pressure to do so, and are confident in their ability to teach EE. Consequently, teachers with significant life experiences related to environmental issues should develop favourable beliefs of the aforementioned determinants that promote commitment. This study is different from many others applying the theoretical framework of the TPB to understand teachers' commitment, in that they mostly measure intentions. However, in this study, actual behaviour is also measured through self-reports. This application of the theory to measure actual behaviour allows for a more powerful test of the theory than only measuring self-reported behavioural intentions (Gotch & Hall, 2004).

3.9. Conclusion

This chapter presented the theoretical and empirical framework within which the study is situated. It began by examining various conceptualisations of teacher commitment. From these discussions, it was concluded that teacher commitment in this study reflect the degree to which teachers psychologically identify with

environmental education goals and values, and the extent to which these goals are actually implemented by the individual teacher in the classroom. The chapter also discussed various theoretical and empirical frameworks that shed light on our understanding of what makes some teachers more committed to teaching EE than others. In the first phase of this discussion, theories of pro-environmental behaviour were presented. This was followed by a discussion of empirical determinants of commitment to teaching EE. The social psychology theory of planned behaviour was then presented as one of the influential frameworks within which to conceptualise the study. Subsequently, studies that explored the importance of significant life experiences in the development of concern for the environment was envisaged to offer insight into understanding commitment. The chapter concluded with a presentation of the model of environmental education commitment which integrates the significant life experience variable into the theory of planned behaviour. It is this theory which provides a framework for the subsequent stages of the thesis.

CHAPTER FOUR

Research Methodologies

4.1. Introduction

This chapter presents a review of the methodological design that was used in the study. The aim here is to outline and justify why a mixed methods approach was chosen for the study and the philosophical assumptions underlying this choice. The first and second phases of this chapter discuss the philosophical assumptions underlying quantitative and qualitative strategies. This is followed by the third phase in which the mixed methodology procedure employed for this study is examined.

4.2. Methodological Debates

The methodologies and methods chosen for any research and the justification for those chosen methods are rooted in the assumptions of the nature of reality and the theory of knowledge (Crotty, 1998). These assumptions or theories are sometimes referred to as paradigms. 'Paradigm' comes from the Greek word *paradeigma*, meaning 'pattern' (Hoban, 2002). Guba and Lincoln (1994) defined paradigm as "the basic belief system or worldview that guides an investigation, not only in the choices of method but in ontologically and epistemologically fundamental ways…" (p. 105). Broadly speaking, it can also be viewed as "systems of shared beliefs among a community of scholars" (Morgan, 2007, p. 65). Researchers adopting specific paradigms often think in similar ways because it is only by following these beliefs when conducting a research that one can gain acceptance within that community (Hoban, 2002). Thus, differences between paradigms have significant and important implications at practical, material and everyday level (Denzin & Lincoln, 2005). Consideration of these philosophical assumptions are vital as it helps prevent what Mason (1996) refers to as "…assembling an untidy bag of methods with little logic, and with little hope of sensibly integrating the products into a coherent analysis" (p. 26). A *methodology* is an action plan or strategy that provides how research is carried out in the context of a particular paradigm. Examples are experimental research,

survey research, ethnography, etc. The methodology governs the choice and use of methods. *Methods* are the techniques and procedures used for the data collection for the study. Examples of methods are questionnaires, interviews, observation, etc.

Debates or wars have been waged regarding the superiority of the two major social science paradigms, that is, the positivist and the constructivist paradigms (Tashakkori & Teddlie, 1998; Guba & Lincoln, 1994). The positivist paradigm has been linked to quantitative methods and constructivist paradigm underlies the qualitative methods with the major disagreement resting on their definition of the nature of reality (Tashakkori & Teddlie, 1998). Purists from both quantitative and qualitative traditions have claimed superiority at arriving at social truth (Tashakkori & Teddlie, 1998; Guba & Lincoln, 1994). These wars have been fought in all disciplines in the social and behavioural sciences among them education, psychology, anthropology and evaluation research. Research in environmental education (EE) has not been immune from these debates (See for e.g. Connell, 1997) with some EE researchers warning of the dangers of mixing varying methodological approaches (Dillon & Arjen, 2006). A more recent position by "pacifists" is that both the qualitative and quantitative methods are compatible. This group of "peace makers" have been called *pragmatists* and their ideas underlie the mixed methods or methodology approach (Tashakkori & Teddlie, 1998). Although various schools of thought exist, only those related to the current study will be discussed. It is also necessary to acknowledge that this is not a treatise of paradigms but a brief overview. A thorough review has been provided by various authors such as Crotty (1998).

4.3. Quantitative Approaches to Research

Quantitative approaches are based on a positivist paradigm. Positivism has its root to the 19th century philosophers like August Comte and Newton. As an approach to social science research, it seeks to apply the research model of physical sciences to investigate and explain the social world (Johnson & Onwuegbuzie, 2004; Denscombe, 2002). Positivists contend that knowledge should solely be based on observable facts and they reject any form of speculation about 'ultimate origins'

(Tashakkori & Teddlie, 1998). They uphold that there is a single reality, inquiry is value-free, time and context free generalizations are possible, and there are real discoverable causes that lead to effects (Guba & Lincoln, 1994). The core of this approach is the emphasis on analysis that identifies independent elements that are equal to variables in scientific experiments (Hoban, 2002). It is therefore a deterministic philosophy in which causes are the determinants of outcomes.

In quantitative research, problems are studied by examining the causes that influence their outcomes such as in experiments. Using a reductionistic approach, ideas and variables that constitute a hypothesis or research question are reduced to small, discrete parts to be tested. Knowledge is acquired through careful observation and measurement of objective reality which exists "out there" in the world. Quantitative researchers thus rely on development of numeric measures of observation. To them, theories exist to govern the world and these theories must be tested and refined for a better understanding of the world. The acceptable research procedure is to begin with a theory, collect data that turn to support or refute the theory and making revisions for further testing (Creswell, 2003). The major strategies of enquiry include experiments, surveys, content analysis and structured observation (Sarantakos, 2005). Closed-ended questions and predetermined approaches are employed to generate and analyse numeric data.

The basic strength of the quantitative approach is that its findings can be generalised to a larger population when the data are based on random samples of sufficient size, and when findings have been replicated on many different populations. The approach also seems to have more credibility with administrators, policy makers and politicians who are generally interested in making quick decisions to cover a large constituency (Johnson & Onwuegbuzie, 2004). Finally, quantitative research is more suitable for studying large number of people.

Critiques of quantitative research claim that ideas from physical science research are best suited in the understanding of material things and are limited when it comes to issues related to morality, spiritual-wellbeing and the meaning of life. Also, since

participants and researchers' own interpretation influences outcomes, the tenets of positivism (e.g. objective, value-free) has been realised to remain an ideal or aspiration and not a reflection of practice in the 'real world' (Denscombe, 2002). For instance, Johnson & Onwuegbuzie (2004) noted that several subjective judgement calls, as for example developing instruments believed to measure a targeted construct, choosing specific tests and items for measurement and making score interpretations are made by quantitative researchers. In education, results from quantitative research have been criticised as being different from practical knowledge of teachers who engage in reflective inquiry (Schon, 1983). Quantitative researchers have also been accused of constructing lists of effective characteristics which are used as a process of improving education. Critiques claim this mechanistic view of reality is based on a static context which assumes a universal similarity of teachers and classrooms (Hoban, 2002). In a satirical description, Hoban (2002) likened this to "disassembling a complicated machine that has been purposely designed for a specific location and putting it back together in a different context, expecting it to work in exactly the same way" (p. 19). Schon (1983) thus called for researchers to acknowledge the complexity, uncertainty, instability, uniqueness, and value-conflict that characterise work settings which makes it difficult to adopt formal knowledge without consideration of changing its context.

4.4. Qualitative Approaches to Research

The underlying philosophical basis of qualitative approach is much complex and constantly evolving. Its root can however be traced to the Interpretive paradigm. Variants of the philosophy of qualitative research include constructivism, critical (Marxist, emancipatory), and feminist-poststructural paradigms (Denzin & Lincoln, 2003). However, all these philosophies share the basic tenets of the interpretive paradigm. Interpretivists reject what they term positivism and called for the superiority of constructivism, idealism, relativism, humanism and sometimes postmodernism (Lincoln & Guba, 2000; Schwandt, 2000). They contend that people seek understanding into the world in which they live and develop subjective meaning of their experiences. These meanings are varied and multiple and researchers' should aim to find the complexity inherent in these views rather than narrowing it to few

ideas or categories. To them multiple constructed realities abound, context-free generalisations are not possible, research is value bound and the values of the researcher cannot be de-linked from his or her findings (Creswell, 2003). They also note that people react to the knowledge that is produced when being studied and the outcomes of research produces a feedback loop which complicates matters in a way that is absent in the natural sciences (Denscombe, 2002).

Qualitative researchers place emphases on the process of interaction among individuals because they believe subjective meanings are negotiated socially and historically. They contend that it is not possible to gain objective knowledge about social phenomena because the researchers' expectations and predispositions colour observations and explanations (Denscombe, 2002). To them, researchers try to make sense of (or interpret) the meanings that other people have about the world. Compared with quantitative researchers who begin with a theory, qualitative researchers inductively develop a theory or pattern of meaning in context. Their strategies of inquiry include phenomenology, grounded theory, ethnography, case study and narrative (Creswell, 2003). Methods employed include use of open-ended questions, interviews, observations, emerging approaches, and text or image data analysis.

This approach is particularly useful for studying a limited number of cases in depth, describing complex phenomena, generating inductively explanatory theory about a phenomenon and providing rich detail of phenomenon in local contexts (Johnson & Onwuegbuzie, 2004). Qualitative perspectives have also influenced researchers to be more careful, modest and more tentative regarding their claims about the social world. Findings from qualitative research are also context-sensitive in that it focuses on understanding a phenomenon by taking environment into consideration (Sarantakos, 2005).

Qualitative research however has its critics who point out the weaknesses of this approach. Notable among them is that findings from qualitative research cannot be generalized and are unique to only the few people included in the research. Findings

from this approach thus have a lower credibility with some policy makers and administrators who are interested in making decisions to cover a large group of people or areas (Johnson & Onwuegbuzie, 2004). Furthermore, the credibility of qualitative findings has been called to question on the grounds that its methods of analysis remain private and not available for public scrutiny (Constas, 1992). Thus it is difficult to know whether what is claimed is trustworthy or defensible. Also, 'postmodernists' have been accused of taking the philosophical argument to a logical extreme. They argue that researchers should abandon all pretence of objectivity and rather accept that social reality is a shifting and a contradictory phenomenon which lends itself to short-lived, small scale and partial accounts by researchers. This argument calls into question the objectivity and authority of the qualitative researcher and taken to a logical extreme can mean that anything goes since no finding is worse than the other. In other words it can be abused by people doing sloppy research to justify their lack of rigour (Denscombe, 2002). It is however worth noting that good qualitative research call for a systematic and rigorous approach.

4.5. Mixed Methods Approaches to Research

Many researchers think the distinction between positivism and interpretivism has been overdrawn because no single methodology is a panacea or a guarantee to understanding all problems. Furthermore, metaphysical debates have very little influence on the practical decisions made by researchers (Morgan, 2007; Guba & Lincoln, 1994). These group of peace makers known as pragmatists, tried to counter the incompatibility thesis of the paradigm 'warriors' which is based on the paradigm-method link (Tashakkori & Teddlie, 1998). Pragmatists are concerned with "what works" and are not interested in searching for metaphysical truths. To them, solutions to problems are of more importance than methods and researchers are encouraged to use all approaches to understand the problem (Creswell, 2003). According to Tashakkori and Teddlie (1998):

> Pragmatists consider the research question to be more important than either the method they use or the worldview that is supposed to underlie the method. Most good researchers prefer addressing their research question with

> any methodological tool available, using the pragmatic credo of 'what works. (p. 21)

The point is that, although paradigmatic considerations and methods employed are necessary, they are not as important in the final analysis as the research questions that one is attempting to answer (Tashakkori & Teddlie, 1998). Taking a pragmatic approach opens the door to multiple methods, worldviews and assumptions and helps help improve communication among researchers from different paradigms. Careful examination of both positivist and interpretive research also shows extensive commonalities between the paradigms. Thus combining both approaches would bring a greater understanding to the problem being studied (Guba & Lincoln, 2005; Johnson & Onwuegbuzie, 2004).

Pragmatism is not committed to any one system of philosophy and underlies a mixed methods approach. Individuals are free to draw from methods, procedures and techniques in both quantitative and qualitative assumptions when they engage in research (Creswell, 2003). Mixed methods research relates to studies that combine qualitative and quantitative approaches into the research methodology of a single study or multiphased study (Tashakkori & Teddlie, 1998). The current acceptable definition of a mixed method research involves collecting and analysing both quantitative and qualitative data in a single study which combines and contrasts the results (Johnson, Onwuegbuzie & Turner, 2007; Creswell, 2003). The origin of mixed method approach has been credited to Campbell and Fiske (1959) who used multiple methods in studying the validity of psychological traits and the idea that qualitative and quantitative methods should be seen as complementary rather than rival camps. The approach termed the *triangulation technique* was to ensure that the difference in findings was accounted for by the traits under study and not the methods employed. Their encouragement to others to use multiple approaches in collecting data within a study prompted other researchers to mix methods (Creswell, 2003).

Although the distinctiveness of paradigm has been argued in the past (see for e.g. Guba & Lincoln, 1994) current statements by so called 'paradigm warriors' are showing signs of convergence and there is a gradual cooperation among the various fields. Borders and boundaries of these paradigms have begun to blur and there is a rising interest in mixed method approaches in current research. Books and journals have been dedicated to explaining and properly outlining the procedures (See for e.g. Creswell, 2003; Tashakkori & Teddlie, 1998). There has also been a limited growth in the use of mixed method approaches in current environmental education research to understand teachers' commitment (e.g. Ko & Lee, 2003). However, a recent paper reviewing publications in *Environmental Education Research* indicate a 'low showing' of mixed method approaches, and only 1 in 10 papers published in the journal used any form of quantitative analysis at the multivariate level (Reid & Scott, 2006). This according to the authors shows an absence of methodological pluralism and a need to consider more integration of both quantitative and qualitative methods in EE research. It is therefore the aim of this study to apply a mixed method approach in understanding teacher commitment to EE.

4.5.1. Benefits and Challenges

The recognition that all methods have limitations means that using multiple methods may ensure that biases inherent in one method are made up for by other methods. In other words, the weaknesses of one method can be offset by the strengths of another (Jick, 1979). Furthermore, mixed methods would offer the opportunity for results from one method to be used to develop or expand on another, and to converge or confirm findings from different data sources (Creswell, 2003). This it is hoped would provide a fuller picture and a deeper understanding of the teachers' commitment (Johnson et al., 2007). Corroborating results from different methods would also ensure a greater confidence in findings compared to situations where only one method was used (Johnson & Onwuegbuzie, 2004). More so, mixing methods would permit the thesis to approach several research questions from different angles or to conceptualize problems in a variety of ways. In other words, each research question calls for its own distinctive method and different questions can be answered from

different methodological perspectives (Mason, 1996). A major reason for adopting a mixed methods approach in this study is related to the call by Greene (1994) for researchers to adopt a mixed methods approach in understanding the complexity of social phenomena in education in order to arrive at a more complete understanding. Johnson and Onwuegbuzie (2004) also called for a methodological pluralism in educational research. They emphasised that:

> Today's research world is becoming increasingly interdisciplinary, complex and dynamic; therefore, many researchers need to complement one method with another, and all researchers need a solid understanding of multiple methods used by other scholars to facilitate communication, to promote collaboration, and to provide superior research. (p. 15)

Systems theory suggests that the real world is complex and stratified and we continuously discover complex layers of reality that help us explain other layers (Capra, 1996). It is therefore expected that using a variety of methods would provide the opportunity for each method to discover different levels information about teachers' commitment as for example quantitative data providing breadth and qualitative data providing depth (Mason, 1996). Creswell (2003) argues that qualitative research analyzes phenomena in a holistic, broad and panoramic fashion whereas quantitative research provides a micro-analysis of phenomena. In other words, while the survey guided by the MEEC provided information on personal factors such as individual teachers' attitude to teaching EE, the qualitative approach based on soft systems methodology (SSM) focused on the holistic aspect of factors influencing teaching behaviour.

It is recognised that using this approach poses a lot of challenges in terms of extensive data collection. Other difficulties include intensive nature of analysing both qualitative and quantitative data and the necessity for the researcher to be familiar with both forms of research strategy (Creswell, 2003). Technical and epistemological difficulties can also arise in comparing and integrating modes of analysis in which one is holistic and interacts, while the other is linear (Mason, 1996). Also, resolving

discrepancies arising in the results from both methods may be saddled with ambiguity.

4.5.2. Methodological Design of the Study

Different types of mixed methods strategies including their sub-categories have been described in the literature (Creswell, 2003; Tashakkori & Teddlie, 1998). Creswell (2003) for instance identified three major procedures (sequential, concurrent and transformative), each with its sub-categories. The sequential procedure is particularly useful for elaborating on, or expanding findings of one method by another. One of the main strategies of this procedure is using a quantitative approach to test theories, followed by a qualitative method that involves a detailed exploration with a few individuals. Creswell (2003) contrasts this procedure with the concurrent procedure where both the quantitative and qualitative data are collected at the same time. The latter procedure converges findings from both data sources in order to arrive at a comprehensive analysis of the research problem. In a transformative procedure, the researcher uses a theoretical lens as an overarching perspective to collect and analyse both quantitative and qualitative data. Data collection within this lens can be either sequential or concurrent.

Creswell's (2003) concurrent transformative procedure served as the methodological design for the study. This was however not in a strict sense as there was an overlap between the phases and preliminary analyses from some questionnaires of the quantitative phase were incorporated and explored in the qualitative phase. A survey was used for the quantitative phase whilst the qualitative phase was based on the framework of Soft Systems Methodology (Checkland & Scholes, 1990). Systems theory and the MEEC served as a theoretical framework through which data was collected and analysed in both phases. Data collection for the survey was carried out using a self constructed questionnaire to measure variables specified in the MEEC. The objective was to explore and determine the extent to which this theoretical model explained teachers' commitment to EE, and to find out the predictive power and relationships among the constructs specified in the model. Structural Equation

Modelling (SEM) techniques which enabled an examination of the various hypotheses in the model were used to analyse the data. In the qualitative phase, SSM approach was used as a framework to develop an interview guide for data collection. In-depth interviews were conducted with teachers and head teachers in schools. This provided a richer understanding of teacher commitment and expanded on the findings of the quantitative phase. Data were analysed into themes and emergent properties were presented. Detailed discussions of these methodological strategies are presented in the quantitative and qualitative procedure chapters later in the thesis.

CHAPTER FIVE

Quantitative Procedure

5.1. Introduction

This section covers three main aspects of the quantitative procedure. The first section begins with the research questions to be answered in the quantitative phase. This is followed by a description of the population, sample and the procedures for obtaining the sample for the study. In the second section, an overview of the multivariate statistical techniques used for data analyses are provided. These are a group of statistical analysis techniques which takes into account the complexity of concepts and their relationship in the social world. These techniques include exploratory factor analysis, confirmatory factor analysis and structural equation modelling (SEM). SEM is a particularly popular technique among social scientists who want to analyse a number of factors and their hypothesised relationships on social behaviour simultaneously. It combines both multiple regression and path analysis and by extension provides other plausible explanations for the phenomena under investigation. It is particularly applied in testing a priori theoretical understandings of human behaviour. Although, a theoretical perspective was used in the current study, the application of SEM was not for theory testing but as an exploratory tool to generate a plausible and parsimonious model that explains teacher commitment to environmental education. The third and final section covers the survey design used for data collection. The section includes the processes followed in developing the questionnaire for the study, description of the various components of the questionnaire and procedure for data collection. Some results of initial data screening and treatment are also presented.

5.2. Research Questions

The primary objective of the survey was to find out what factors motivate teachers' commitment to teaching environmental education (EE) and what the barriers to their

commitment are. In trying to address this broad objective, the following specific questions were explored:

1. What factors determine teachers' commitment to teaching EE?

2. Does the proposed model of environmental education commitment provide an adequate explanation of teacher's commitment to EE?

3. What are the relative strengths of the factors influencing commitment to teaching EE?

4. How do these factors influence each other to shape a teachers' commitment to teaching EE?

By exploring these questions, an understanding of the major motivators was established and the complex relationships between various factors influencing commitment were also elucidated. This provided an insight into why some teachers are committed to teaching environmental education more than others.

5.3. Research Population and Sample

5.3.1. Research Population

The research population of the study consisted of all primary schools in Scotland. As was stated earlier, education about environmental issues early in life is a significant part of building pro-environmental attitudes and behaviours in later life since it is during this time that children build up strong attitudes toward issues. It is therefore worthwhile to focus on the activity of primary schools where this attitude and perception building is initiated. There were 2259 primary schools in Scotland in the 2003-2004 school year. Primary schools in Scotland are organised under the jurisdiction of each local authority. Each of the 32 local authorities is responsible for policy implementation at the primary school level. The schools in each local authority represent a good spread in terms of rural and urban communities, school

size and variations in policy emphasis. Given this background, effort was made to include all local authorities in the sampling process in order to capture a representative sample of schools for the study. This representative sample might then provide generalizable results from the study.

The individuals participating in the study were primary school teachers. Teachers were chosen because the variables of interest were mainly attitudes, opinions, and experiences regarding EE and not the classrooms or school structures per se. However, by sampling schools and not teachers, it was possible to increase geographical spread and subsequent representativeness and to include teachers from different localities of Scotland in the study. Head teachers were the point of contact where letters requesting access and participation were sent. This helped avoid a lengthy process of first seeking permission from head teachers and then teachers.

The sample although not prescriptive was directed towards primary 6 teachers. This group was specifically targeted in order to improve variability in the response and to avoid situations where head teachers were tempted to give the questionnaire to only teachers engaged in environmental education activities in schools. This would have amounted to a kind of self selection and thus may undermine the attempt at random selection of samples. Also, targeting primary 6 teachers eased decision making for head teachers who have a lot of work load and schedule to contend with in schools. It was reasoned that any more time required by them in deciding which teacher was suitable to respond to the questionnaire was likely to lead to deferment of decision, discourage participation and subsequently increase in non response rate. Being specific in the request was seen as the best course to increase quick action and increase response rate. It was also reasoned that teachers are more likely to respond to head teachers' request rather than direct requests from the researcher.

5.3.2. Sample and Sampling Procedure

Several factors were taken into account in determining appropriate sample size and sampling procedure. To obtain a representative sample for the study, a formula

provided by Dillman (2000, p. 205–208) was used in calculating appropriate sample size. This computation takes into account population size (2259 primary schools in Scotland), a sampling error of (+/- 5%), 95% confidence level and a maximum variation in the population (i.e. 50/50 split). This approach was taken so that results from the sample study might be generalised to the entire population. Although an attempt is made to generalise findings to the population, it is not the main aim of this study. Results from the said computation yielded a sample size of 328 and since a postal survey was to be used, a non-response rate of 50% was added yielding a total sample of 492. The choice of sample size was also influenced by the choice of structural equation modeling as the tool for analysing the data. This is a large sample technique, and Kline (2005) noted that sample sizes that exceed 200 cases could be considered as 'large'.

An initial letter (Appendix A) was sent to all 32 local authorities in Scotland seeking their permission to approach schools within their authority for the study. The letter also contained a draft copy of the questionnaire and letters to be sent to head teachers during the actual study. Some of the authorities replied and requested a special ethics form be completed in order for permission to be granted and this was done. Of the 32 authorities contacted, 19 responded and gave the go ahead for the study.

The sample for the research was generated using a stratified random sample from a list of all primary schools in the nineteen local authorities in Scotland who gave permission for the study. Stratified random sampling is a modification to the well known simple random sampling technique which allows researchers to obtain a greater degree of representativeness by decreasing the probable sampling error (Babbie, 2007). This involves putting a population into homogeneous groups (strata) before sampling. Thus rather than selecting a sample from the total population at large, appropriate numbers of elements are selected from homogeneous subsets of that population (Babbie, 2007). In other words, samples are selected on the basis of the relative proportion that each group represents in the population. The local authorities were used as strata and on the basis of the relative proportion of the population represented by each authority, a number of schools were randomly

selected from each local authority that constitute the same proportion of our desired sample (Rubin & Babbie, 2005). For example, if Glasgow authority constituted 10% of all schools in the population (that is, the whole of Scotland) and a sample size of 500 was desired, then 50 schools were randomly selected from Glasgow. This is known as proportionate stratified sampling.

This sampling approach was also chosen because some local authorities wanted to know the number of schools that would be included from their authority before granting permission. Since the aim was to select samples randomly to ensure representation, this approach was recognised as appropriate for selecting schools in each authority. Also, schools under each authority differ slightly in policy focus and implementation and stratification will allow for more representation of all schools in Scotland. This geographic stratification also allows for representativeness on variables like social class, ethnic group, size of school, rural-urban spread and so forth. Thus according to Rubin and Babbie (2005), taken as a whole, stratified sample is likely to be more representative on several variables than a simple random sample.

5.4. Statistical Techniques

This section begins with a description of the strategies used for score computation in the current study. It is then followed by a brief overview of the structural equation modelling process. Finally, results of data screening and treatment are presented. Both SPSS 14.0 and AMOS 6.0 (Analysis of Moment Structures) software programs were used in the data analysis. SPSS was mainly used for data screening and descriptive analysis while AMOS was applied for the confirmatory and structural regression analysis.

5.4.1. Computation of Composite Scores

This section explains how scores were computed for each construct measured in the theoretical model and the rationale for adopting these strategies. Composite scores were computed using the principle of aggregation. This is a widely used technique

for computing scores for most psychological constructs and involves simply summing or averaging items specified to measure a particular construct. For instance, in computing composite scores for attitudes, researchers tend to sum or average series of related items to create a global attitude score for an individual. Aggregation is an accepted strategy for improving the reliability of a measure by decreasing the error of measurement (Paulhus, Lysy & Yik, 1998). There is however a debate about the appropriate way in which composites scores should be computed for constructs and their use in structural equation modeling. Some of the main issues of relevance in this study are discussed in the following sections. These include the use of additive composites, unit weighting, and item parcelling.

5.4.2. Additive and Multiplicative Composites

According to Ajzen and Fishbein (1980) item scores for indirect attitude and injunctive norms should be computed by following the expectancy-value assumption in which belief items are multiplied by evaluation outcomes. For instance the score for the indirect attitude item that 'teaching EE makes pupils become aware of environmental problems' would be computed as follows: (item score for belief that teaching EE leads to pupils being aware of environmental problems multiplied by item score for belief that making pupils aware of environmental problems is important). Following Ajzen and Fishbein's (1980) expectancy value-model, Shuman (1995) recommended a multiplicative composite for the significant life experiences construct. However, there are problems associated with using multiplicative composites on both conceptual and statistical grounds in that it is identical to constructing a product term for testing an interaction effect (Evans, 1991). Referring to other studies, Evans (1991) also points out that multiplicative composites using the theory of planned behaviour for example affects size of correlation coefficients and subsequently has implications for effect size, a phenomenon absent in additive models. Similar problems of multiplicative composites have been confirmed by the findings of Trauer and Mackinnon (2001). A proposed solution is to use a three-stage hierarchical regression analysis to test whether expectancy value construct, i.e. multiplicative construct was better than an

additive construct. An increase in R^2 from Stage 2 to Stage 3 indicates whether the multiplicative version of the model is better than the additive model (Kakoko, Astrom, Lugoe, & Lie, 2006; Armitage et al., 1999; Evans, 1991). If the regression of the multiplicative component in stage 3 does not significantly increase the amount of explained variance, then there is no evidence for the multiplicative assumption. Although problems of multicollinearity may arise, it is of less importance as one is only trying to estimate whether the overall model is valid and whether the interaction adds a unique variance.

The assumptions of multiplicative composites were tested by running a hierarchical regression of intention on all the components of indirect attitude, injunctive norms and significant life experiences. Results from the hierarchical regressions showed there was no evidence for multiplicative composites. Thus additive composites were computed by summing and averaging scores of expectancies and evaluation components (Kakoko et al., 2006; Armitage et al., 1999; Evans, 1991). For instance the score for the indirect attitude item that 'teaching EE makes pupils become aware of environmental problems' was computed as follows: (item score for belief that teaching EE leads to pupils being aware of environmental problems plus item score for belief that making pupils aware of environmental problems is important. The sum was then averaged). In all, each item score for injunctive norms (referent's norm plus motivation to comply with norms), indirect attitude (behavioural belief plus evaluation of the belief) and significant life experience (extent of the experience plus importance of the experience) were based on the average of two items.

5.4.3. Item Parcelling

Item parcelling is a measurement practice commonly applied in multivariate approaches to psychometrics, particularly for use with latent-variable analysis techniques like exploratory factor analysis and SEM (Little, Cunningham, Shahar & Widaman, 2002). Item parcelling is an approach that involves creating an aggregate-level indicator comprising the sum (or average) of two or more items responses. The new scores that are created are known as parcels. In other words, item parcelling is

theoretically similar to the creation of composite scores. Parcelling is particularly recommended for small sample studies due to its numerous advantages (Marsh & Hau, 1999). The use of item parcelling in this study is based on two empirical advantages.

The first merit for using this approach is that parcels have been found to have numerous psychometric merits relative to individual items. In other words, problems associated with item-level data such as lower reliability, lower communality and greater likelihood of distributional violation are less likely in parcel data (Little et al., 2002; Kishton & Widaman, 1994). This psychometric argument is directly linked to classical test theory and the principles of aggregation. For instance Rushton, Brainerd, & Pressley (1983) demonstrated using published data that aggregate scores are more representative of the psychological construct that a researcher wants to measure compared with individual items. They also found aggregate scores to be statistically more reliable than individual scores. The fundamental explanation for this result is based on classical test theory which assumes that, an infinite number of indicators can be selected to measure a construct and each indicator has some degree of relationship with the constructs' true centroid. Thus, based on the law of large numbers, a person's true score on a psychological construct is more confidently represented when a larger number of measurements of the construct are used. This is because as the number of items increases, non normal distributions become more normally distributed (Little et al., 2002). In other words, the use of additional items tend to yield a more encompassing and inclusive representation of a construct.

The second consideration for using parcels is based on the parameter to sample ratio and the estimation of overall model fit in SEM. It is usually recommended that for each parameter estimated in a model, there should be at least 10 cases (Kline, 2005). Thus, when large number of items rather than parcels is estimated in a model, a larger sample is required to avoid instability of factor solutions especially in cases where psychometric properties of items are poor (Marsh & Hocevar, 1988). Due to the relatively moderate sample size of the study and the large number of items employed in measuring each construct, using parcels will help reduce the number of

parameters estimated in the model, hence less demand on sample size. Also, acceptable overall model fit indices are likely when parcels rather than items are analysed. This is because parcelled data are more parsimonious, have fewer chances for residuals to be correlated or dual loadings to emerge, and lead to reductions in the various sources of sampling error (MacCallum, Widaman, Zhang, & Hong, 1999)

Parcelling is however a controversial strategy and some researchers have expressed reservation about this procedure (see for example Bandalos, 2002; Hall, Snell & Foust, 1999). They for instance point out that models based on parcelled data are problematic as for example masking double loading of items on multidimensional constructs. However, Little et al. (2002) suggests that this argument holds only when one is interested in the relation among individual items comprising the measured variable. In a situation where the focus of interest is on the relationship among the constructs as is the case for the current study, parcelling is more strongly warranted. Little et al. (2002), however suggested researchers carry out prior analysis to establish the factorial structure (dimensionality) of the items in each construct so as to apply the appropriate parcelling technique.

Based on the suggestion by Little et al. (2002), a Confirmatory Factor Analysis (CFA) which tests the fit between a specified model and the data was carried out to determine the dimensionality of items in each specified construct before parcelling. Results from the CFA confirmed the constructs to be multidimensional (Chapter Six). Following from this, one of the approaches for parcelling multidimensional constructs suggested by Kishton and Widaman (1994) was adopted. This strategy involves creating a number of parcels for each construct by joining items from the different dimensions of the construct to create each parcel. For example, since attitude was determined to have two dimensions (indirect and direct attitude) each of the three parcels created for attitude (A1, A2, and A3) had items from each of the dimensions. This approach creates domain-representative parcels that encompass both the common variance and the reliable unique facets of the multiple dimensions (Little et al., 2002). The approach also has the advantage of producing better stability and fit of a model. Three parcels each were created for all constructs. This is to

ensure that the model was identified (at least three indicators per construct) but also to avoid too many parameters being estimated as this has implication for the sample size required.

5.4.4. Item Weighting

One issue in score computation is whether to weight or not to weight items in creating composites scores. In most cases items are summed and averaged without consideration for the contributing strength of individual items. This strategy of applying equal weights to all items in computing composite scores is known as unit-weighting (Kline, 2005; Paulhus et al., 1998). In other words, unit weighting is where one adds the raw scores from items in a questionnaire to create a composite score without applying any weighting system to the items. Some authors have however called for the weighting of items by their importance in computing composite scores (e.g. Rowe, 2006). These include the use of factor score weights of items computed through confirmatory factor analysis, regression and other complex statistical manipulations. Rowe (2006) for instance criticised composite scores based on unit-weighting on the grounds that (a) it ignores the possibility of some items contributing more to the measurement of the composite than others, and (b) unit-weighting may invalidate the composite score if one or more of the items measure a construct other than the one under consideration.

The case against weighting items stem from the argument that results obtained from weighted scores are difficult to interpret (Trauer & Mackinnon, 2001). This is because it is difficult to defend any particular method of weighting over the method of simple summing unweighted ratings. Also, the fact that both weighted and unweighted summated scores tend to correlate highly begs the relevance of weighting (Trauer & Mackinnon, 2001; Nunally, 1978). Kline (2005) posits that weights applied to scores in order to compute composites are subject to capitalization on chance variation within a particular sample. A number of authors have also shown composites from unit weighting to be parsimonious and more robust than those obtained from weighted scores (Kline 2005; Trauer & Mackinnon, 2001; Thacker,

Fields, & Tetrick, 1989; Nunally, 1978). Cohen (1990) admonishes researchers to adopt the simple-is-better principle in statistical analysis. In an example to illustrate this dictum, he recommended unit-weighting in creating composite scores and warned about the pitfalls of weighting items in creating composites. Recognising the complications of weighted scores, composite scores for constructs in the current study were created by simply adding and averaging scores of items used to measure the particular constructs.

5.4.5. Structural Equation Modelling

5.4.5.1. An Overview

Structural equation modeling (SEM) is a comprehensive statistical technique that allows a set of hypothesised relationships between one or more variables to be examined (Hoyle, 1995). SEM is not a single statistical technique but a collection of techniques including multiple regression, path analysis, and confirmatory factor analysis. As an a priori approach, researchers are required to specify the nature of relationships between variables and the directionalities of these relationships before hand. This a priori specification by the researcher represents a model that is evaluated in the analysis (Kline, 2005). In other words, SEM is theory driven and one can only use the technique with reference to prior knowledge or hypothesis about the potential relationships among the variables (Ullman, 2001). It is this characteristic that makes SEM a confirmatory technique and the a priori specification of models makes its analysis useful for inferential purposes (Byrne, 2001).

In the SEM process, the researcher postulates a statistical model which is based on theory, empirical research or combination of both. The model which indicates a relationship between variables is expressed diagrammatically to clarify the researcher's ideas about the relationships. The goal of SEM is to statistically test this hypothesised model in order to determine the extent to which it is consistent with the data obtained from the sample of interest. If an adequate goodness-of-fit is arrived at, it means the model argues for the plausibility of the postulated relationships among the variables. On the other hand, if an inadequate goodness-of-fit is arrived at, then

the hypothesised relationships are rejected as not tenable. Thus, what the researcher does is to impose the structure of the hypothesised model on the sample data and then test how well his or her observed data fits this restricted structure (Byrne, 2001). The focus is the fit of the whole model although individual hypothesised effects are important. The decision about a model does not fall to a simple reject or accept criterion in which researchers must abandon their model if it is rejected. This is because in practice, initial results from most applications of SEM do not support the model and researchers prefer to modify and retest their initial hypotheses rather than abandon the entire model (Kline, 2005).

According to Joreskog (1993), there are three main scenarios of SEM applications. The first is the strictly confirmatory approach in which a researcher specifies a single model, collects data, and tests the model for fit to the data. The researcher then either rejects or fails to reject the model based on the results without any further modifications to the original model. The second approach is an alternative models scenario where the researcher postulates several models and tests their plausibility using the same data. In this case the goal is to find the most appropriate model that fits the data. The third and final approach is a model-generating scenario where an initial model does not fit the data and is modified by the researcher. The modified model is then tested with the same data with an aim to find a theoretically plausible model that explains the sample data. In this scenario, the researcher is said to proceed in an exploratory rather a confirmatory fashion because the revised model is tested with the same data. A review of SEM applications however shows the third scenario is the most common of the three approaches (Kline, 2005; Byrne, 2001). Given the high cost of conducting research, it is quite rare to terminate one's research based on rejected hypothesis. In this study, the application of SEM was more of an exploratory approach for model generation although an a priori model was specified at the initial stage.

SEM offers numerous advantages in data analysis which has led to its popularity as the test of choice over other related tests such as multiple regression, path analysis, analysis of covariance and analysis of variance. An important characteristic of SEM

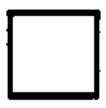
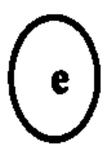
is that it allows for the evaluation of complex and multidimensional relationship among variables. It is the only analysis that allows a complete test of all relationships and by extension the entire model (Ullman, 2001). Such hypothesis testing, especially of higher order complex relationships (e.g. indirect effects) are sometimes difficult or impossible to test with other multivariate techniques like multiple regression. This characteristic of SEM makes it an attractive analytical tool for this study since one of the objectives is to examine how the variables specified in the model as a whole influences teacher commitment to environmental education.

Furthermore, the analyses of relationships among variables in SEM are free of measurement errors because the technique allows for explicit estimation of measurement errors (Ullman, 2001). Unlike other traditional multivariate techniques which assume that errors in explanatory variables vanishes, SEM estimates and removes the measurement errors leaving only common variance. This helps reduce the inaccuracies that might be present in results when errors are sizeable thus ensuing the reliability of measurements (Byrne, 2001).

5.4.5.2. AMOS

Analysis of Moment Structures (AMOS 6.0; Arbuckle, 2005) was the computer program used to run the SEM analyses in this study. The choice of AMOS over other equally competent programs like LISREL, Mplus or EQS is based on pragmatic issues of availability and other attractive features. The graphical user interface offered by the program for instance allows researchers to pictorially specify the hypothesised relationships within their model. This particular feature makes the program user friendly and easier to learn especially for new users. Also, the program prevents users from making specification errors by disallowing model specifications that violate SEM's basic assumptions (Kline, 2005). Furthermore, AMOS graphics offers extensive possibilities for exploratory analyses through its specification search function. Table 5.1 shows the common symbols used in AMOS to represent path diagrams.

Table 5.1: Symbols used in AMOS for path diagrams

Symbol	Terminology/Definition
	Latent variable – also known as factors, constructs. These are unobserved hypothetical variables (e.g. attitude)
	Measured variable – also known as observed variables, indicators, manifest variables. They represent scores of items in the questionnaire.
	These represents direct effects (path coefficients) when specified between latent variables. It is the hypothesised relationship between unobserved variables. When specified from latent variables to indicators, they represent factor loadings (path loadings). It is the correlation between the latent variable and the indicator.
	Covariance (correlations) are unanalysed relationship between two variables with no implied direction
	Indicator errors – also known as measurement error point to indicators. They represent the error in indicator that is not explained by the factor.
	Disturbance points to factors (latent variables). Like errors, they indicate error in dependent latent variable not accounted for by predictors.

5.4.5.3. The Two-Stage Approach of Testing Structural Equation Models

The testing of the structural equation models in this study were in two stages following recommendations of Anderson and Gerbing (1988). In the first stage, all variables (both independent and dependent) were individually specified as a measurement model and tested. This was followed by a second stage in which all the variables were specified as a structural regression model and analysed to determine whether it fits the data. This particular approach was adopted because of the exploratory nature of the current study.

According to Anderson and Gerbing (1988), a two-step modelling approach that involves separately testing and re-specifying measurement models, prior to simultaneously testing measurement and structural models is advantageous in many ways. A one-step approach that simultaneously tests the structural and measurement

components of the model in a single analysis is problematic especially when the overall fit of the model is poor. This is because it is difficult to locate the sources of misfit in a one-step modelling since the researcher cannot tell whether the problem lies with the measurement or structural component of the model (Kline, 2005). On the other hand, in the two-step approach, the measurement and structural components of the model are independently estimated. A poor fit of the measurement component does not only indicate that the researchers' hypothesis about measurement is wrong, but also shows that the fit of the structural component may even be worse. As a result, if the measurement model is rejected, the researcher can re-specify and test a new model to find an acceptable measurement model before proceeding to test a structural regression model. Subsequently, if all the measurement models are inadequate, then the interpretation of structural model results becomes much less interesting (Graham, Guthrie & Thompson, 2003). In this study, a confirmatory factor analysis (CFA) was used to test each of the measurement components of the model before specifying and testing a structural component.

Measurement Model

The first step of analyses was the testing of measurement models using confirmatory factor analyses (CFA). CFA is a statistical procedure frequently used to test the fit of theoretically and empirically grounded model to data (Graham et al., 2003). In CFA procedure, the measurement models specify the factor structure, inter-correlations among sub-scales in a multi-factor model, and measurement errors. The procedure however does not test causal relationships between latent variables. In this study, each variable was examined separately. Variables were specified as multi-factor models and represented by multiple indicators. The hypothesised structure of each of the measurement constructs were tested for fit to the data using first-order CFA. Models were refined and re-tested in the event of poor fit in order to arrive at an explanatory structure for the data.

In addition to the possibility of detecting sources of misfit, the testing of measurement models was also to help retain only items that were good indicators of the underlying variable. CFA tests the factorial validity of the constructs and of the

scores obtained from the measurement instrument (Byrne, 2001). According to Noar (2003) CFA gives further confirmation that the psychometrics of a scale is strong. It allows for an investigation of the relationships between latent variables and their indicators and also helps to determine the validity and reliability of the measures used to represent the constructs of interest (Kline, 2005). Furthermore, the use of CFA enabled an examination of the hypothesised dimensionality of each construct. The information about dimensionality is particularly important for the purposes of item parcelling (see for e.g. Little et al., 2002).

Structural Regression Modelling

The second step of estimation involves testing of the structural component of the structural regression model after acceptable measurement models for the constructs were established. The structural regression component is similar to the CFA except that the former also estimates causal relationships between latent variables. This includes both direct and indirect (mediation) relationships between independent and dependent variables. Based on theory and previous research, various direct and indirect relationships were hypothesised among the measurement constructs.

5.4.5.4. Steps in Structural Equation Modelling

The testing and analyses of models in SEM involves a number of steps. These steps include model specification, identification, estimation, evaluation of overall fit and re-specification of models to improve fit (Kline, 2005; Hoyle, 1995). These procedures are similar for testing CFAs and structural regression models.

Model Specification

Specification is the first step in SEM analysis. It is the process of expressing hypothesised relationships that exists or do not exist among observed and latent variables in the model (Weston & Gore, 2006). The relationships among variables are known as parameters or paths and can be represented either pictorially or as a series of equations. It is these model parameters that are estimated by the computer with the sample data (Kline, 2005). Parameters are typically specified as either *fixed*

(set to a value of 0 or 1 and not estimated, e.g. correlations between errors are fixed), *free* (believed to be non zero and estimated from data e.g. paths between items and the construct) or *constrained* (fixed on some variables but free to vary on others e.g. each indicator is constrained to measure only one construct). The model for the study was specified using path diagrams that represent a series of regression equations.

Model Identification

This is a fundamental consideration when specifying models in SEM. Identification deals with obtaining single unique values for each free parameter from the observed data (Hoyle, 1995). Thus if it is theoretically possible to derive single estimate for each parameter, then the model is said to be identified. For models to be identified, they must meet two basic requirements. The first is that there must be at least as many observations as free model parameters ($df_m \geq 0$). Secondly, every latent variable must be assigned a scale in order for the computer to be able to calculate estimates of effects that involve latent variables. Models that violate the first requirement are said to be *under-identified* and do not contain enough information for parameter estimation. A model is said to be *just-identified* when the number of parameters are equal to the number of observations. When there are fewer parameters than observations, then the model is *over-identified* (Kline, 2005). Generally, an over-identified model is preferred because it allows for degrees of freedom greater than zero and therefore contains information to be tested. All models analysed in this study were identified.

Parameter Estimation

The next step after specifying a model is to obtain estimates of the free parameters from a set of observed data. Estimation is the process of determining the value of the free parameters and their respective errors (Hoyle, 1995). This is done using a SEM software program, and in this case AMOS 6.0. There are several estimation procedures, including maximum likelihood (ML), unweighted least square (ULS), generalised least square (GLS) and asymptotic distribution free (ADF), available to estimate parameters. ML estimation is however the most popular procedure and the default in most SEM software programs. ML is an iterative method which involves a

series of attempts by the computer to derive initial solutions followed by subsequent calculations to improve the estimates for the model. The estimates maximise the likelihood that the data were drawn for the said population (Kline, 2005). In other words, the procedure compares the sample covariance matrix to the implied population covariance matrix. A requirement for estimation is the provision of initial start values for the parameters. These are automatically provided by AMOS and are generally accurate. Both the CFA and structural regression models in this study were estimated using ML estimation. Although ML assumes data normality, it is generally robust and can provide reliable estimates if this assumption is moderately violated (Chou & Bentler, 1995). ML is also particularly useful when sample sizes are small. The assumptions of multivariate normality were however examined prior to submission of data for analysis in AMOS (see section on data screening).

Evaluation of Model Fit

The evaluation of model fit is the next step after models have been estimated. The purpose is to determine how well the model as a whole explains the data. In other words, evaluation determines whether the hypothesised associations among variables in the model adequately reflect the observed associations in the data. Generally, evaluation of fit should include (a) how well the overall model fits the data, (b) significant and strength of estimated parameters and (c) variance accounted for in observed and latent variables. While the later two criteria are easy and straight forward, a considerable disagreement exists about what constitutes an acceptable overall model fit (Weston & Gore, 2006; Kline, 2005; McDonald & Ho, 2002). Thus researchers are encouraged to report multiple indexes of overall fit (McDonald & Ho, 2002; Hu & Bentler, 1999; Hoyle & Panter, 1995), a strategy that has been adopted in this study to evaluate model adequacy. Another problem with determining overall fit is a decision regarding which indexes to report due to the plethora of indexes available. Following recommendations of current state of practice (McDonald & Ho, 2002; Boomsma, 2000; MacCallum & Austin, 2000), the model chi-square, root mean square error of approximation (RMSEA) with its 90% confidence intervals, the comparative fit index (CFI) and standardised root mean square residual (SRMR) were selected for evaluating overall fit. It is however noteworthy to state that what

constitutes fit is not entirely straight forward. Also, evaluation of structural equation models can refer to either absolute or incremental fit (Hoyle & Panter, 1995).

The model chi square is the most frequently used measure of overall fit. It is an absolute fit index which directly assesses how well a model fits the observed data. It can be seen as testing the difference in fit between a given over-identified model and a just-identified version of it. This is because almost all just-identified models perfectly explain the data. The chi square is described as a "badness-of-fit" index because higher values correspond to poor fit of the model to the data. In other words a significant chi square value (> .05 or .01) suggests that the model does not fit the sample data whilst a non-significant chi square value (< .05 or .01) indicates a model that fits the data. This is contrary to the alternate application of the chi square test to evaluate associations for two-way contingency tables.

Although this is the most commonly reported absolute fit index, there are limitations in relying on model chi square as a fit statistic. The first concerns the plausibility of the hypothesis tested by the model chi square which is whether the model perfectly fits the observed data. Finding this exact fit is mostly unrealistic. Another problem associated with the test is that it is sensitive to the size of correlations and larger correlations among variables generally lead to higher model chi square values. Also, large sample sizes tend to lead to a rejection of models because it may be unlikely to obtain non-significant model chi square with larger samples. In spite of these limitations, the model chi-square is generally reported by all researchers. This is because the chi-square is a key ingredient in the formulas of most other indexes (Kline, 2005). An alternative index which caters for the limitations of the model chi square is the normed chi-square or chi square ratio (Byrne, 2001) which is obtained by dividing the model chi-square by the degrees of freedom. Guidelines of acceptability for the chi square ratio are not clear but values below 3.0 are generally accepted as indicating reasonable fit (Kline, 2005). Although the model chi-square was reported in this study as a general rule, the chi square ratio was more the index of evaluating absolute fit.

The Root Mean Square Error of Approximation (RMSEA) is another absolute fit index. It measures the error of approximation of the lack of fit between the research's model and the population covariance matrix. Unlike the model chi square which measures the degree of perfect fit, the RMSEA measures approximate fit and does provide a more reasonable standard for evaluating models. This index also corrects for model complexity in that given two models with similar overall explanation, the simpler model will have the more favourable RMSEA value. The RMSEA is a "badness-of-fit" index with higher values indicating worse fit while a value of zero indicates the best fit. Acceptable cut-off points proposed by Browne and Cudeck, (1993) shows values less than .05 indicate a good fit, those from .05 to .08 represent reasonable fit and those above .10 indicate poor fit. It is worth noting that these values are based on subjective judgements by experts in the field and cannot be regarded as infallible (Byrne, 2001). As such, care should be taken especially when sample sizes are small in order not to over-reject true population models (Hu & Bentler, 1999). Researchers have been encouraged to report the 90% confidence intervals (CI) to assess the precision of the RMSEA estimates as it incorporates the sampling error associated with the index. Rule of thumbs for the 90% CI shows lower bound below .05 and upper bound below .10 are indicative of close approximate fit of the researcher's model to the population. Boundary conditions for the 90% CI are however likely to produce mixed results with smaller samples (Kline, 2005). The RMSEA and its 95% CI were used to evaluate all models in the study.

The Comparative Fit Index (CFI) is an incremental index and is among the most widely used in SEM. CFI like all incremental indexes, compares the improvement of the researcher's model with a baseline model called the independence or null model, which specifies no relationship among variables. The purpose is to find out whether the researcher's model is an improvement over the null model; otherwise, there is no need to prefer the research's model. The CFI unlike other incremental fit indexes does not assume perfect population fit of the researcher's model. A rule of thumb for the CFI index is that values greater than .95 indicate a good fit (Hu & Bentler, 1999) however values above .90 may indicate reasonably good fit of the researcher's model

especially when sample size is small (Marsh, Hau & Wen, 2004; Hu & Bentler, 1999). The CFI was another index used for evaluating all models in the study.

The Standardised Root Mean Squared Residual (SRMR) index is based on the covariance matrix and is a standardized version of the root mean square residual. Conceptually, the SRMR is the average difference between the actual correlations among observed variables and the correlation predicted by the model. In other words, it is a summary of how much difference exists between the observed data and the model. When the model has a perfect fit, then the average difference between the observed and model correlation should be zero. Rule of thumbs indicates SRMR values of less than .10 are generally considered favourable (Kline, 2005). Simulation research by Hu and Bentler (1999) suggests the SRMR is among the best of fit indexes. The SRMR was also used for model evaluation.

Due to the exploratory nature of the current study, an index for comparing competing theoretical models needs to be taken into consideration. This is to ensure an adequate evaluation and comparison of alternate models with original hypothesised models when the initial model poorly fits the data. Indexes such as the chi-square of the difference statistic serve a useful purpose for comparing alternative models. However, given that the fit indices of the models can equally serve as a meaningful basis of comparison (Keith, 2006), no additional indexes were selected. In the current study the fit indices used to assess model fit include chi square ratio below .30, CFI above .90 with its 90% CI, RMSEA below .80 and SRMR below .10. Although the model chi-square was reported in accordance with trends in SEM, it was not used as a basis of evaluating overall fit.

The other crucial aspect of estimation apart from overall fit indexes is the significance of estimated parameters. This is because models are meaningless if they fit the data well but have only few significant parameters (Weston & Gore, 2006). Thus, as well as evaluating model fit, other aspects including significance of proposed parameters, hypothesised directions, direct and indirect effects, and amount of variance explained were evaluated to determine the adequacy of overall fit. Also,

standardised errors, critical ratios associated with parameter estimates and standardised residual covariances were inspected to identify problems in the model.

Model Modification

It is a known fact in SEM that rarely is an a priori model the best fitting model (see for example Kline, 2005; Byrne, 2001; Joreskog, 1993). As a result modification (re-specification) and re-estimation of the original model is often necessary to achieve a better fit of the model (Byrne, 2001). This is what Joreskog (1993) referred to as the model generation strategy described in the section above. However, model modification is a controversial topic especially if the modifications are post hoc and not specified a priori. This is because post hoc modifications have a high probability of capitalization on chance and the potential of finding a replicable model is quite low (McDonald & Ho, 2002; Hoyle & Panter, 1995). However, due to the peculiarity of social science research, post hoc modifications are common, and for good reason (Byrne, 2001). In order to minimise the potential of achieving misleading models, researchers are admonished not to modify their models purely on the basis of statistical suggestions or data. Rather, modifications suggested by data should be carefully considered and only carried out within the confines of theoretical acceptability as it is only then that one has a chance of discovering a true model (McDonald & Ho, 2002; Hoyle & Panter, 1995).

Model modifications were envisaged and carried out in this study due to the exploratory approach that was adopted. This is due in part to the fact that some of the constructs used in the model have not been previously validated and the multiple item approach for measuring some constructs (e.g. commitment and intention) had not been previously tested using SEM. Bearing in mind the potential of arriving at misleading results elucidated above, modifications for the models were only carried out when they were substantively meaningful and within the theoretical limits of the study. All modifications are theoretically justified and a clear history of the decision step is provided following recommendations of McDonald & Ho (2002).

5.4.5.5. Model Validation using Bootstrapping

A statistical re-sampling technique called bootstrapping (Efron & Tibshirani, 1993) was employed for validating various aspects of the final model. This is a simple but powerful tool that has a variety of applications in statistics and applied research (Yung & Chan, 1999). Bootstrapping simply involves the computer drawing various random samples from the 'original' (the researcher's) sample with replacement (Zhu, 1997). In other words, the researcher's original sample is treated as a pseudo-population where new samples are drawn with replacement to generate a new data set called a bootstrap sample. Kline (2005) notes that this new sample simulates the drawing of numerous samples from a population when repeated many times (e.g. > 1000 samples). Parameter estimates and standard errors are then computed from the bootstrap sample which can be compared with estimates obtained from the original sample. One advantage for this approach is that while the method for estimating parameters and standard errors for the original sample are based on normal theory assumptions (in this case maximum likelihood estimation), the bootstrapping technique does not assume data normality. This assumption of data normality underling maximum likelihood (ML) estimation is likely to result in the underestimation of parameter standard errors especially when sample sizes are small and the assumptions of normality are violated. Bootstrapping on the other hand has been found to produce robust and accurate estimates when the normality assumption is violated and sample sizes are small to moderate (Cheung & Lau, in Press; Shrout & Bolger, 2002). This characteristic allows researchers to assess the stability of parameter estimates and to report their values with a greater degree of accuracy (Byrne, 2001). It is however worthy to note that, results from bootstrap procedure can be misleading. This might particularly be the case if the original sample from which the bootstrap sample is drawn is not representative of the population (Kline, 2005; Zhu, 1997).

An important reason for using the bootstrap technique in this study is to test the significance of indirect effects (see model conceptualisation for details) hypothesised in the model. The bootstrap test has been recommended as the most powerful method for testing indirect effects and their level of significance especially when the sample

is small to moderate and data violates the assumption of multivariate normality (Cheung & Lau, in Press; Shrout & Bolger, 2002). The conventional method for examining the presence of indirect effect is by separately testing each path for statistical significance. Thus researchers make the case for a significant indirect effect if all the paths (i.e. all the direct effects) comprising the indirect effect are significant. Shrout and Bolger (2002) however found this approach to have limited statistical power. They point out that having a statistical significance for each path in the indirect hypothesis does not necessary support a significant indirect effect. Also, there is a possibility of a significant indirect effect even if only one direct path is significant and the other is only close to significance. Furthermore, the indirect effect can be non significant even if all the direct effects are significant.

Researchers have thus been encouraged to test the significance of the indirect effect using a Bias-corrected bootstrap with 95% confidence interval. MacKinnon Lockwood and Williams (2004) have particularly recommended the Bias-corrected (BC) bootstrap in AMOS for detecting mediation effect. This is because BC bootstrap does not assume data normality, have been found to yield more accurate confidence intervals and provides the greatest statistical power for detecting indirect effect compared to other methods that assume normal distribution (Cheung & Lau., in Press; Shrout & Bolger, 2002). To evaluate the significance of hypothesised effects, one must examine the upper and lower bounds of the CI. The range of the CI tests the null hypothesis that the regression weight among specified paths is equal to zero. So if the 95% CI of a hypothesised path does not include zero then the path is said to be statistically significant (Byrne, 2001). In other words, to reject the null hypothesis that the indirect effects are non-significant, the lower and upper bound of the 95% CI should not include zero. Based on these procedures, a bootstrapping method was carried out on the final model. The bootstrap standard errors and the ML are both reported for purposes of comparison. Also the BC 95% CI of all indirect effects are reported.

The statistical procedures discussed so far are summarised in the form of a diagram in figure 5.1. This summary also indicates the logical steps of the quantitative analysis.

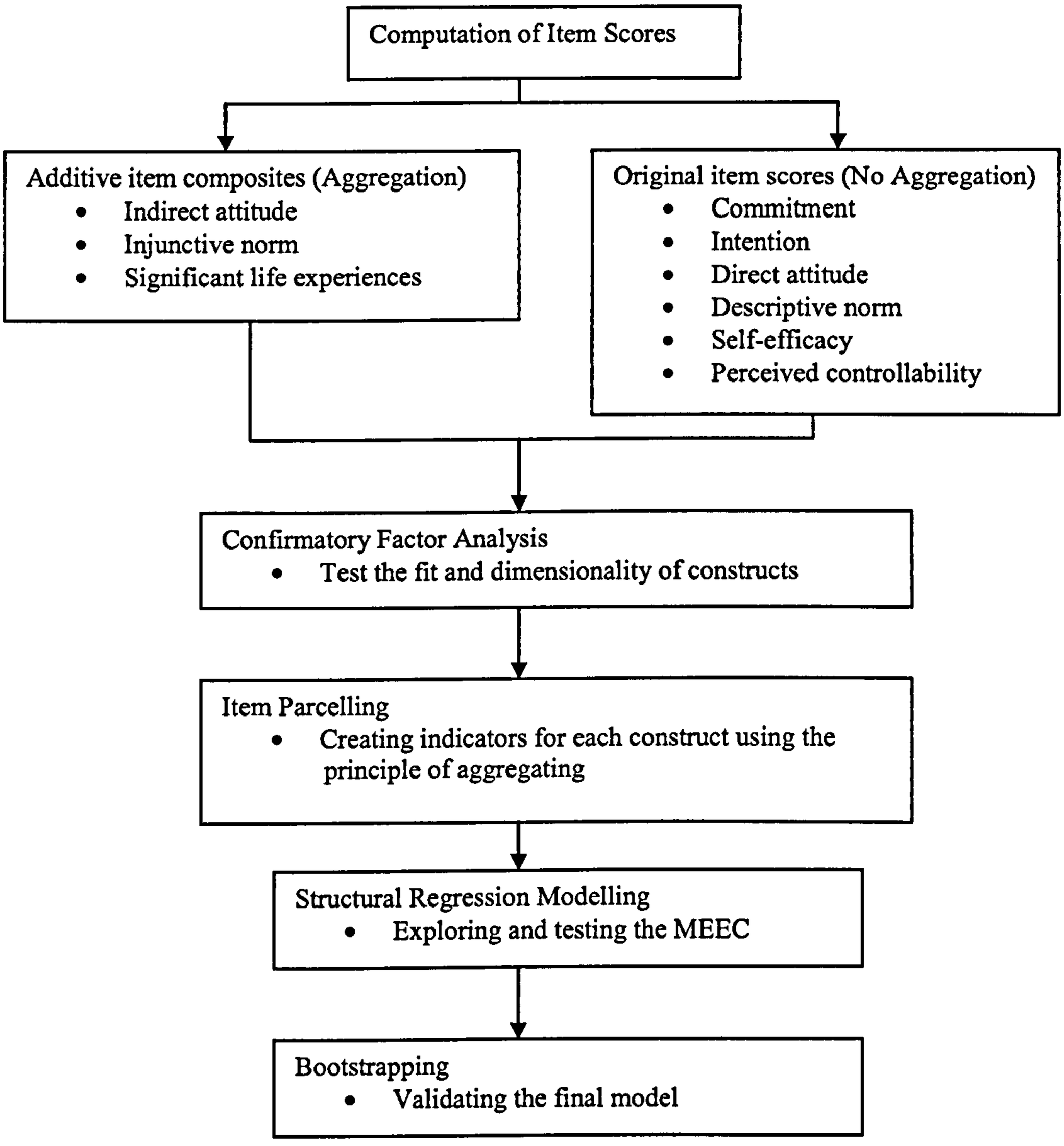


Figure 5.1: Summary and Diagrammatic Representation of Statistical Procedures

5.5. The Survey

Survey research is considered probably the best method available for collecting original data in the social sciences with the aim to describe a population which is usually too large to observe directly (Babbie, 2007). An important feature for

choosing a survey is that findings can be generalised to the entire population and inferences can be made about characteristics of that population (Babbie, 2007). Thus prevalence can be established with greater confidence provided the sample is not unduly biased. This offers an opportunity to gain an understanding of the population at large and to formulate policies or strategies that is to some extent applicable to the population. Also, surveys are considered excellent means by which attitudes and orientations within a population can be effectively measured (Babbie, 2007).

A cross-sectional strategy in which data is collected at one point in time was used. This is in line with the objectives of testing and exploring a theory and comparing findings to similar studies in which cross-sectional strategies have been used. A self administered questionnaire was the main instrument for collecting information. The questionnaire was partly designed from scratch and partly adapted from previous studies that have used a similar theoretical perspective.

5.5.1. Instrument Development

This section is divided into two main parts. The first part describes the process of constructing the questionnaire whilst the second part provides a detail description of the questionnaire itself. The questionnaire was chosen as the most suitable method to elicit and record the proposed variables that influences teachers' commitment to environmental education (EE). As a commonly used research tool, questionnaires are sometimes widely misused because of the erroneous notion that they can be applied in every research field (Kyridis, Mavrikaki, Tsakiridou, Daikopoulos, & Zigouri, 2005).

A series of steps following recommendations by Ajzen and Fishbein (1980) were adopted in constructing questionnaire for the study. The first step was aimed at eliciting salient beliefs that underlie the constructs in the theoretical model. These salient beliefs were then used as items in the questionnaire in order to collect information for testing the research hypotheses. A convenience sample of six experienced primary school teachers who were seconded to the University of

Strathclyde were selected and interviewed. They were asked to reflect on and state some of the advantages and disadvantages of teaching EE; factors that help promote or inhibit their ability to teach EE; people who encouraged or discouraged them in the teaching of EE; and significant experiences that they thought influenced their interest in teaching EE. The responses were content analysed into themes and labelled using steps recommended by Ajzen & Fishbein (1980). All themes that fit a construct in the theoretical model were labelled with that construct. For example, statements reflecting positive or negative beliefs about EE were put into themes and labelled as attitudes while statements about hindrances to EE were put into themes and labelled as perceived behavioural control. To increase validity of the content analysis, two researchers who were not directly involved in the study were asked to conduct separate content analysis. Results were evaluated and final list of themes were produced in order from most frequently mentioned to least frequently mentioned. About 75% of all the salient beliefs were then converted into a set of statements to measure the appropriate construct in the study.

The second step in the questionnaire construction was identifying and adapting items from previous studies. Authors who applied a similar theoretical model in a published article were contacted for a copy of their original questionnaire and permission was sought to adapt either the structure or some items in their questionnaire with a promise to properly reference items adapted. Questionnaires and permission were obtained from studies of Ko and Lee (2003), Shuman (1995), and Conner and McMillan (1999). Items were adapted from studies of the first two authors.

The third and final step focused on constructing and pilot testing the questionnaire. Items resulting from the content analysis and questions adapted from previous studies were used in constructing several drafts of the questionnaire. To improve content validity and clarity, two senior researchers in psychology and one in environmental education not directly involved in the study were asked to review and comment on the questionnaire. This led to a review of content and structure. It was then pilot tested on two groups of primary teachers (N = 20) who questioned,

critiqued and provided useful insight that led to rewording, review of the length, numbering, formatting, deletion and addition of new elements in a bid to ensure face validity. For instance the word "pupils" replaced "students" as primary school teachers identified more with this terminology. Content and construct validity was also achieved by applying a well established theory on human behaviour and by following recommendations for questionnaire construction by developers of the theory. This similar approach has been used by numerous studies that used the theory of planned behaviour. A final version of the questionnaire for the study was arrived at after several reviews with supervisors.

The final questionnaire was made up of 119 items divided into an introductory section and five main parts (A-E) (Appendix B). Each part aimed to ask questions that will help measure and record the constructs in the proposed model. The questionnaire was printed on both sides to reduce use of paper and the bulky nature in order to encourage higher response. Questions were numbered section by section with each new section starting from the beginning. The essence of this was for respondents not to be put off responding by observing a large number at the end if numbering was continued. All variables were measured on a 7-point likert scale. Although Ajzen and Fishbein (1980) recommend that questions are mixed throughout the study to avoid response bias, this was not followed as this strategy would have increased questionnaire length and decreased the response rate. Also, findings show that more educated respondents, in this case primary school teachers, are less influenced by the order of questionnaire items (Benton & Daly, 1991). Babbie (2007) also stressed that randomising items in questionnaire will probably strike respondents as chaotic and worthless. This also makes it more difficult for respondents to answer because they must continuously switch their attention from one topic to another.

5.5.2. Measures

The final questionnaire was divided into an introductory section and five main sections. A cover page that introduced the study and what it was about was also

provided. This cover page further gave instructions regarding what is required of participants and the contact details of the researcher.

Introduction

The introductory section provided a definition of the term 'teaching environmental education (EE)'. The term 'teaching EE' was used throughout the questionnaire to keep participants focused on what the study is about. Teaching EE was defined as teaching of environmental issues (litter, waste minimization, water, energy, school grounds, health and wellbeing, biodiversity and transport) within the primary curriculum this year with the aim of developing pupils' knowledge, skills, attitudes and experiences that will enable them develop an informed and responsible environmental behavior. The topics reflect the main areas promoted by the Eco School programme. Since majority of the schools have registered with the programme, they are more familiar with them as reflecting EE. The definition also reflect some of the provisions in the 5-14 curriculum (Scottish Executive, 2000) and the topics that teachers are expected to cover within a school year. The final aspects of the introduction asked participants to provide some background information (years of teaching experience, gender, number of classes being taught and the school's involvement in the Eco School programme).

The main questionnaire was divided into five main sections. Section (A) measured teachers' level of intended commitment and actual commitment to EE. Section (B) measured life experiences that are significant in influencing commitment while section (C) measured attitudes. Items in section (D) measured subjective norms and the final section (E) collected information on teachers' perception of control in teaching EE. A short introduction was provided before each section to help respondents make sense of the questionnaire. These introductions make a questionnaire less chaotic since each section taps a variety of data and puts respondents in a proper frame of mind from answering the questions (Babbie, 2007).

Commitment and Intention

Intention and commitment were measured using paired questions. Intention was operationally defined as the ideal behaviors that participants would like to engage in, while commitment was defined as the extent to which participants actually carried out these behaviors. Items mostly adapted from Ko & Lee (2003) were used to elicit teachers intention (ideal practice) and commitment (current practice). Participants were asked to circle a number that reflected their intended practice on a particular statement and later to circle a number that reflected their current practice. This approach was to allow participants to critically reflect on their current behaviour after an opportunity was provided for them to state their preferred behaviour. Items reflected three main scales: Core EE Content (Environmental Knowledge, Attitude and Behavior); Teaching Practice and Teaching Methods.

The framework for evaluating commitment and intention was based on the framework of education ABOUT, FOR and IN the environment. These interrelated 'threads' of experience, concern and action constitute strategies that cover the broad objectives of EE (Palmer, 1998). Education *about* the environment refers to the environment as a subject of investigation and includes the teaching of basic knowledge and appropriate technical skills that enables pupils to understand the complex relationship between the environment and humans. This knowledge enables pupils to critically evaluate environmental issues based on informed understanding and promotes desirable attitudes and values (Palmer, 1998). Education *in* (or *through*) the environment involves using the environment as a resource in teaching pupils. This calls for engaging pupils in hands-on experiences using various investigative techniques that inevitable lead to greater understanding and acquisition of skills for problem solving. Education *for* the environment focuses on the development of pupils' values, attitudes and positive action toward the environment.

Items in the core EE content scale were designed to cover and assess the extent to which teachers intend to and actually teach EE to cover the various learning domains (Environmental Knowledge, Attitude and Behaviour). For example, questions included the extent to which teachers intend to and actually teach EE in order for

pupils to acquire understanding of environmental concepts and issues (Knowledge), become sensitive toward the environment (Attitude) and gain actual experience in solving environmental problems (Behaviour). The items measured on a 7-point likert scale (1 = No, 7 = Strong) asked participants to rate what their ideal emphasis on teaching environmental education is and the extent to which they currently carry out the intended practice.

The teaching approach and teaching method scale were designed to elicit the extent to which teachers intended to and actually used strategies that enable them to cover the broad objectives of EE. Both scales measured teachers' preferred strategies and the kind of resources they use in their teaching. Teaching approach for instance evaluated extent to which pupils were engage in classroom learning activities, use of resource persons and use of local examples. Teaching method covered the extent to which teachers intended to and actually engaged in taking pupils on fieldtrips, experiments and use of audio visual materials and methods. All items were measured on a 7-point likert scale using various anchor words (Disagree – Agree; Never – Always) where appropriate. The total scale for intention and commitment were computed by summing up all items in the scale and averaging the scores. A higher score indicates high intention and more commitment toward environmental education.

The measurement of actual behavior through self-reports makes this study different from others since the application of the theory of planned behaviour in similar studies measured behavioral intentions and not actual behavior. Also Shuman's (1995) application of the MEEC measured behavioral intentions and not actual behavior. According to Gotch and Hall (2004), measuring the extent of engagement in actual behavior allows a more powerful test of the theory of planned behaviour than just behavioral intentions. To ensure reliability, multi-items approach was used in measuring both the intention and commitment constructs.

Attitude

Attitude was defined as a teachers' favourable and unfavourable feeling toward teaching EE to their pupils during the school term. Two scales (indirect and direct attitude measures) were used to gauge participants' attitude. Indirect attitude items were measured by teachers' beliefs about the likely outcomes of teaching environmental education to pupils (1 = Unlikely, 7 = Likely), and the importance of these beliefs (1 = Not Important, 7 = Very Important). There were six likely belief outcomes and six evaluation statements. Participants were asked to circle a number that represented their feeling about possible outcomes of teaching EE to their pupils and how important it was to them that they achieve those outcomes. In computing total indirect attitude scores, each behavioural belief item was added to its corresponding outcome evaluation item and sums were averaged (Kakoko et al., 2006; Armitage et al., 1999; Evans, 1991).

Direct attitudes were elicited with six items scored on 7-point bipolar adjectives. Items were adapted from Shuman (1995). Items tapped both instrumental (e.g. bad-good, harmful-beneficial) and affective (e.g. unpleasant-pleasant, hard-easy) aspects of attitude as suggested by Ajzen (2002). A total direct attitude score was computed by summing and averaging scores on all items. Higher scores on both the direct and indirect attitude scale indicate more positive attitude to EE.

Subjective Norm

Two scales defined subjective norms. These are injunctive norms and descriptive norms. Injunctive norm items measured the extent to which participants perceived pressure from referents to engage in EE (e.g. 'Fellow teachers think I: Should not (1) to Should (7) teach EE') and the extent to which they are motivated to comply with these normative pressure (e.g. 'How important is it that you teach like fellow teachers want you to teach', Not at all - Very much; scored 1 to 7). In all, there were eight *normative pressure* items and eight *motivation to comply* items relating to fellow teachers, school and education authorities, government agencies who support the teaching of EE (groups identified in the pilot study). Like the indirect attitude scale, total injunctive norm scores were computed by adding each normative pressure

item to its corresponding motivation to comply item and averaging the sums (Kakoko et al., 2006; Armitage et al., 1999; Evans, 1991).

Descriptive norms items measured the extent to which participants perceived referents to be engaging in the behavior itself. These were measured on two anchor words with scores ranging from 'Never' (1) to 'Frequently' (7). For example participants were asked to indicate the extent to which fellow teachers and school authorities actually engage in EE. Scores on this scale were summed up and averaged to form total scores for descriptive norms. Higher scores on both the injunctive and descriptive norm scale indicate greater influence by referents on participants.

Perceived Behavioural Control

Perceived behavioural control was defined as the extent to which participants see themselves as having control over teaching EE (perceived controllability) and having the competences to engage in it (self-efficacy). Six items in the perceived controllability scale were used to measure the extent to which teachers have the freedom and resources to teach EE (Never – Always; scored 1 to 7). Five items in the self-efficacy scale (adapted from Shuman, 1995) measured how certain participants' felt about their ability to teach EE to their pupils in the school year. Participants were asked to rate the extent to which they strongly disagreed (1) or strongly agreed (7) with the statements provided. Total score for both scales were computed by summing and averaging items. Higher scores on all scales indicate more control over teaching EE.

Although the relevance of each control item was included in the questionnaire following the suggestion by Ajzen (1991), these items were not included in the analyses as they did not make theoretical sense in the context of the behaviour measured in this thesis.

Significant Life Experience

Life experience was operationally defined as the frequency of having specific experiences and how influential the experience was (is) in motivating how and what

they teach. The construct was measured on two scales (Outdoor Recreation Experience; Environmental Education and Action Experience). The items for the scales were partly adapted from Shuman (1995).

Seven items on the outdoor recreation experience scale measured experiences like participating in outdoor activities, environmental clean-up and restorative projects, gardening, and volunteering in natural resources or environmental organisations. The environmental education and action experience scale was made up of six items that measured experiences like taking part in class and school activities that focused on the environment as a student, finding out about the environment through the media and participating in environmental education workshops and conferences. Participants rated the extent to which they have had a specific experience (1 = Never, 7 = Often) and how influential the experience is in motivating how and what they currently teach (1 = Not Influential, 7 = Extremely Influential). Total scores for each scale were computed by additively combining item scores representing the extent of experience and their respective level of influence, and finally averaging the sum (Kakoko et al., 2006; Armitage et al., 1999; Evans, 1991). Higher scores on both scales indicate a strong influence of environmentally related experiences.

5.5.3. Data Collection Procedure

The data collection strategy was a mail survey modified from Dillman (2000). A mail containing a letter (Appendix C), a questionnaire and self-addressed stamped envelope was sent to 500 head teachers of the selected schools. They were requested to give the questionnaire where possible, to a primary six teacher to be completed and returned. All letters were printed on a department headed letter and were personally signed by the researcher to increase the response rate. Three weeks after the initial mailing, a postcard was sent to all schools thanking those who have responded and asking those who have not yet responded to do so. Opportunity was given to those who could not find their questionnaire to request a new one to be sent to them which some of them did. The letter also requested that teachers interested in a follow up interview provide their contact details on a separate piece of paper and

mailed back with the questionnaire. The request for their details to be on a separate paper was to ensure anonymity and confidentiality

Initial returns were screened for any trends, mistakes or misunderstanding that would necessitate an immediate step to remedy the situations. All returns were as expected with no major trends or signs that the questions were misunderstood. All responses were given an identification number and entered into SPSS 14.0 for processing and analysis.

In all a useable return rate of 36.4% (n = 182) made up of 164 (n = 90%) female 18 (n = 9.9%) male participants was obtained. This is consistent with current gender composition in Scottish primary schools where 93% of teachers are females (Scottish Executive, 2006b). With regards to the number of classes each participant teaches at a particular time, 57.7% reported teaching only one class at a time (any class from primary 1 to 7), 24.2% taught combination of two classes, 12.1% taught more than three classes and 6% taught all seven classes. This shows that over 40% of teachers teach more than a class which has implication with respect to time constraints. It is, however, acknowledged that most schools where teachers teach more than two classes have very small class sizes. Years of teaching experience varied greatly. This ranged from seven months to thirty years of experience. The average teaching experience was 15.41 years. Of the total respondents, 63.2% (115) of the schools had green flags or were in the process of getting it with 45.1% (82) of all respondents having an environmental committee or club in their schools.

5.5.4. Initial Data Screening and Treatment

As has already been mentioned, various forms of multivariate analysis and tests were employed for analysing the data. These group of tests known as parametric statistics make assumptions about the distributional characteristics of the data. Data screening and preparation were thus critical to ensure that these assumptions were met. Kline (2005) for instance notes that data related problems can occur if these assumptions are not met and this can cause the failure to yield logical solution for multivariate

statistics such as structural equation modelling. Data screening is also relevant for ensuring the accuracy of values that are entered into the data base. It also helps to account for and solve problems related to missing data as these problems can distort the research findings. Thus it was important to screen data before any type of multivariate analysis was conducted in order to establish trust in the results.

Accuracy of Data Entry

The raw data were initially screened for errors that might have occurred during data imputation. Descriptive statistics were run using SPSS 14.0 to check minimum, maximum and frequency values of each item. Box plots were also used to check for any outliers and this revealed very few out of range values which were checked with the original questionnaire and corrected.

Missing Data

The next step was to deal with missing values which is an endemic problem across the social sciences (Juster & Smith, 1997). Estimates in political science survey for example point to about 50% of participants having missing values (King, Hopnaker, Joseph, & Scheve, 2001) and educational research is no exception. Results from SPSS Missing Value Analysis shows that there was problem of missing values for 39 participants in the study. This ranged from absence of response on three items to more than fifteen items. Four of the questionnaires which were returned uncompleted due to closure of the school or participant not being interested are not included in this figure.

After reviewing several texts and literature (E.g. Acock, 2005; Raghunathan, 2004; Tabachnick & Fidell, 2001) to find the most practical way of dealing with missing data, Expectation Maximization strategy was chosen to compute and input missing values. This strategy was chosen because it is considered the simplest and most reasonable approach to input missing data (Tabachnick & Fidell, 2001, p. 66). Expectation maximisation is an iterative procedure involving two steps - expectation and maximisation - for each iteration. The E step finds a conditional expectation of the "missing" data, given the observed values and the current estimates of the parameters, such as correlation. The second step, the M step, performs maximum

likelihood estimation as though the data has been filled in. Finally, after convergence has been achieved, SPSS saves in the filled-in data in the data set (Tabachnick & Fidell, 2001).

The missing data were first examined to see if there were any patterns. After conducting a missing value analysis, it was concluded from results that data were missing at random. Seven cases which had more than 15 variables missing were deleted as the percentage of missing values was considered to be high and equivalent to a non-response. This brought the total sample size to 182. Expectation maximization (EM) strategy was then used to compute missing values for the remaining 32 cases. The advantages of this procedure are that it avoids impossible matrices, overfitting (making the solution look better than it actually is), and produces realistic estimates of variance (Tabachnick & Fidell, 2001). Later multiple regression analysis for only complete data was compared with those using estimated missing values and results were similar.

Although it is possible to compute EM in AMOS (software for running the structural equation model), the presence of missing data in AMOS makes it impossible to calculate modification indices. Thus, it was decided the best solution was to compute the missing data in SPSS before submitting to AMOS for analysis in order to be able to compute modification indices.

Normality and Homoscedacity

Multivariate normality is a basic assumption that underlies most multivariate statistical analyses. It is the assumption that variables in the data set are normally distributed. Although most statistical techniques like SEM are robust against minor violations of normality, extreme non-normality is likely to decrease the quality of results obtained (Tabachnick & Fidell, 2001). Assessing normality is important in the early stages of multivariate analysis if the goal is to draw inferences to the general population. Although data normality is not always required for analysis, the presence of data normality can result in better solutions whereas non-normality is likely to result in a degraded solution (Tabachnick & Fidell, 2001). Most SEM estimation

methods like the maximum likelihood estimation in this study assume that the distribution of the data to be analysed is multivariate normal.

Normality can be assessed either graphically or statistically. Skew and kurtosis are the two basic components of statistical normality. Skewness measures the symmetry of the distribution and if a variable's mean is not in the centre of the distribution then that variable is skewed. In a positively skewed distribution, most of the scores are below the mean whilst negatively skewed distributions have most scores above the mean. Kurtosis on the other hand measures the extent to which scores cluster around a central point. Variables with positive kurtosis (leptokurtic) have scores clustering more to a central point, are peaked and have a longer tail. Negative kurtosis (platykurtic) however indicates that variable scores cluster less to a central point, are relatively flat and have shorter tails. Variables with normal distribution have a skew and kurtosis value of zero. A general rule of thumb for evaluating skewness and kurtosis is to convert them into a Z-score by dividing the skewness and kurtosis index by their standard errors (Tabachnick & Fidell, 2001; Kline, 2005). Absolute values greater than 1.96 (known values for normal distribution) indicate significant ($p < .05$) skew and kurtosis (Field, 2005). Other cut-off points for normality are values less than plus or minus one (< +/- 1.0) (Leech, Barrett & Morgan, 2005). The problem with this method is that it is affected by sample size and large samples tend to produce non normal results. This is because the standard error for both skewness and kurtosis decrease with large *N* and large samples are likely to be rejected with minor deviations from normality (Tabachnick & Fidell, 2001). Also variables with statistically significant skewness do not deviate enough from normality to make a substantive difference in analysis if sample size is large. Furthermore, the effect of skewness and kurtosis in the underestimation of variance has been found to disappear with samples sizes between 100 and 200 (Tabachnick & Fidell, 2001).

An additional recommendation for evaluating multivariate normality in large samples is to inspect the visual appearance of the distribution through a frequency histogram. Also important are the normal probability plots and the detrended normal probability plots. Distribution of points on reasonably straight line of the normal probability plot indicates a normal distribution. With the detrended plot, a normal distribution is

inferred when points are evenly distributed above and below the horizontal line (Tabachnick & Fidell, 2001). A popular measure of multivariate normality in SEM is the Mardia's coefficient. In AMOS this is reported with a critical value that is used to assess the extent of deviation from normality. When the coefficient is greater than the critical value, then the data is said to be multivariate non-normal.

The assumption of homoscedasticity is that the variability in scores for one continuous variable is roughly the same at all values of another continuous variable (Tabachnick & Fidell, 2001). This is related to the assumption of normality and if the assumption of multivariate normality is met, the relationship between variables is homoscedastic. The variables in the study were screened to determine the nature of their distributions. The skew and kurtosis for items and parcels were used to evaluate the univariate distribution of variables. Due to the relatively large sample size, both the frequency histogram and Mardia's coefficient were also used to ascertain multivariate normality. These findings are presented in chapter five in addition to other descriptive statistics.

Outliers

Outliers are extreme values reported for a variable or combination of variables. Outliers distort the statistics obtained from analysis, increases possibilities of type I and II errors, and decrease the possible generalization of results. The data for the study was screened for outliers using multiple regression analysis. According to Tabachnick and Fidell (2001), cases with standardised residuals of more than 3.3 or less than -3.3 in the residual scatterplots are defined as outliers. No outlying residual was present in the residual scatterplot. Further screening was carried out by inspecting Mahalanobis Distances statistic. This describes the distance in standard deviation units between a set of scores (vector) for an individual case and the sample means for all variables known as the centroid (Kline, 2005). Using a critical chi-square value of 20.52, $df = 5$, $p<.001$, (Tabachnick & Fidell, 2001, Table C.4) additional exploratory analysis were conducted to identify any outlying cases. Only three outlying cases (ID number 97, 132 and 177 with values 23.15, 22.52 and 22.09 respectively) were found. Given the size of the data, this was not unusual. However, to check if these outlying cases will influence the results Cook's distance value was

inspected. The maximum of the Cook's distance was .12 far below the cut-off maximum of 1 (Pallant, 2005, p. 152). In other words, no particular action was warranted.

Multicollinearity

Multicollinearity occurs when variables are too highly correlated (r = .90 and above) as to render certain mathematical operations unstable or impossible (Kline, 2005). Multicollinearity does not contribute to a good regression model and affects computation of multiple regression results. It also causes both logical and statistical problems because variables with high correlations are redundant and tend to inflate the size of error terms and actually weakens analysis (Tabachnick & Fidell, 2001). Problems of multicollinearity can be checked by inspecting the correlation matrix of variables. The correlation matrix table of all variables and parcels were inspected prior to submission of data for further analysis. Results are presented in chapter five.

5.6. Conclusion

This section has presented an overview of the quantitative procedure employed in this thesis. The research questions to be answered in the quantitative analysis were presented followed by a description of the sampling strategy and the statistical techniques employed. The procedures used in data collection, the steps taken to check the accuracy of data imputation and screening the data for outliers were also elucidated. Explanation was also provided on the extent of missing data and strategies adopted in dealing with the problem. Finally, results from preliminary analysis showed the data to meet the basic assumptions for proceeding with the proposed multivariate analysis.

CHAPTER SIX

Quantitative Analysis and Results

6.1. Introduction

This section presents the analysis and result of the quantitative phase of the study. As stated earlier, the aim of the quantitative phase was to test the explanatory power of the model of environmental education commitment, explore the relationships between the variables specified in the model and to determine the main predictors of teachers' commitment. In the first phase of analysis, confirmatory factor analyses (CFA) were carried out to assess the convergent and discriminant validity of each measurement construct. The logic for considering measurement models separately was to obtain an adequate model for each construct and to determine the dimensionality of individual constructs for parcelling purposes (Little et al., 2002). Furthermore, the use of a large pool of items in the questionnaire ensures internal consistency and reliability. However, evaluating a large number of items in CFA is problematic and unlikely to produce reasonable results. This is because very large samples are required for evaluating large number of parameters and the possible problems of correlated measurement errors are more likely. Prior to the presentation of the CFAs, an overview of the descriptive analyses (mean, standard deviation, and Cronbach's alpha) and correlations of the items and construct are presented. While only descriptive results of constructs are presented here, detailed descriptive analysis of items are presented in the Appendices. The second and final phase of this section involved the testing, modification and validation of the entire model.

As indicated in the preceding chapter, model fit was evaluated using the following fit indices: Chi square ratio (X^2/df) values below .30; Comparative Fit Index (CFI) values above .90 with its 90% confidence interval (CI); Root Mean Square Error of Approximation (RMSEA) values below .80; and Standardised Root Mean Square Residual (SRMR) values below .10. Although the model chi-square (X^2) was reported in accordance with trends in SEM, it was not used as a basis of evaluating overall fit.

6.2. Results - Testing of Measurement Model (CFA)

6.2.1. Commitment

Fourteen items representing three sub-scales were used to measure teachers' level of commitment to teaching EE. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix D.1. Overall, average response shows that teachers have a moderately high commitment to teaching EE (M = 4.99, SD = 0.82). The mean scores within the core EE content scale showed that teachers placed more emphasis on teaching pupils to develop respect for the belief and opinion of others (M = 5.41), and to be more sensitive towards the environment (M = 5.16). Less emphasis was generally placed on teaching pupils to become involved in solving environmental problems (M = 4.23). These findings indicate teachers placed more emphasis on the attitudinal component of environmental education than the behavioural component. The approach and method most favoured were using local examples (M = 5.44) and engaging in outdoor activities with pupils (M = 5.05).

The range of item standard deviations (0.90 to 1.66) indicates that responses to the 14 items were consistently close to the mean rating. In other words, there was a similar pattern of response across the items measuring commitment. The data set in general indicates some level of normality as skewness and kurtosis values were below the recommended value of plus or minus one (< +-1). Values for univariate skewness ranged from .01 to -.90 while the range for kurtosis was from .00 to .88. All but four items were negatively skewed indicating a cluster of scores at the high end. This approximately normal distribution was confirmed by the frequency histogram. Inspection of the correlation matrix shows the coefficients to be mostly above .30 indicating a positive relationship among items hypothesised to measure the construct. These correlations on the whole ranged from small (r = .130) to large (r = .776), with medium to large correlations observed among items specified to measure specific sub-scales in the construct. The highest correlation, .776 was between items CP5 (pupils gaining actual experience in solving environmental issues) and CP6 (pupils becoming involved in resolving environmental issues). This was no surprise

as these were item pairs specified to measure the behavioural domain of the construct. The reliability coefficient estimated as Cronbach's alpha was .909 for the commitment construct. Commitment to EE was specified as the dependent variable in this study and several predictive constructs were conceptualised as influencing the level of commitment.

Teachers' commitment to environmental education was hypothesised as a multidimensional construct represented by Current Core EE Content (Knowledge, Attitude and Skills), Current Teaching Practice and Current Teaching Methods. This dimensionality of commitment to EE has not been determined or tested in previous studies. Using a first-order CFA model, the hypothesised three-factor model for commitment was tested using the maximum likelihood (ML) estimation method. Results from the analysis indicated the three-factor model did not fit the data well (X^2 = 240.58; *df* = 74; X^2/df = 3.25; CFI = .876; RMSEA = .112 with a 90% confidence interval .096-.127; SRMR = .073). Only the SRMR index was within the recommended criteria for fit.

Inspection of the estimates showed all paths specified to be statistically significant (p < .001) indicating that there was not a necessity to delete any item or path. To improve model fit, modification indices were requested and various indices were examined. The results suggested that covarying measurement errors of some items will improve the fit of the model. Systematic analysis based on theoretical grounds was carried out to either covary or combine items. In other words, only modifications that made theoretical sense were considered.

The first statistical suggestion was an error covariance between items 5 & 6 on the commitment scale. These items conform to 'pupils would have gained actual experience in solving environmental problems (item 5)' and 'pupils will become more involved in resolving environmental issues (item 6)'. These are item pairs used to measure the skills component of the Core EE Content sub-scale and were the items with the highest inter-item correlation. Item pairs were deliberately included to control for response bias and increase reliability of response. However, a high degree

of item overlap in CFA indicates item redundancy and triggers a kind of method effect suggesting correlation of item errors (Byrne, 2001; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Decision was therefore taken to combine these items into a single score to measure the skills component of the construct. The new item score (item 56) was labelled as 'pupils gaining experience to be able to resolve environmental problems.' Two other error covariances were considered for improving the model. The first was error covariances between items 7 and 8 while the second was between items 1 and 2. Considering these items measure the same construct in the model, it is probable the items share a similar source of measurement error. These error covariances are also very common with questionnaire items and represent another form of method effect. Further examination of standardised residual covariances was carried out to confirm if suggested modification indices were valid. Based on these considerations, the measurement model was re-specified to include the following changes: Combination of items 5 and 6; Error covariance between items 7 and 8, and items 1 and 2.

This new model was analysed and values of selected indices suggested an approximate good fit to the data ($X^2 = 119.14$; $df = 60$; $X^2/df = 1.98$; CFI = .95; NFI = .90; RMSEA = .078 with a 90% confidence interval .054-.093; SRMR = .064). The standard errors and critical ratios of items (See Appendix D.2) are also within the ranges of good fit. The final model which shows the factor loadings and reliability coefficients of each item is displayed in Figure 6.1.

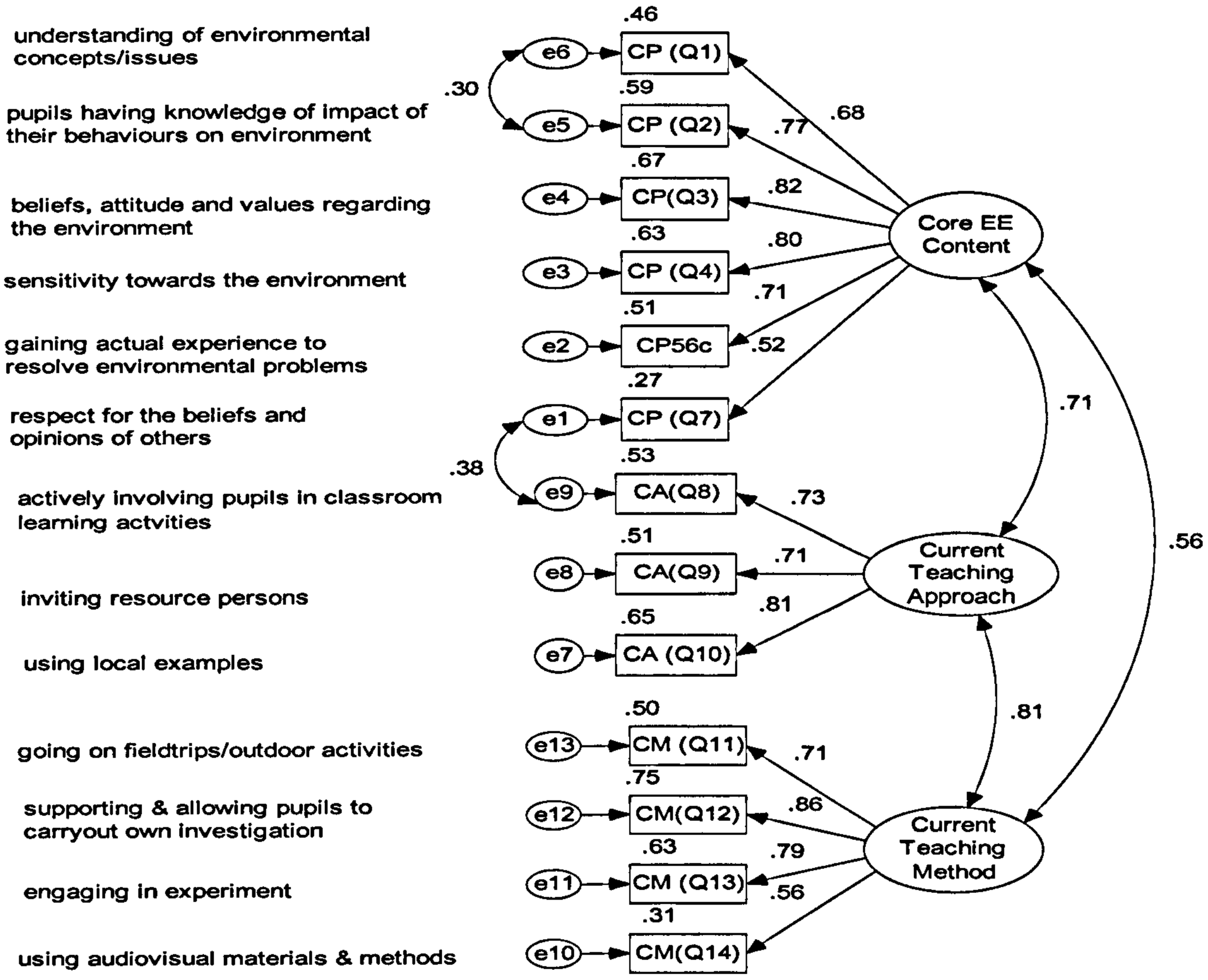


Figure 6.1: Final Three-Factor Measurement Model of Commitment

Focusing on the model, it appears the items provide a relatively strong measure of the commitment constructs. Standardised factor loadings (structure coefficients) displayed in Figure 6.1 for core EE content, teaching approach and teaching methods are .51 ($p < .001$) or higher. Because each indicator is specified to measure just one factor, the standardised factor loadings estimate indicator-factor correlation. In general, indicators are expected to have a higher estimated correlation with the factor they are believed to measure. The relatively high standardised factor loading for each indicator suggests convergent validity. Since, the factors are specified to measure the same psychological construct, the moderately high correlation between the factors also signify convergent validity. The evidence of discriminant validity among the sub-scales is also strong because the estimated standardised factor correlations are below the recommended value of 0.90 (Kline, 2005). In conclusion, these results

suggest items used in the questionnaire are valid for measuring teachers' commitment to EE.

6.2.2. Intention

Teachers' intention to teach EE was hypothesised to directly predict commitment. Like commitment, fourteen items representing three sub-scales were employed to assess intentions. The items used for measuring commitment and intention were the same. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix E.1. Average response from participants indicate very high intentions to teach EE (M = 6.30; SD = .49). The mean score of items within the core EE content scale showed that teachers intended to place more emphasis on teaching pupils to develop respect for the belief and opinion of others (M = 6.58), and to be more sensitive towards the environment (M = 6.51). This indicates an overall intention to place more emphasis on the attitudinal component of EE. However, there was an equally high intention to teach the knowledge and the behavioural components of EE as well. The intended approach and method was to actively involve pupils in learning activities (M = 6.45) and to engage pupils in experiments (M = 6.29).

There was less variability (range of item SD = .643 - .922) among responses on the 14 intention items compared to that reported for commitment. This indicates similar responses on all items by participants and the mean is an accurate representation of teachers' intentions. The data set indicates some level of non-normality as skewness and kurtosis values were above the recommended value of plus or minus one (< +-1). All item scores were negatively skewed with values of univariate skewness ranging from -.54 to -1.7 whiles the range for kurtosis was from .08 to 3.0. This non-normal distribution was confirmed by the frequency histogram which showed a cluster of scores at the high end. The Mardia's coefficient (86.27, CR = 27.49) for multivariate normality requested through AMOS also indicate a departure from normality. The impact of non-normality on the results of analyses is however likely to be negligible due to the relatively large sample size (Tabachnick & Fidell, 2001). Also, the

maximum likelihood estimation used in analyses is robust against minor violations of normality (Anderson & Gerbing, 1988). Generally, strong positive inter-item correlations were reported with coefficients ranging from .067 to .832. Although some non significant inter-item correlations were reported, all items specified to measure similar sub-scales were significantly correlated indicating a relationship among items specified to measure a similar construct. The highest inter-item correlation was between two item pairs, IP5 and IP6, specified to measure the skills components of the construct. Cronbach's alpha reliability coefficient for the intention was .884.

As indicated above, intention was measured as a multidimensional construct with the following factors 'Intended Core EE Content (Knowledge, Attitude and Skills), Intended Teaching Practice and Intended Teaching Methods'. The three-factor intention model was specified and tested with a First-Order CFA. Like commitment, the dimensionality of intention to teach EE has not been determined or tested in previous studies. Results of the analysis showed a poor overall model fit (X^2 = 278.49; *df* = 74; X^2/df = 3.76; CFI = .841; RMSEA = .124 with a 90% confidence interval .108-.139; SRMR = .075) with only the SRMR index within the recommended value for good fit.

Estimates showed all paths specified in the model to be statistically significant ($p <$ .001) therefore there was not a necessity to delete any item or path. To improve model fit, modification indices were requested and various indices were examined. The results suggested that covarying measurement errors of some items will improve the fit of the model. Systematic analysis based on theoretical grounds was carried out to either covary or combine items. Suggested modifications that did not make any theoretical sense were not considered.

The first statistical suggestion was an error covariance between item 5 'pupils would have gained actual experience in solving environmental problems' and item 6 'pupils will become more involved in resolving environmental issues' on the intention scale. These were item pairs to measure the skills component of the Core EE Content sub-

scale and equally produced the highest inter-item correlation. Since these items are the same as those discussed under commitment (refer to commitment in previous section), a similar justification based on item redundancy was used to combine both items into a single score (item 56) to represent 'pupils gaining experience to be able to resolve environmental problems'. Subsequent error covariances were suggested but these did not make much theoretical sense.

A new model was therefore re-specified to include the combination of items 5 and 6. This modified model provided an approximate good fit to the data ($X^2 = 122.92$; $df = 62$; $X^2/df = 1.98$; CFI = .943; RMSEA = .074 with a 90% confidence interval .054-.093; SRMR = .062). The standard errors and critical ratios of items (See Appendix E.2) are also within the ranges of a good fit. The final model which shows the factor loadings and reliability coefficients of each item is displayed in Figure 6.2.

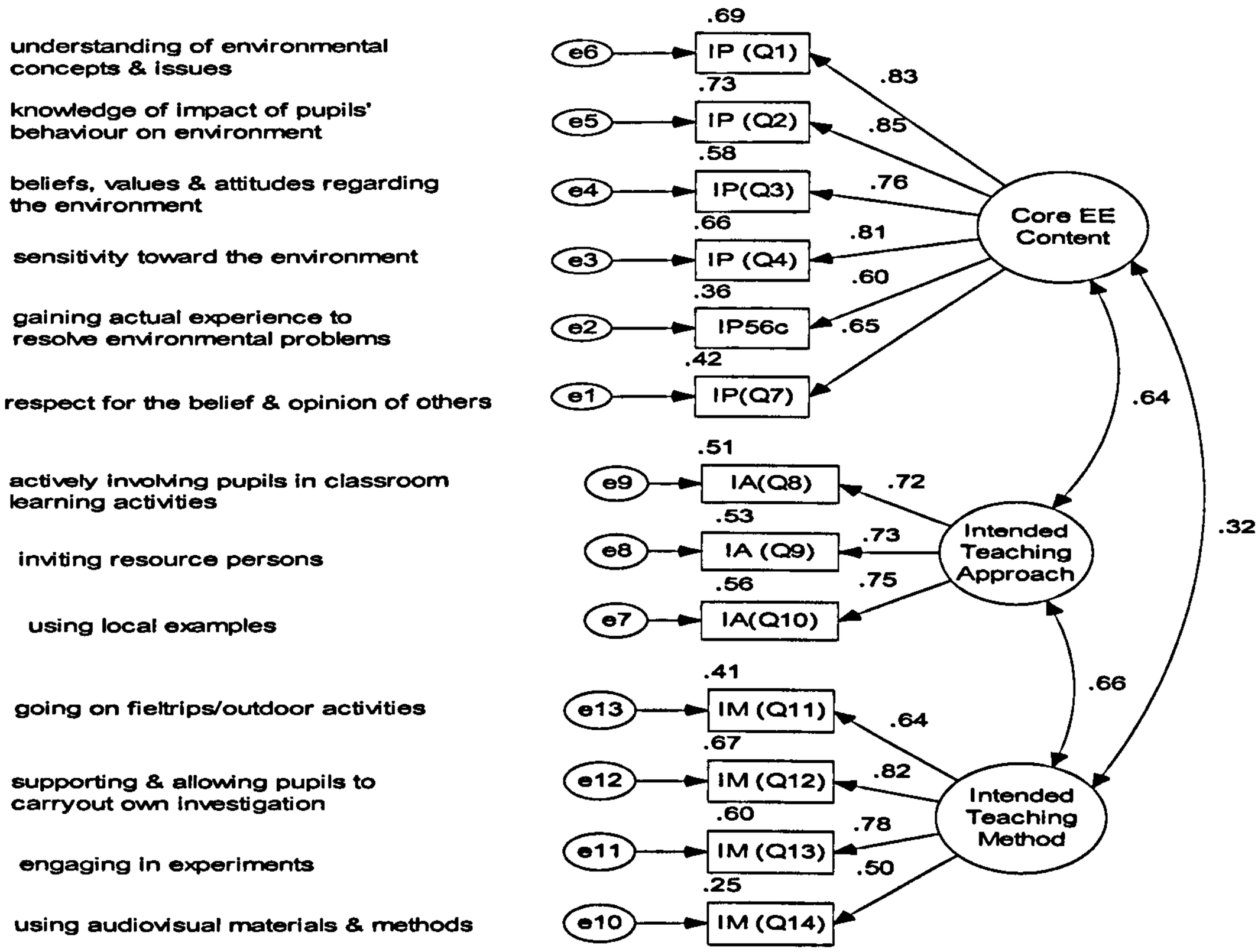


Figure 6.2: Final Three-Factor Measurement Model of Intention

The high standardised factor loadings (structure coefficients) displayed in Figure 6.2 for intended core EE content, teaching approach and teaching methods (> .50; $p < .001$) indicates that the items provide a relatively strong measure of the intention constructs. The standardised factor loadings estimate indicator-factor correlation. In general, indicators are expected to have a higher estimated correlation with the factor they are believed to measure. The relatively high standardised factor loading for each indicator and the moderately high inter variable correlations suggests convergent validity (Kline, 2005, p.183). The relatively moderate estimated correlations ($r < .66$) among the sub-scales indicate discriminant validity. In all, these results suggest items used in the questionnaire are valid for measuring teachers' intention to teach EE.

6.2.3. Attitude

Attitude was measured with 12 items representing two sub-scales. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix F.1. Overall average responses on the attitude scale shows a strong positive attitude ($M = 5.81$, $SD = .72$) toward the teaching of EE. The strongest belief held by teachers regarding the teaching of EE is that it would make pupils understand environmental issues ($M = 6.40$) and bring about changes in pupils attitude and behaviour toward the environment ($M = 6.03$). A similar pattern of response on the 12 attitude items is evident through the range of standard deviations (0.78 to 1.33). This small variability in responses shows the mean closely approximates teachers' ratings of their attitude. The data set in general indicates some level of non-normality as skewness and kurtosis values were above the recommended value of plus or minus one (< +-1). Values for univariate skewness ranged from -.60 to -1.2 while the range for kurtosis was between -.03 to 2.4. All items were negatively skewed indicating a cluster of scores at the high end. This approximately non-normal distribution was confirmed by the frequency histogram. The Mardia's coefficient (75.23, CR = 27.68) for multivariate normality requested through AMOS also indicate a departure from normality. The impact of non-normality on the results of analyses is however likely to be negligible due to the relatively large sample size (Tabachnick & Fidel, 2001). Also, the maximum

likelihood estimation used in analyses is robust against minor violations of normality (Anderson & Gerbing, 1988).

Overall, inter-item correlations were moderately high (ranging from .273 to .875) indicating a strong relationship between the items hypothesised to measure attitude. The highest correlation was reported between D13Ab and DA13c (r = .875). Considering that these two items were specified to measure the indirect attitude component, the strong relationship between them was expected. The Cronbach's alpha reliability coefficient for the attitude scale was .921.

The hypothesised two-factor model specified as 'indirect and direct attitude measures' was tested with a first-order CFA. Overall values of selected fit indices shows that the two-factor model poorly explains the data ($X^2 = 208.10$; $df = 53$; $X^2/df = 3.92$; CFI = .91; RMSEA = .127 with a 90% confidence interval .109-.146; SRMR = .059). The CFI and SRMR however shows some level of approximate fit although these are not enough for an acceptable overall fit.

Modification indices and other estimates were next examined to determine sources of misfit. Although all paths were statistically significant, the item DA13e measuring the direct attitude component had the lowest standardised factor loading (.421). This item reflects how 'hard or easy' it is to teach EE. A low standardised loading of an indicator with the factors they are supposed to measure is an indication that the item does not properly measure the factor thus suggesting poor convergent validity (Kline, 2005). A poor psychometric property of the item was also evidence in that the item hard very low correlation with all other items on the attitude scale. Marsh and Hau (1999) equally recommended the use of items with high factor loading especially in situations of small samples. Theoretical examination of the item indicates it more reflects individual perception of control. Also, individuals might consider behaviour as hard or difficult irrespective of their belief about the behaviour. Since a similar item was specified to measure perceived behavioural control in the study and the original specification of hard/difficult item was defined as measuring perceived behavioural control (Ajzen & Madden, 1986), a decision was taken to delete the

item. Additional modifications to improve fit include combination of two items (Da13f and DA13d). These items measure the cognitive determinants of attitude, that is, Negative/Positive and Harmful/Beneficial ratings respectively (Pal, Rise, Sutton & Roysamb, 2005). Since these items tap into the same psychological domain and indicates possibility of item redundancy (Byrne, 2001), both were combined to form a single score. The final modifications include error covariance between two sets of items (A4, A1 and A2, A1) based on possible method effect with questionnaire items (Byrne, 2001). Also, because these items tap responses from the same psychological domain covarying their errors makes theoretical sense hence a justification for their inclusion.

A new model was specified with these four modifications: deletion of item DA13e, combining Da13f and DA13d into a single score, covarying the error terms between items A4, A1; and A2, A1. The analysis converged to an admissible solution with values of selected indices suggesting a reasonably good overall fit ($X^2 = 72.93$; $df = 32$; $X^2/df = 2.27$; CFI = .973; RMSEA = .084 with a 90% confidence interval .059-.110; SRMR = .041). The standard errors and critical ratios of items (See Appendix F.2) are also within the ranges of good fit. The final model which shows the factor loadings and reliability coefficients of each item is displayed in Figure 6.3.

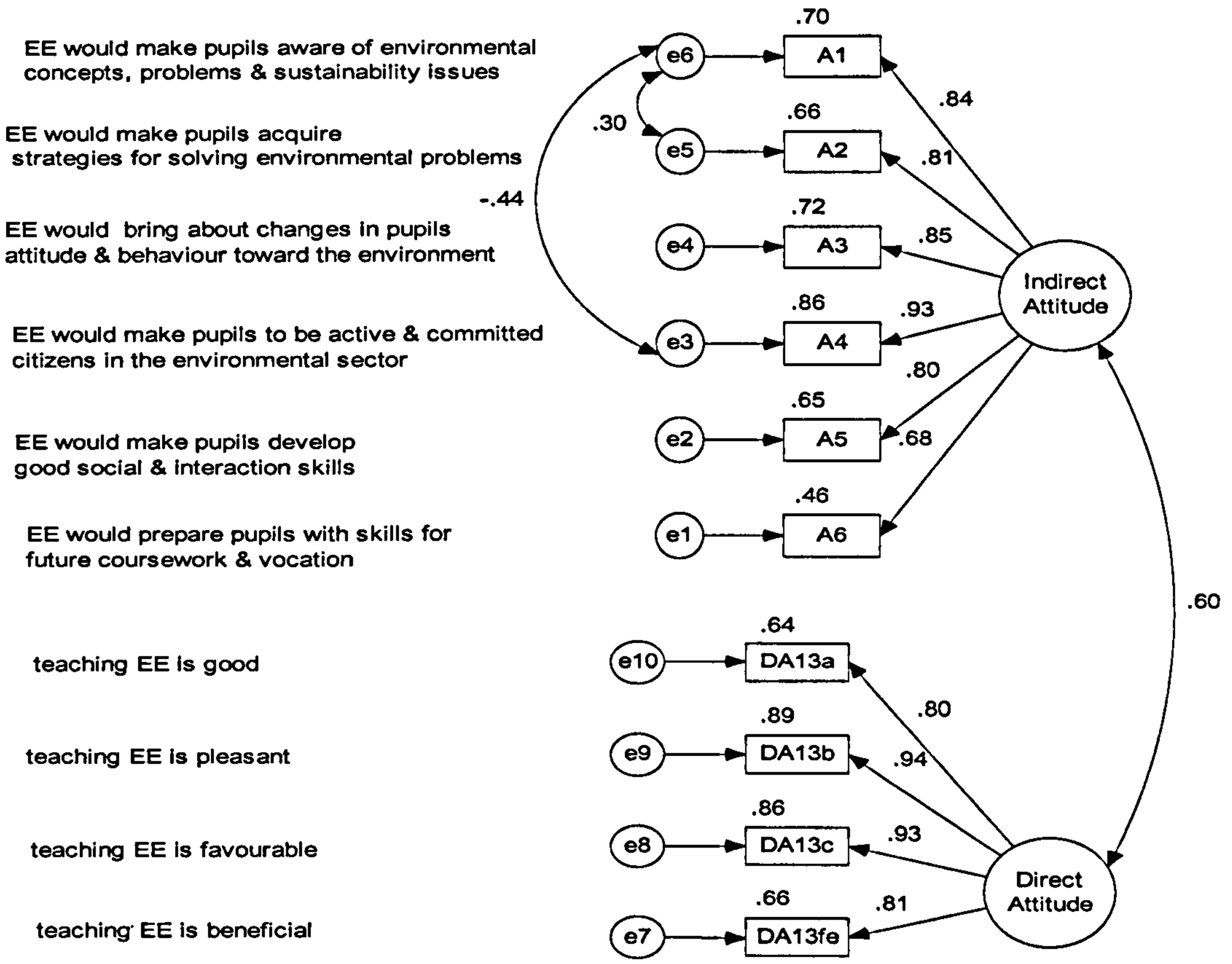


Figure 6.3: Final Two-Factor Measurement Model of Attitude

The high standardised factor loadings (structure coefficients) displayed in Figure 6.3 for indicators of the two attitude constructs (> .68; $p < .001$) indicates that the items provide a relatively strong measure of the attitude constructs. The relatively high standardised factor loading for each indicator and subscale suggests convergent validity (Kline, 2005, p.183). Discriminant validity is also evident in the moderate correlation between the two factors. In all, the favourable results suggest items used in the questionnaire are valid for measuring the attitudinal variable, and a global attitudinal construct thus underlies these items.

6.2.4. Subjective Norm

Sixteen items representing two sub-scales were used to measure the subjective norm construct. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix G.1. Overall average response from participants indicate strong ($M = 5.21$, $SD = .71$) normative pressure to teach

EE. Teachers identified school and education authorities as their most influential referent (M = 5.91). They however, perceived fellow teachers to be the referent most involved in teaching EE. The variability of response on the 16 subjective norm items was very small ranging between 1.00 and 1.58. This indicates that participants' ratings of all 16 items were similar and the mean is an accurate representation of the extent of normative pressure. The data set in general indicates relative normality as only two items had a skewness and kurtosis values above the recommended value of plus or minus one (< +-1). Values for univariate skewness ranged from -.60 to -1.1 while the range for kurtosis was between -.12 to 2.4. All items were negatively skewed indicating a cluster of scores at the high end. This approximate normal distribution was confirmed by the frequency histogram.

The correlation matrix generally indicates all items to be correlated with other items. Overall, inter-item correlation ranged from .10 to .69 with correlations mostly being low to moderate in strength. There were a number of non significant correlations including items specified to measure a specific sub-scale. However, the injunctive norm item S4 (government and its agencies responsible for EE issues) in particular had very low correlations (< .30) with all other items. The highest correlation of .69 was between items DN17d (school/education authority) and DN17e (government agencies) both specified to measure the descriptive norm sub-scale. This was however expected as both represent the central source of authority which is the *Scottish Executive*. Cronbach's alpha coefficient of reliability for the subjective norm construct was .864.

The two-factor Subjective Norm model was fitted to the data and tested using a First-Order CFA. The fit of this two-factor model did not meet the criterion of acceptability (X^2 = 455.87; *df* = 103; X^2/df = 4.42; CFI = .683; RMSEA = .138 with a 90% confidence interval .124-.151; SRMR = .091). As a result of the poor fit of this model, it was re-specified and tested as a unidimensional construct and this model was a worse fit.

When modification indices were examined, it was realised extensive modification was required to arrive at even a reasonable moderate fit. Some of the suggested modifications did not have a strong theoretical backing. In order to avoid producing a fit model that capitalizes on chance due to statistical manipulations, a pragmatic decision was taken to accept the subjective norm model as a poor fitting one. Two injunctive norm items (S1 = non governmental organisations; and S4 = government and its agencies responsible for EE) with low standardised factor loadings (.36 and .27 respectively) were however deleted. The correspondence descriptive norms from these two items were however kept in the model. The final model with the two deleted items equally did not provide acceptable fit indices (X^2 = 408.21; *df* = 76; X^2/df = 5.37; CFI = .687; RMSEA = .155 with a 90% confidence interval .141-.170; SRMR = .096). Although the final model seems to have produced even worse fit than the earlier model, it was preferred because of the high standardised factor loading of all items. This disappointing outcome raises the question about the fundamental strategy for measuring subjective norms. The poor fit of the model (factorial validity) might either be due to problems with the theory underlying the measurement of the construct or with the structure of the questionnaire. This problem with the subjective norm construct is consistent with previous findings that it is the most problematic construct in the theory of planned behaviour (e.g. Armitage & Conner, 2001). The standard errors and critical ratios of items (See Appendix G.2) were however within the acceptable ranges. The final model which shows the factor loadings and reliability coefficients of each item is displayed in Figure 6.4.

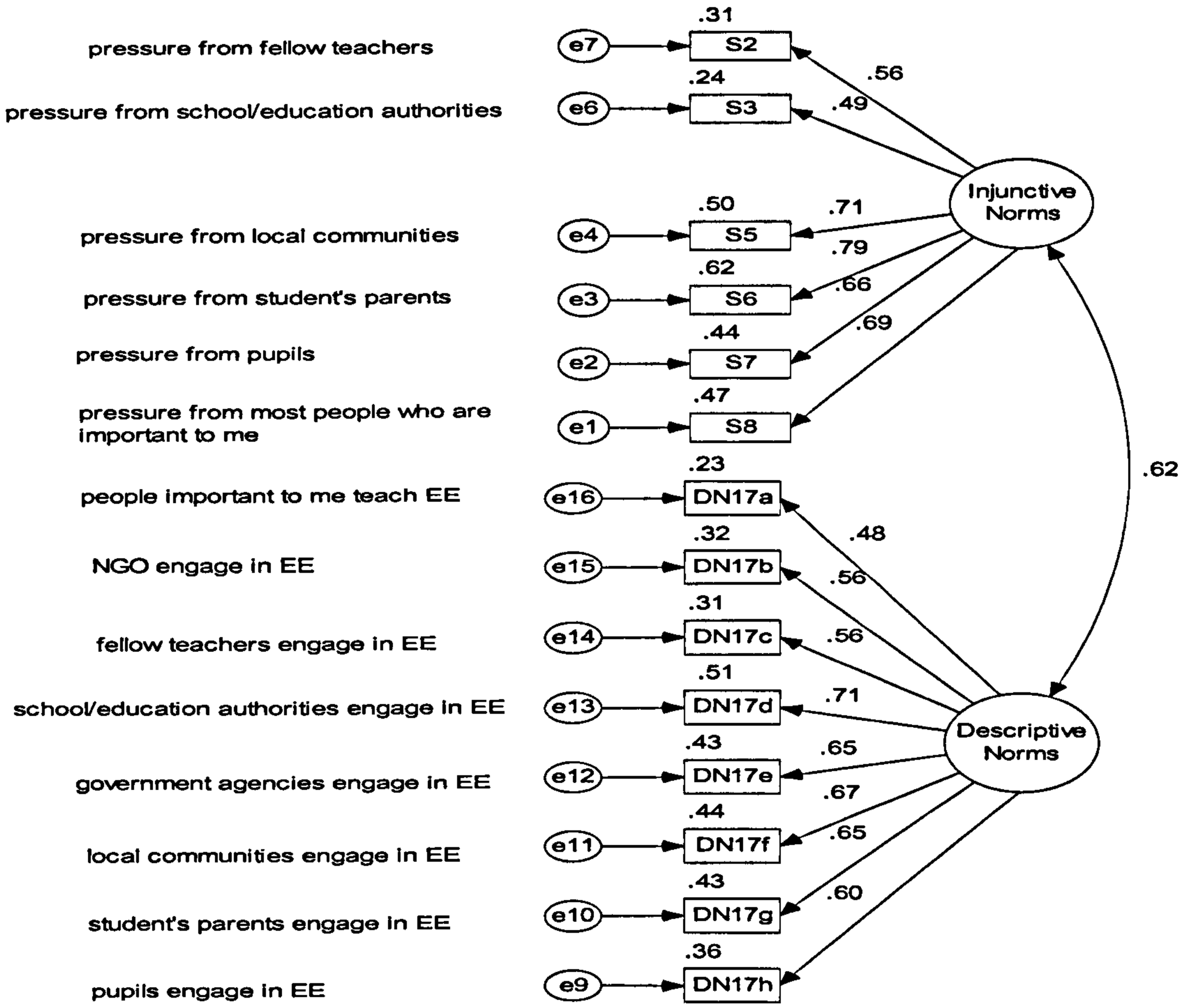


Figure 6.4: Final Two-Factor Measurement Model of Subjective Norm

Focusing on the model itself, the standardised factor loadings (structure coefficients) displayed in Figure 6.4 for both indicators of the two subjective norms constructs shows that the items strongly reflect the constructs they were specified to measure. All specified paths were statistically significant ($p < .001$). Inter variable correlation also indicate a relationship between the two subjective norm constructs. These results suggest some level of convergent validity (Kline, 2005, p.183). In all, the mixed results indicate that, the case for a subjective norm construct underlying these items is quite weak.

6.2.5. Perceived Behavioural Control

Perceived behavioural control was measured with 11 items representing two sub-scales. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix H.1. Average response to the 11 items indicates teachers have a moderate perception of control over teaching EE (M = 4.78, SD = .95). The item scores on the perceived controllability scale indicate that teachers have very little freedom in the curriculum (M = 3.66) and a very low control over teaching EE in general (M = 3.78). The highest control item is support from fellow teachers (M = 5.30). On the self-efficacy scale, teachers had a moderately high efficacy to teach EE effectively (M = 5.51). The variability of response on all items was small (item *SD* ranging from 1.08 to 1.96), indicating that the mean score closely approximates teachers' level of perceived behavioural control. The data set in general indicates an approximate level of normality as skewness and kurtosis values were mostly below the recommended value of plus or minus one (< +-1). Values for univariate skewness ranged from -.02 to -.86 while the range for kurtosis was between -.03 to 1.2. All items had low negative skews indicating a cluster of scores at the high end. This approximate normal distribution was confirmed by the frequency histogram.

Inter-item correlations were generally moderate to high although some non significant coefficients were reported. Overall, there was a strong relationship between items specified to measure each sub-construct. Significantly high correlations were particularly reported among the self efficacy sub-scale items with the highest being between items SE13 and SE 14 (.857), that is, 'having necessary skills to teach EE' and 'understanding environmental concepts well enough to effectively teach EE' respectively. Cronbach's alpha coefficient of reliability for the perceived behavioural control construct was .845.

Based on previous research, two-factors were specified for the Perceived Behavioural Control (PBC) construct. These are perceived controllability and self efficacy. Using a First-Order CFA, this two-factor model was tested for goodness-of-fit. Analysis revealed a poor fit of the model to the data (X^2 = 159.75; *df* = 43; X^2/df

= 3.71; CFI = .894; RMSEA = .122 with a 90% confidence interval .103-.143; SRMR = .091).

Examination of estimates shows all paths to be statistically significant. Factor loadings were first inspected to identify any low loadings and possible sources of misfit. Results show the 'general controllability item' (DC1) had low factor loadings (.39) on the controllability scale. Modification indices however suggested error covariance between this item and the 'freedom in the curriculum item (AR4)'. By referring to earlier interviews with teachers, it was realised that they mostly referred to presence or absence of overall controllability as freedom in the curriculum. This shows that, participants did not identify with the general controllability wording. Thus the item was not a good measure of controllability factor. Further evidence of the unsuitability of the item was revealed through high standardised residual covariances. Based on these revelations and the fact that the freedom in the curriculum item was seen as reflecting overall controllability, the general controllability item (DC1) was deleted. The second modification that was considered regards the perceived difficulty item (DC2) which reflects whether participants considered teaching EE to be 'Easy or Difficult'. Although originally specified to measure only self-efficacy, correlation residuals between the item and the controllability factor are large. Because the standardised loading of the perceived difficulty item on its original factor is at least moderate (.577), it is possible that this item may actually measure both factors (Kline, 2005). The perceived difficulty item (DC2) was therefore specified to load on both the self-efficacy and controllability factor. The final modification was an error covariance between opportunity to go on field trips (AR8) and access to resource persons (AR10). As noted in other modifications, items that tap from a similar psychological domain are likely to covary (method effect e.g. Byrne, 2001) and because they both measure controllability it makes theoretical sense to covary their errors.

These modifications to the original model produced a good fit to the data (X^2 = 63.80; *df* = 32; X^2/df = 1.99; CFI = .97; RMSEA = .074 with a 90% confidence interval .047-.101; SRMR = .041). The standard errors and critical ratios of items

(See Appendix H.2) are also within the ranges of good fit. The final model which shows the factor loadings and reliability coefficients of each item is displayed in Figure 6.5.

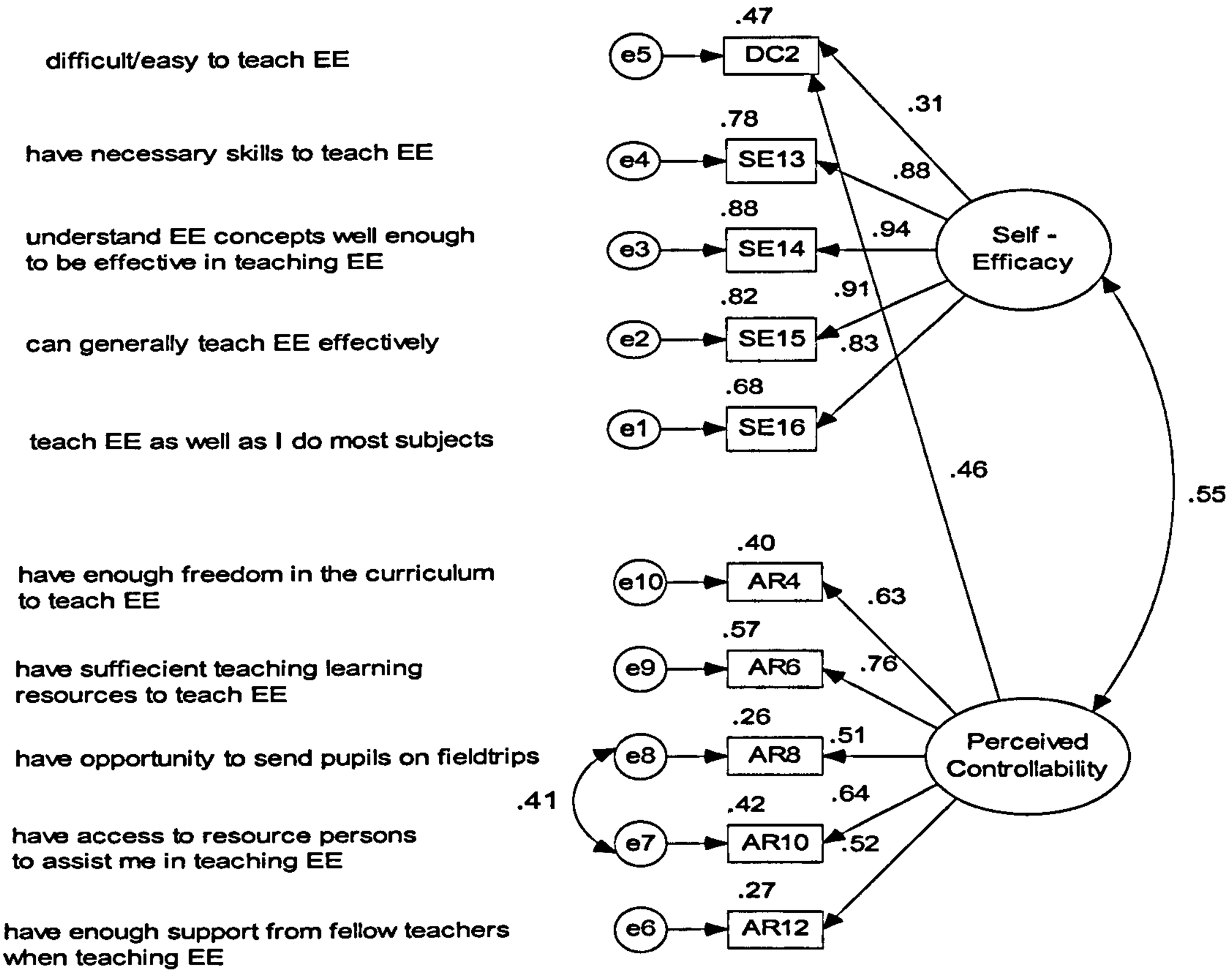


Figure 6.5: Final Three-Factor Measurement Model of Perceived Behavioural Control

The standardised factor loadings (structure coefficients) displayed in Figure 6.5 for indicators of the two PBC constructs were fairly high (> .51; $p < .001$). This indicates that the items provide a relatively strong measure of the PBC constructs. Since the item DC2 is specified to measure two constructs, its values will be interpreted as a standardised beta weight. In other words, although the factor loadings from this item on the two factors are low, the amount of variance explained will be larger than most of the other items. The relatively high standardised factor loading for each indicator and inter factor correlations suggests convergent validity (Kline, 2005, p.183). Discriminant validity is also present in that the inter factor correlations are below the

recommended level of 0.90. In all, the favourable results suggest items used in the questionnaire are valid for measuring the PBC variable, and a global PBC construct underlies these items and subscales.

6.2.6. Significant Life Experiences

Significant life experience was measured with thirteen items representing two sub-scales. Each item score represents the extent to which participants experience a particular environmentally related event and how influential the event is or was in influencing how and what they teach today. Descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of items are presented in Appendix I.1. Average responses from participants on the 13 life experience items shows moderate (M = 4.04, SD = 1.01) levels of significant life experiences related to environmental issues. Participating in outdoor activities (M = 5.17) was rated as the most significant outdoor recreation experience while finding more about the environment through the media (M = 5.61) was the most significant EE and action experience. The range of item variability (SD = 1.13 to 2.13) shows similar patterns of response on all items. This indicates that the mean score of the construct closely approximates participants' level of significant life experience. The data set in general indicates some level of normality as skewness and kurtosis values were above the recommended value of plus or minus one (< +-1). Values for univariate skewness ranged from -.25 to 3.6 while the range for kurtosis was between -.10 to 2.2. There was a relative mix of negative and positive skew with large numbers of negative kurtosis, an indication of a relatively flat distribution. This approximately non-normal distribution was confirmed by the frequency histogram. The Mardia's coefficient (13.21, CR = 4.51) for multivariate normality requested through AMOS also indicated a departure from normality. The impact of non-normality on the results of analyses is however likely to be negligible due to the relatively large sample size (Tabachnick & Fidel, 2001). Also, the maximum likelihood estimation used in analyses is robust against minor violations of normality (Anderson & Gerbing, 1988).

Inter-item correlation coefficients were generally low to moderate (ranging from .082 to .582) with some non significant correlations recorded. The highest correlation was recorded between item Q6 and Q5 all measuring participant's outdoor recreation experience. Specifically, participants who reported that they more often engage in gardening (Q5) also reported reading more literature about the environment (Q6). Cronbach's alpha coefficient of reliability for the significant life experience construct was .844.

The hypothesised two-factor model specified for measuring significant life experience was tested for goodness-of-fit using a First-Order CFA. The two-factor model conceptualised as outdoor recreation experience, and environmental education and action experience did not produce a good fit to the data (X^2 = 198.10; *df* = 64; X^2/df = 3.09; CFI = .796; RMSEA = .108 with a 90% confidence interval .091-.125; SRMR = .078).

Following from this poor fit, systematic examination and modifications were undertaken to improve the model. The first modification indices suggested the presence of two item pairs (item 4 and 10) that should be combined. These two items both reflect membership of an environmental club and volunteering for environmental organisations respectively. This item redundancy was represented in the model by suggested large error covariance and large standardised covariance residuals (Byrne, 2001). Based on the theoretical similarity, both items were combined to produce a new item named 'membership of and volunteering for environmental organisations (Q104)'. The second modification involved the deletion of item Q1 which represents life experiences relating to 'taking part in classes and school activities that focused on the environment'. This item had the lowest standardised factor loadings (.46) and large standardised residual scores with other items. Considering the age range of respondents, it is possible most of them did not have a subject called EE as they were students and as such could not identify with the experience. This was confirmed during the interview section where older teachers indicated they did not have anything like EE during their school days. It was therefore decided the item might not be an appropriate measure of the construct

hence its deletion. The final two modifications involved error covariances between items Q3 and Q104; and items Q7 and Q11 based on possible method effect (Byrne, 2001). Because both of these items reflect similar psychological constructs, it makes theoretical sense to covary their errors. A test of the modified model was conducted and results indicated an approximate good fit to the data ($X^2 = 69.80$; $df = 41$; $X^2/df = 1.70$; CFI = .945; RMSEA = .062 with a 90% confidence interval .036-.087; SRMR = .059). The standard errors and critical ratios of items (See Appendix I.2) are also within the ranges of good fit. The final model which shows the factor loadings and reliability coefficient of each item is displayed in Figure 6.6.

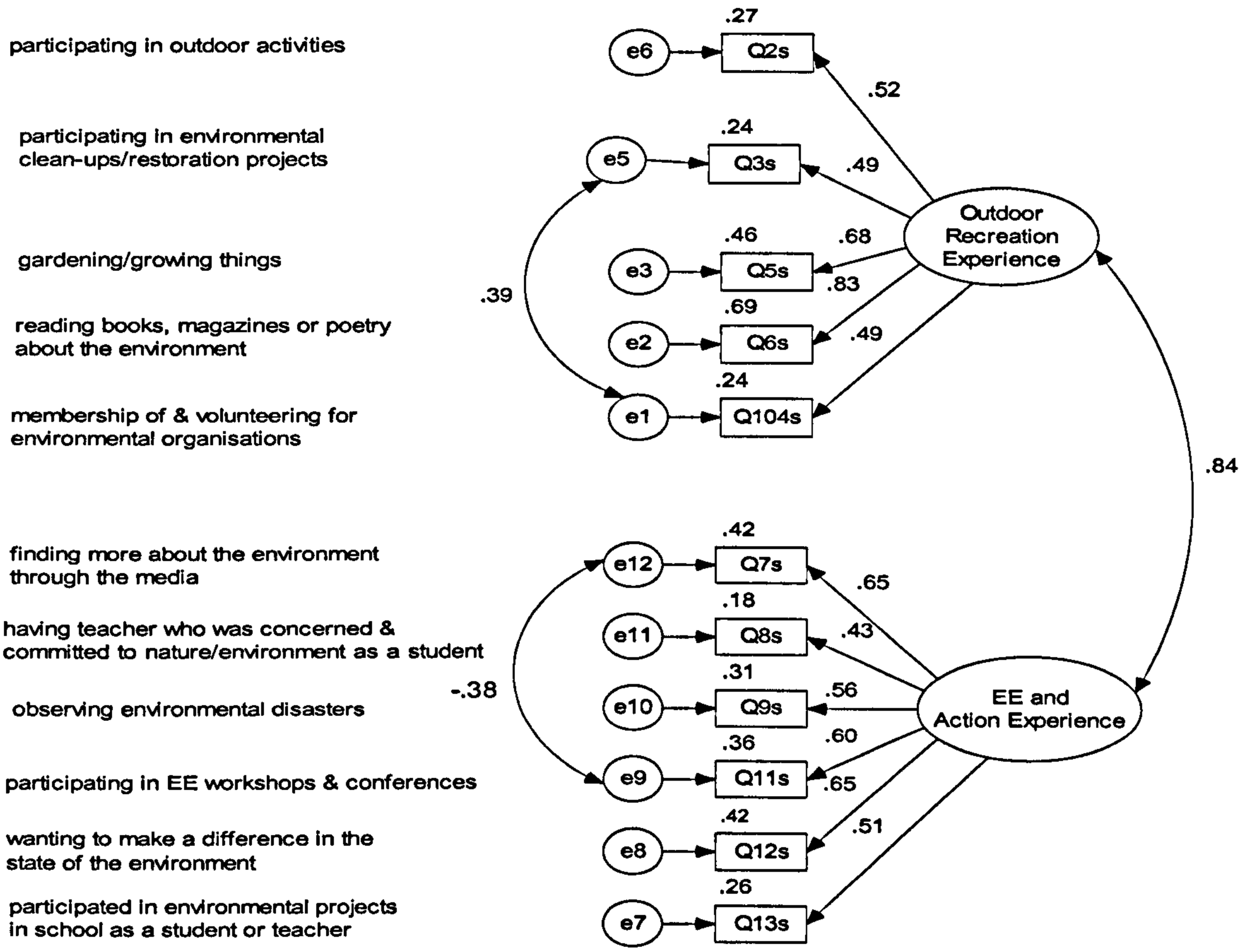


Figure 6.6: Final Three-Factor Measurement Model of Significant Life Experience

Indicators of the two life experience variables represented in Figure 6.6 show fairly high standardised factor loadings (.43 - .83; $p < .001$), an indication that the items provide a relatively strong measure of the life experience constructs. The relatively high standardised factor loading for each indicator and high correlation between the

sub-sacles suggests convergent validity (Kline, 2005, p.183). Although the inter factor correlation is quite high, it meets the criteria for discriminant validity (< .90). In all, the favourable results suggest items used in the questionnaire are valid for measuring the significant life experience variable, and a global significant life experience construct underlies these items and subscales.

6.2.7. Conclusion

The factor structures of commitment, intention, attitude, perceived behavioural control and significant life experience showed them to be multidimensional. The hypothesised structures are satisfactorily represented by the modified multi-factor models. A satisfactory factor structure was not achieved for the subjective norm construct and this raises a question about the actual dimensionality of the construct. Standardised factor scores of the items and correlation among the subjective norm constructs were however satisfactory. The results of the CFA shows that although item pairs are useful in ensuring reliability of constructs, they can be problematic and lead to poor model fit due to high error covariance among such items. These considerations must be taken into account when one attempts to use such item pairs. In order to adequately represent the MEEC, the subjective norm construct was kept for the final testing of the model. With an adequate measurement obtained, the analysis proceeded to the second stage of the two-step modelling, that is, the evaluation of the structural model.

6.3. Results - Structural Equation Modeling

6.3.1. The Structural Regression (SR) Model

The next step in analysis following the confirmatory factor analyses was a specification of the measurement models as a Structural Regression (SR) model for testing. Prior to testing of the SR model, items under each construct were aggregated to form 3 parcels per construct (see Table 6.1) following recommendations of Kishton and Widaman (1994; see item parcelling above). This strategy involves creating a number of parcels for each construct by joining items from the different

dimensions of the construct to create each parcel. The choice of no more than three parcels per construct was to ensure the model was identified (had enough information in order to be estimated) but also to limit the number of indicators (parameters) in the model due to the small sample size. In all there were 18 different item parcels.

Table 6.1: Item parcels for MEEC variables

Factor	Parcels	Specific Items	No. of Items
Commitment	PCMT1 PCMT2 PCMT3	CP7,CP1,CA8,CM13,CM12 CA56,CP3,CA9,CM14 CP4,CP2,CA10,CM11	5 4 4
Intention	PINT1 PINT2 PINT3	IP1,IP3,IA8,IM11,IM13 IP7,IP4,IA10,IM12 IP2,IP56,IA9,IM14	5 4 4
Attitude	PATT1 PATT2 PATT3	A3,A5,DA13c,DA13fd A2,A4,DA13b A1,A6,DA13a	4 3 3
Subjective Norm	PSN1 PSN2 PSN3	S8,S5,DN17g,DN17b,DN17e S3,S6,DN17d,DN17c,DNh S7,S2,DN17a,DN17f	5 5 4
Perceived Behavioural Control	PPBC1 PPBC2 PPBC3	SE15,SE14,AR4,AR10 SE13,DC2,AR12 SE16,AR8,AR6	4 3 3
Significant Life Experience	PSLE1 PSLE2 PSLE3	Q104,Q5,Q9,Q11 Q6,Q3,Q7,Q8 Q2,Q12,Q13	4 4 3

The hypothesised structural relationships between the dependent, independent and mediating variables were examined following a sequence of model testing and refinement. The model was analysed using the maximum likelihood method as it performs consistently in less than optimal conditions. Systematic analyses were carried out in the event of poor model fit and a new model was specified based on statistical and theoretical grounds.

According to the MEEC, teachers' commitment to environmental education is determined by perceived social, psychological and physical factors. These include intentions to teach EE, attitude towards teaching EE, influence of subjective norms to teach EE, perception of control (perceived behavioural control) over teaching EE, and significant life experiences related to environmental issues. All these variables directly or indirectly contribute to an understanding of teachers' commitment. As hypothesised by the model, commitment is directly predicted by intentions and perceived behavioural control. Intentions on the other hand is predicted by attitude, subjective norms and perceived behavioural control. These later variables are in turn predicted by significant life experiences. Intention, attitude, subjective norms and perceived behavioural control are specified as dependent and mediating variables. Commitment is specified only as a dependent variable while significant life experience is only specified as an independent variable. Using the measurement model in Figure 6.7, the following hypothesised aspects of the MEEC were tested:

- Firstly, significant life experiences have a direct effect on attitude, subjective norms and perceived behavioural control
- Secondly, subjective norms, attitude and perceived behavioural control have an independent direct effect on intention
- Thirdly, intentions and perceived behavioural control have independent direct effect on commitment
- Fourthly, significant life experiences, subjective norms, attitude and perceived behavioural control have indirect effect on both intentions and commitment.
- Finally, the paths suggested by the above hypotheses adequately explain teachers' commitment to environmental education.

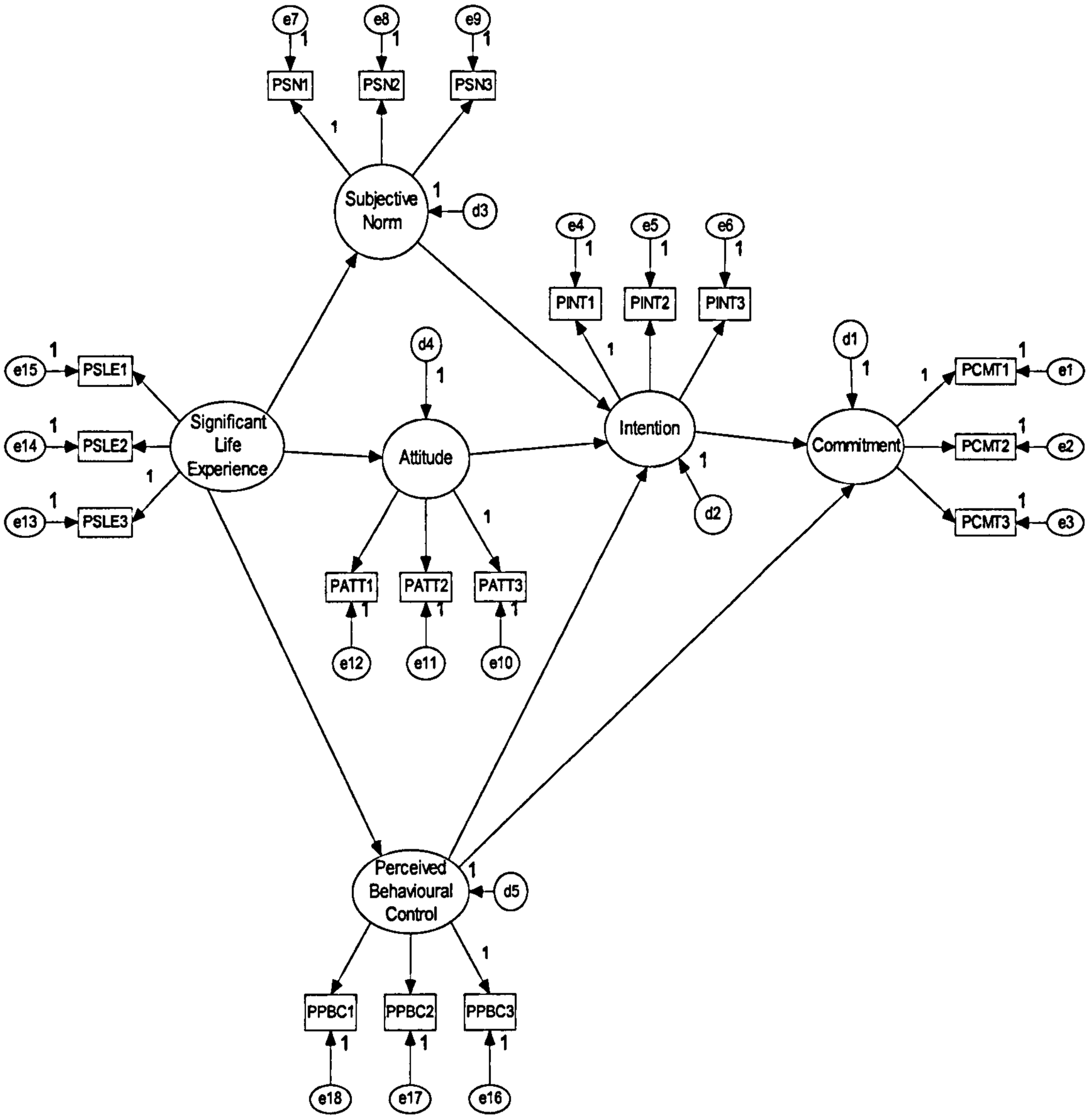


Figure 6.7: The Model of Environmental Education Commitment

The descriptive statistics (mean, standard deviation, skew and kurtosis) and correlation matrix of item parcels for all the MEEC constructs are presented in Table 6.2. Generally all parcels representing the same construct had a similar mean score with the highest mean scores recorded for intention parcels. Dispersions around the means are similar for all parcels with a slightly higher variability reported for perceived behavioural control (standard deviation of 1.0 to 1.2, and subjective norm (standard deviation of 1.1 to 1.2) parcels. The skew and kurtosis statistics for all parcels were generally negative and lower than the cut-off of 1.0. This shows a normal distribution for the data set and all constructs compared to initial values

obtained for item analyses. In other words the distribution of the data set after the initial confirmatory factor analysis and parcelling improved the univariate normality of all constructs. The case for multivariate normality was however weak as indicated by Mardia's coefficient (29.35, CR = 7.37) obtained through AMOS. Although the maximum likelihood estimation used in analyses is robust against minor violations of normality (Anderson & Gerbing, 1988), a bootstrapping technique was used to ensure that non significant paths are not accepted as significant.

Generally, the correlation matrix shows a significant inter correlation between parcels of all constructs indicating that the constructs are related in some ways. Two life experience parcels however were not significantly correlated with an intention parcel. The highest significant correlations were observed among parcels specified to measure a specific construct. The strongest correlation matrix was between attitude parcels (ranging from .79 to .89) while the lowest was between significant life experience parcels (ranging from .59 to .70).

Table 6.2: Correlation matrix and other descriptive statistics (mean, SD, skew & kurtosis) of item parcels for the MEEC (n = 182)

	PCMT1	PCMT2	PCMT3	PINT1	PINT2	PINT3	PATT1	PATT2	PATT3	PPBC1	PPBC2	PPBC3	PSN1	PSN2	PSN3	PSLE1	PSLE2	PSLE3
PCMT1	1.00																	
PCMT2	.721**	1.00																
PCMT3	.751**	.782**	1.00															
PINT1	.485**	.427**	.457**	1.00														
PINT2	.440**	.344**	.391**	.777**	1.00													
PINT3	.442**	.520**	.488**	.776**	.746**	1.00												
PATT1	.463**	.551**	.457**	.364**	.323**	.352**	1.00											
PATT2	.431**	.581**	.501**	347**	.279**	.389**	.893**	1.00										
PATT3	.468**	.567**	.470**	.351**	.249**	.362**	.794**	.848**	1.00									
PPBC1	.445**	.545**	.542**	.235**	.201**	.313**	.512**	.596**	.494**	1.00								
PPBC2	.469**	.502**	.523**	.286**	.250**	.324**	.493**	.557**	.499**	.773**	1.00							
PPBC3	.463**	.425**	.582**	.308**	.202**	.279**	.441**	.456**	.415**	.774**	.656**	1.00						
PSN1	.331**	.480**	.434**	.366**	.283**	.352**	.473**	.486**	.441**	.375**	.394**	.354**	1.00					
PSN2	.430**	.447**	.458**	.395**	.242**	.385**	.475**	.497**	.481**	.412**	.486**	.385**	.715**	1.00				
PSN3	.397**	.430**	.444**	.387**	.313**	.352**	.492**	.531**	.484**	.444**	.473**	.391**	.793**	.665**	1.00			
PSLE1	.210**	.321**	.349**	.183*	.071	.190*	.334**	.442**	.402**	.461**	.438**	.400**	.245**	.307**	.387**	1.00		
PSLE2	.209**	.338**	.285**	.227**	.140	.235**	.397**	.458**	.403**	.471**	.493**	.334**	.397**	.407**	.463**	.707**	1.00	
PSE3	.239**	.375**	.364**	.323**	.238**	.354**	.423**	.503**	.500**	.458**	.459**	.384**	.318**	.326**	.449**	.614**	.597**	1.00
Mean	*5.11*	*4.83*	*5.18*	*6.30*	*6.44*	*6.21*	*5.91*	*5.77*	*5.92*	*4.73*	*5.24*	*4.74*	*4.93*	*5.34*	*4.90*	*3.70*	*4.04*	*5.05*
SD	*.82*	*.98*	*.90*	*.54*	*.49*	*.54*	*.78*	*.83*	*.75*	*1.0*	*1.0*	*1.2*	*.87*	*.85*	*.84*	*1.2*	*1.1*	*1.2*
Skew	*-.34*	*-.04*	*-.38*	*-.50*	*-.71*	*-.58*	*-.77*	*-.56*	*-.87*	*-.24*	*-.56*	*-.29*	*-.25*	*-.56*	*.15*	*.30*	*.10*	*-.35*
Kurtosis	*.11*	*-.75*	*.09*	*-.31*	*.18*	*.04*	*.70*	*-.05*	*1.0*	*-.09*	*-.05*	*-.38*	*-.15*	*.56*	*-.28*	*-.36*	*-.57*	*-.39*

Correlations significant: * $p < .05$; **$p < .01$

A raw data file analysed to test the fit of the model specified in Figure 6.8 above converged to an admissible solution. Selected indices showed a generally fair approximate fit of the model to the data ($X^2 = 295.92$; $df = 127$; $X^2/df = 2.33$; CFI = .935; RMSEA = .086 with a 90% confidence interval .073-.098; SRMR = .086) taking into consideration the small sample size. Some of the indices like the RMSEA however indicate a problem with the overall model fit. For the sake of clarity, only latent variables of the path diagram are presented here. A more complete result which includes parameter estimates, standard errors, critical ratios, and reliability coefficients of parcelled is presented in Appendix J.1.

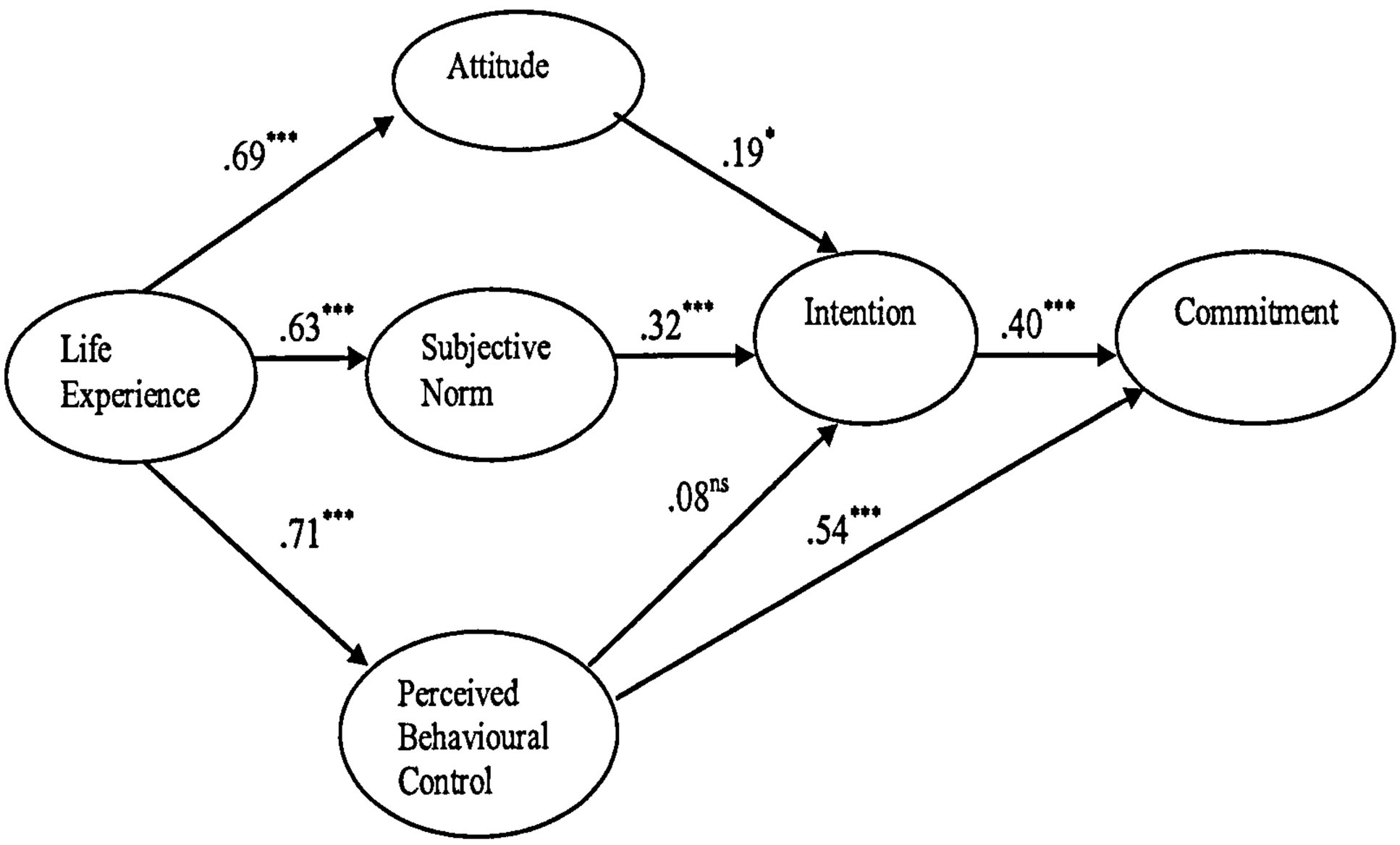


Figure 6.8: The Hypothesised Model of Environmental Education Commitment.

Note: All effects are standardised. Factor loadings significant: ***p < .001; * p < .05; ^{ns}=Non significant.

The next step in the model evaluation was an inspection of the strength of hypothesised parameters. As indicated in Figure 6.8 above, all the estimated parameters were statistically significant except for the path between PBC and intention which was not significant ($\beta = .08$, $p = .376$). This finding suggests that PBC is not a predictor of intentions and the effect of perceived behavioural control on commitment is not mediated by intention as specified in the original model. This

finding is different from general results obtained from the application of the theory of planned behaviour, in which attitude and PBC are usually the main predictors of intention (see for example Armitage & Conner, 2001). However, according to Ajzen (1991), the strength of the PBC in predicting intention is dependent on the strength of subjective norm and attitude. Thus in situations where attitudes and normative pressure are strong, PBC may be less predictive of intentions (Ajzen, 1991). The standardised solution on the other hand shows a strong predictive power of subjective norms ($\beta = .32$, $p < .001$) and attitudes ($\beta = .19$, $p < .01$) in predicting intentions. The non significant predictive path between PBC and intentions thus makes theoretical sense based on Ajzen's findings. In other words, deleting the non significant path between PBC and intentions is theoretically grounded (makes theoretical sense).

Since the original model did not provide a good fit of the model to the data, decision was taken to modify and re-estimate a new model. The first modification was the deletion of the non significant path specified between PBC and intention. Additional problems in the model were indicated by large error correlation residuals among some parcelled indicators. Modification indices show that two of the parcelled indicators forming the SLE scale may covary to improve the model. Since these indicators all measure the same psychological construct, the measurement error correlations reflect a common method variance (Kline, 2005).

Based on the above statistical and theoretical suggestions, a new model was re-specified to include the following changes:

- The path from PBC to intention was deleted. This means that PBC is no longer a direct predictor of intentions
- The residuals/errors of two significant life experience parcels were covaried

The re-specified model was analysed and values of selected indices show an acceptable fit of the model to the data ($X^2 = 269.53$; $df = 127$; $X^2/df = 2.12$; CFI = .945; RMSEA = .079 with a 90% confidence interval .066-.092; SRMR = .062). This

result suggests that the re-specified model of environmental education commitment provides a plausible approximation of the data. All parameter estimates were statistically significant and meaningful (see Appendix J.2). The final model showing only latent constructs are presented in Figure 6.9.

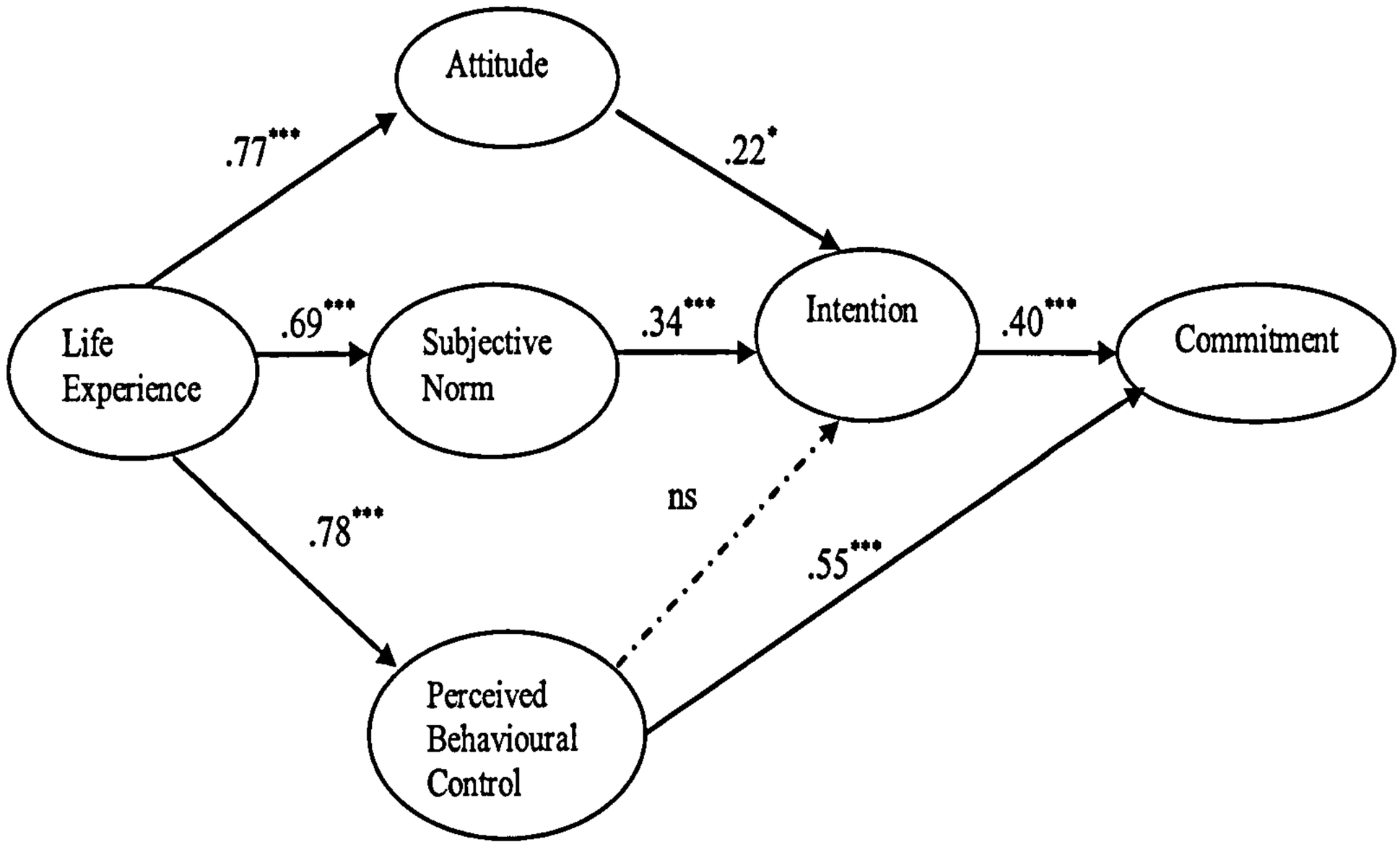


Figure 6.9: Final Revised Model of Environmental Education Commitment.

Note: All effects are standardised. Factor loadings significant: ***p < .001; *p < .05

In the final revised MEEC, significant determinants of teachers' commitment to EE are intention to teach EE, perception of control, subjective norms, attitude toward the teaching of EE, and significant life experiences connected to environmental issues. As shown in Figure 6.9 above, these variables affect commitment either directly or indirectly making some variables mediator variables. These significant direct and total indirect effects on commitment are presented in the next section. Individual indirect paths are also presented.

6.3.2. Direct and Indirect Predictors of Commitment to EE

Teachers' commitment to EE education was directly predicted by their intention to teach EE and their perception of control over teaching EE. Of these direct effects, teachers' perception of control had a stronger positive influence on commitment to EE ($\beta = .55$, $p < .001$). Given the adequacy of the model, when perceived behavioural control goes up by 1 standard deviation, commitment goes up by .55 standard deviations. In other words, teachers who perceive control over teaching EE in terms of resource availability, flexibility in the curriculum and self-efficacy are more likely to teach EE to their pupils. Intention to teach EE also had a moderately positive influence ($\beta = .39$, $p < .001$) on commitment.

Apart from the direct effects, other predictors specified in the model contributed indirectly through several mediators to influence teachers' commitment to EE (See figure 6.9). Significant indirect predictors of commitment were, significant life experience (total indirect effect $\beta = .58$) and subjective norm (total indirect effect $\beta = .14$). Attitude toward EE (total indirect effect $\beta = .086$) had a significant positive indirect effect on commitment, although this effect was small.

Life experience had one significant path of influence on commitment. This indirect effect is through perceived behavioural control (indirect effect $\beta = .43$). According to this path, having significant life experiences related to environmental issues increases teachers' perception of control over EE. This increased perception of control increases teachers commitment to EE. Although life experience had two other positive indirect effects through subjective norm (indirect effect $\beta = .093$) and attitude (indirect effect $\beta = .067$) on commitment, these effects were small. The significant indirect influence of subjective norm on commitment was mediated by intention. That is, increased normative pressure to teach EE makes teachers' intend to teach more EE. This increased intention subsequently makes them teach more EE. Like subjective norm, the influence of attitude on commitment is through a mediated effect by intention.

In all, the direct and indirect effects from the MEEC variables explain 59.1% of the variance in commitment. Perception of control had a strong positive direct influence on commitment whilst intention to teach EE moderately increases commitment. Significant indirect effects include having life experiences connected to environmental issues and normative pressure to engage in EE. The indirect pathways also revealed several key mediator variables including perception of control over teaching EE and intention to teach EE. The next section examines the direct and indirect predictors of these mediating variables.

6.3.3. Direct and Indirect effects on Intention to Teach EE

Intention to teach EE was directly affected by subjective norm and attitude. Normative pressure on teachers to engage in EE ($\beta = .34$, $p < .001$) and positive attitude toward EE ($\beta = .20$, $p < .001$) leads to an increase in teachers' intention to teach EE. Perceived behavioural control was not a direct predictor of intention as proposed in the theory of planned behaviour. The life experience variable had a significant indirect effect ($\beta = .40$, $p < .001$) on intention through two paths.

Significant life experiences indirectly predicted intention through subjective norm (total indirect effect $\beta = .23$) and attitude total (indirect effect $\beta = .17$). The suggestion from this finding is that having life experiences related to environmental issues is likely to positively influence teachers' perception of pressure from referents to engage in EE. This positive evaluation of normative pressure to teach EE makes teachers intend to teach EE. Furthermore, significant life experiences related to environmental issues makes teachers develop positive attitude toward teaching EE. This positive attitude makes teachers intend to teach more EE. These direct and indirect effects explain 24.1% of the variance in intention.

6.3.4. Direct effects on Attitude towards EE

Attitude toward EE was directly influenced by significant life experience ($\beta = .77$, $p < .001$). In other words, teachers with relevant life experiences connected to environmental issues are likely to develop positive attitude toward teaching EE. This direct predictor account for 59% of the variance in attitude.

6.3.5. Direct effect on Perception of Control of EE

Teachers' perception of control over teaching EE is directly predicted by significant life experiences connected to environmental issue ($\beta = .77$, $p< .001$). Thus life experiences connected to environmental issues have a strong positive influence on teachers' perception of control over teaching EE. This direct effect explains 60.2% of the variance in teachers' perception of control over teaching EE.

6.3.6. Direct effects on Subjective Norm Beliefs

There was a relatively strong positive direct effect on subjective norms by life experiences ($\beta = .69$, $p < .001$). An explanation of this path may be that, if teachers have significant life experiences related to environmental issues then they are likely to respond more positively to requests by their significant others to engage in EE. A similar result was found by Shuman (1995). This direct effect explains 48.1% of the variance in the subjective norm influence.

6.3.7. Model Validation

As evident from results of data screening and descriptive analysis, most of the variables used in the model did not meet the assumption of normal distribution. This is likely to lead to an underestimation of parameter standard errors and a subsequent erroneous acceptance of non significant paths. A bootstrap method was therefore used to generate standard errors that test the robustness of parameter estimates obtained from maximum likelihood (ML) estimation. Also, by using bootstrapping, a robust test of the significance of indirect effects hypothesised in the ML estimation can be tested (Cheung & Lau, in Press; Shrout & Bolger, 2002). In this bootstrap

simulation, a Bias-corrected (BC) bootstrap method with 95% confidence interval was requested to test the significance of the indirect effects found during model evaluation. 1000 bootstrap samples were generated to obtain standard errors and confidence intervals for the parameters. According to Shrout and Bolger (2002), a bootstrap sample between 500 – 1000 enables one to obtain stable BC bootstrap confidence intervals that can be confirmed when analysis is repeated by other researchers.

Table 6.3 shows a comparison between results obtained from bootstrap standard error estimates and those obtained through ML estimation to ascertain whether there was any over-acceptance of non-significant paths in our final model. Although only direct and indirect effects among factors are reported here, both standard error and confidence interval for parcelled indicators were also examined and are all statistically significant. The lower and upper bound of the 95% confidence interval of all paths did not include zero. This means that all direct effects specified in the ML estimation are statistically significant. Examination of standard error estimates for unstandardised direct effects indicates very minimal percentage changes (from -1.92% to 43%) in standard error for specified paths among factors. These findings suggest that distribution of parameter estimates appear to be closer to those expected under normal theory assumptions (Byrne, 2001). Also, the standardised parameter estimates obtained from the bootstrap estimates were the same as those from ML estimation. This suggests that the strength of parameters observed in the ML estimation is likely to be similar to those in the overall population.

Table 6.3: Maximum Likelihood and Bootstrap SE Estimates, and Confidence Interval for Estimated Direct Paths

Parameters	Unstandardised			Standardised		
	ML SE	Bootstrap SE	% change in SE	95% BC Confidence Interval		p
				Lower Bound	Upper Bound	
Intention→Commitment	.093	.113	43	.256	.528	.002
Perceived behaviour control → Commitment	.052	.051	-1.92	.418	.662	.002
Attitude → Intention	.064	.068	6.28	.029	.409	.025
Subjective norm→ Intention	.056	.074	32.14	.115	.552	.007
Life Experience → Perceived behaviour control	.111	.122	9.90	.672	.846	.003
Life Experience → Attitude	.073	.098	34	.675	.846	.001
Life Experience → Subjective Norm	.086	.100	16	.589	.790	.002

Note: ML = maximum likelihood; SE = standard error; BC = Bias-corrected; p = level of significance

Turning to the indirect effects (Table 6.4), the BC 95% CI were examined for the statistical significance of all indirect effects. Results show both the upper and lower bounds of all indirect effects did not include zero, that is, the effects were significantly different from zero. In other words the hypothesised indirect effects in the model are all statistically significant.

Table 6.4: Maximum Likelihood and Bootstrap SE Estimates, and Confidence Interval for Estimated Indirect Paths

Parameters (Total Indirect Effect)	Estimates	SE	Standardised 95% BC Confidence Interval		P
			Lower Bound	Upper Bound	
ATT → CMT	.086	.042	.013	.173	.024
SN→ CMT	.135	.053	.043	.254	.005
SLE→CMT	.583	.050	.476	.672	.002
SLE→INT	.402	.064	.280	.536	.003

Note: CMT = Commitment; INT = Intention; ATT = Attitude; SN = Subjective norm; SLE = Significant life Experience; BC = Bias-corrected; p = level of significance

Overall, the above findings demonstrate that results obtained from the ML estimation are robust despite the violations of the normality assumptions. The findings also suggest the possible replicability of findings in the overall population.

6.3.8. Summary

This chapter presented the findings of the quantitative phase. In the first section, a description of the variables was presented and their hypothesised dimensionality tested and refined. The results from this indicated a valid measurement model for commitment (three factors), intention (three factors), attitude (two factors), perceived behavioural control (two factors) and significant life experiences (two factors). The hypothesised two factor model for the subjective norm construct was not confirmed although the factor scores for indicators were acceptable. Nevertheless, this construct

was included and tested in the final model. Result from the initial model was of a fair fit. Significantly, perceived behavioural control did not predict intentions as hypothesised in the original theory of planned behaviour. A modified model with this path deleted resulted in a good fit. The relationships among the construct in terms of hypothesised direct and indirect effects were presented. The final model was evaluated using the technique of bootstrapping and this indicated that the relationships in the model were quite robust. The next two chapters of this thesis presents the procedures and results from the qualitative phase.

CHAPTER SEVEN

Qualitative Procedure

7.1. Introduction

This chapter explains the procedure followed in the qualitative phase of the study. An overview of the methodological design used in this qualitative phase is first presented followed by the research questions that guided the qualitative phase. The third section explains how the interview schedule was constructed using soft systems methodology and what the main considerations were. Procedures for selecting respondents are then elucidated in the fourth section followed by an account of the interview process. The final section dwells on the main data analysis strategies employed in analysing the interview data.

7.2. Overview of Soft Systems Methodology

The research design adopted for this qualitative phase was Soft Systems Methodology (SSM) although it should be emphasized that the study is not entirely based on this approach. SSM is an enquiry process used to study 'purposeful human activity systems' that represent behaviours where people undertake activities to achieve a specific goal. According to the methodology, problems within human activity systems (HAS) are characterised by complexity and difficulties in problem definition since what constitutes a problem can vary from person to person. Problems within the HAS are therefore termed soft problems because their definition is fuzzy and ill-structured in comparison to hard systems (for example natural or physical) where problems are more straight forward to define (Checkland & Scholes, 1990). The purpose of SSM is therefore to encourage researchers to use the concept of 'systems' which focuses on a holistic approach (multiple factors and their interactions) to study and understand these complex problems.

Philosophically, the methodology is part of the interpretive tradition concerned with the meaning individuals and groups attribute to situations and how this influences

their intentions and actions (Checkland, 1999; Rose, 1997). This interpretive perspective has been acknowledged as making the methodology useful in the understanding of complex problems (Rodriguez-Ulloa & Paucar-Caceres, 2005). The SSM was originally conceptualised as a seven-stage approach. However, an extended and newer version shows the methodology as an interactive process (see Figure 7.1).

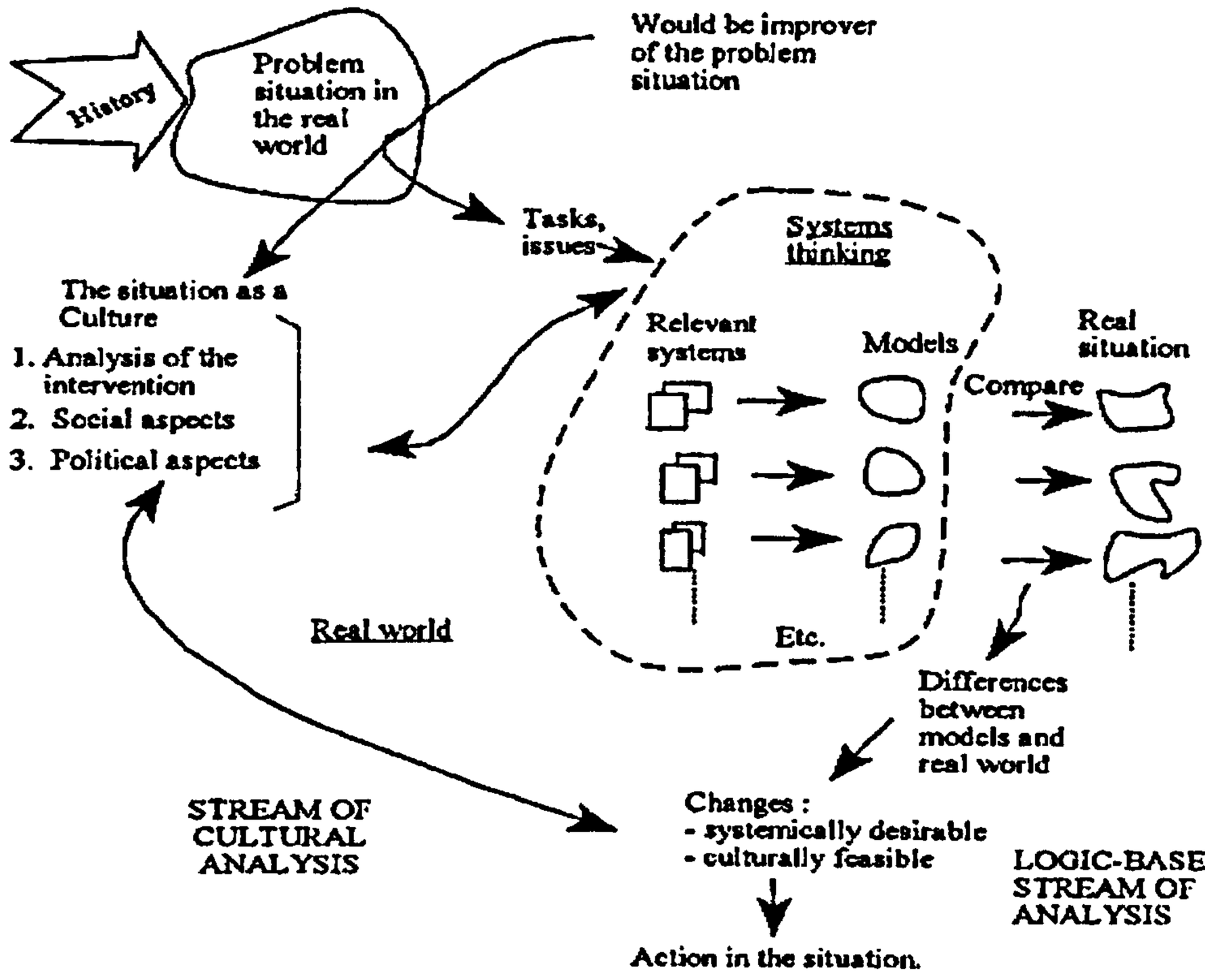


Figure 7.1: Soft Systems Methodology Process (Checkland & Scholes, 1990)

According to the SSM model, the initial stage of analysis is an investigation and definition of the problem situation in conjunction with those involved in the HAS. The essence is to obtain a comprehensive overview of what currently pertains in the area of interest. Analyses of cultural dimensions of the area of interest are core to this initial investigation. These comprise analysing possible interventions, political and social systems. In addition to these, the historical background of the system should be taken into account. Apart from analysing the situation and those involved, the researcher should also analyse his or her role as well as that of those who commissioned or sponsored the research. Given that the researcher or sponsors have

an interest in the problem situation, analysing their role will reveal the part played by them in creating the problem and what role they must play in resolving it.

In the next stage of analysis, the researcher uses the findings of the initial investigation to select a hypothesised solution for the problem. This selected perspective is known as the root definition or the relevant system. The hypothesised solution is then structured into logical steps to represent how the system should function. These logical steps known as system models, are then compared with the system the researcher uncovered during the problem definition stage. The goal is not to implement the researcher's model but use it to structure a debate that will result in feasible and desirable changes to the problem situation.

Generally, the activities in the SSM process fit into three distinctive stages (see Figure 7.2). The first stage is a finding out process which involves an analysis of the area of interest. It is in this area of interest that a problem situation can be located. The second stage is a systems thinking stage which aims to identify and discuss specific transformations (changes) that can help improve the problem area. The third stage is a comparison of the activities in the systems thinking stage with what was unearthed in the finding out stage in order to make feasible recommendations for improving the situation.

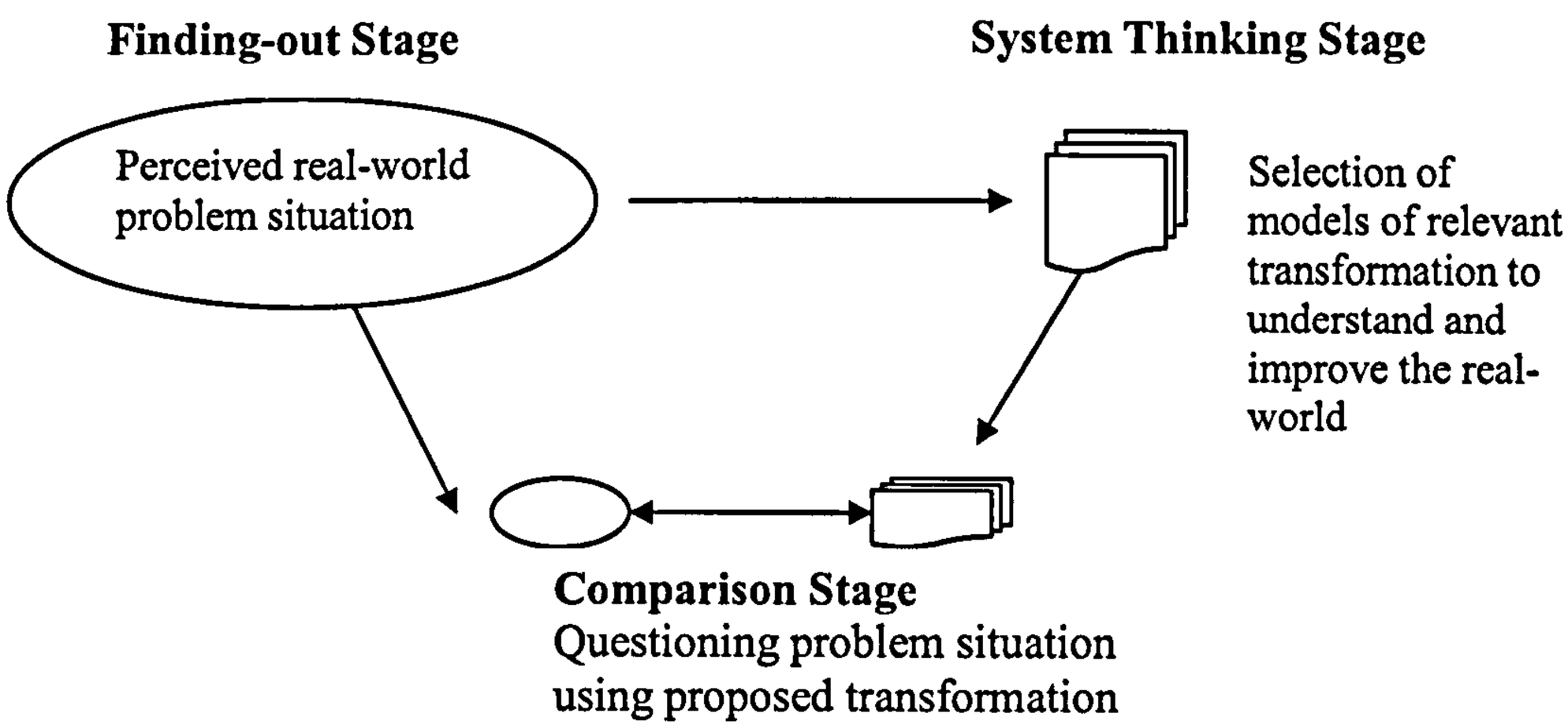


Figure 7.2: Soft System Methodology (Adapted from Checkland & Scholes, 1990)

Checkland and Scholes, (1990) pointed out that the stages specified in the model do not have to be religiously adhered to. In principle, a start can be made anywhere and the user can mould the process to suit a particular situation. In other words, the "mouldability" by a particular user for a particular situation is the objective of the methodology. This they claim is what makes a methodology more powerful than a method or technique. Several authors have also suggested ways in which the methodology could be adapted. Rose (1997) for instance suggested four ways in which the methodology could be modified and used in conjunction with other methods. These include using it for problem structuring, testing the good-fit of other models, triangulating with other methods or as a coordination tool. A study by Mingers and Taylor (1992) also found that many users of the methodology have either missed out some stages or made personal adaptations to it. They also discovered wide ranges of application among users. The methodology in this thesis has equally been modified and is not based on the full process described above. Significantly, the approach has been used mainly as a framework for data collection. Specifically, considerations arising from the various stages of the methodology were used as a framework to structure questions in order to explore the influences on teachers' commitment to EE. All the questions were explored in an interview format. The interview data was analysed into themes and sub-themes and emergent properties are presented. The main stages of the SSM and how they influence the various questions in the interview guide are presented later in this chapter with an explanation of how the current study differs from a full application of the stages.

SSM was chosen as a framework for data collection in order to understand the complex nature of teaching environmental issues. The SSM approach proposes that soft problems involve complex social, political and human dimensions. Teaching like all other social phenomena is a complex venture and the need to consider this complexity in educational research has been advocated (see for example Hoban, 2002; Banathy, 1991). Studies on teacher commitment to environmental education (EE) indicate various factors acting synergistically to influence the teaching of EE (Cutter & Smith, 2001; May, 2000). Using a SSM framework that adopts a holistic approach will therefore capture several of these levels of influence and interventions

based on these findings are more likely to produce a synergy that encourages and sustains commitment. In a nutshell, SSM provides a structure which is likely to capture a more complete and holistic view of teachers' commitment. Furthermore, the success of the methodology over the past 30 years justifies a consideration for its application in education (Tajino, 2002). In addition, SSM is simple to use and does not require complicated tools. However, it is comprehensive and insightful in its ability to identify problems and to generate recommendations for improving a stated problem area. According to Patel (1995), SSM helps to unearth hitherto unrecognized flaws in the existing process of teaching and learning. Apart from its usefulness, the methodological steps of the SSM logically match the Model of Environmental Education Commitment (MEEC) variables used in the quantitative phase. For example, 'Actors' and the analysis of power hierarchy in the SSM is equivalent to subjective norms in the MEEC. Likewise analysis of environmental constraints in the second phase elucidates perceived behavioural control within the MEEC.

7.3. Research Questions

The primary objective of the qualitative phase was to build and expand on the survey findings by exploring why some teachers are more committed to teaching EE than others and what the barriers to teaching EE are. The study also aims to explore how teachers' commitment can be increased. In general terms, the objective of the qualitative phase was to help uncover issues which might have been missed during the quantitative phase, provide an in-depth explanation of the influences on teacher commitment and how these factors interact with each other. Specifically, the qualitative phase sought to answer the following questions:

1. What is the nature of teachers' current commitment to environmental education?

2. What are the motivations for teachers' commitment to environmental education?

3. What barriers inhibit teachers' commitment to environmental education?

4. How can the commitment of teachers towards environmental education be increased?

5. What major sources of power exist to influence teachers' commitment?

7.4. Sample Selection

There are no strict or agreed rules for sampling in qualitative research (Sarantakos, 2005). What researchers aim for is the possibility to select participants that can best help bring understanding to the phenomenon of interest (Creswell, 2005). Generally, sampling procedures employed by qualitative researchers have been classified as purposive, accidental, snowball, theoretical and so on (Sarantakos, 2005). Creswell (2005), however note that all qualitative sampling is purposeful sampling within which can be found different strategies. The strategies according to him are differentiated in terms of whether they are employed before or after data collection begins. Purposeful sampling involves intentionally selecting individuals who are "information rich" so that by understanding these individuals the researcher can gain an in-depth understanding of the central phenomenon. The various strategies within purposeful sampling include maximal variation, extreme case, theory, opportunistic, snowball and so on.

Participants for the study were initially recruited during the survey phase. Respondents to the questionnaire who were interested in a follow up interview were asked to provide their contact details on a separate piece of paper when returning the questionnaire. Contact was established with all teachers who provided their details immediately questionnaires were received. This was in the form of emails and written letters thanking them for volunteering to participate and promising to contact them again one week after scheduled Easter holidays. Participants were then contacted by phone after the said period to arrange appropriate dates and times for

interviews. No initial decision was made on the number of participants to select for the interview. This is because the strategy was to select as many participants as possible until the point of data saturation (Creswell, 2005). Thus, the initial participants were selected to ensure a reasonable mix of typicality. To achieve this aim, a maximal variation strategy (Patton, 2002) was used to select individuals with different characteristics. The strategy is useful when one aims to explore the multiple perspectives of individuals in order to gain a richer picture of the phenomenon and to identify important common patterns among these individuals (Creswell, 2005).

In all eight (8) participants were selected for the final interview based on rank, years of teaching experience, gender, involvement in Eco School programme, school size and location (Table 7.1). These variables were chosen to reflect the typicality of the survey participants as well as to ensure maximal variation. The decision to select eight participants was based on the realisation of data saturation between the sixth and seven participants. In other words, responses were relatively similar to those of previous participants. Also, the characteristics of the remaining participants were quite similar to those who had already been selected. The final participants were made up of four head teachers, two principal teachers and two teachers. The two teachers were newly qualified with teaching experiences of seven months and two years. All the head teachers had teaching responsibilities. It was envisaged that the head teachers would not only reflect on personal experiences but that of their teachers as well. Their rich experience was also likely to contribute to a much more detailed account of commitment to EE taking historical perspectives into account. The two new teachers were selected to obtain a perspective from less experienced teachers and newly qualified teachers in schools. There were 2 males and 6 females. All schools were registered for the Eco School program with three schools obtaining the green flag which is the highest recognition for participating in the Eco School programme.

The small sample used for the qualitative data is a potential drawback to the findings in terms of generalisation of results to the population of teachers. The selection of small samples is however useful in qualitative research where the aim is not to

generalise results but to present the complexity of information provided by participants. Moreover, collecting a larger sample can result in the researcher presenting only superficial perspectives as larger data sets are difficult to explore in details (Creswell, 2005). In addition to the above, the process of collecting and analysing qualitative data is time consuming and adding more cases only lengthens that time.

Another likely limitation of the results from the qualitative study is that most of the participants for the interview were teaching in small to medium size schools with only one participant coming from a city school. This is a potential bias in the sample because the nature of teaching in larger and city schools vary considerably from those of small to medium ones. However, some of the participants in town and small size schools have also had experiences of teaching in larger and city schools and therefore provided some level of perspective on that. Another potential limitation is the self selection method of participants which might have resulted in a situation where only participants who are passionate about environmental education might have expressed their interest in the follow-up interviews.

Table 7.1: Characteristics of Interviewees

Alias[2]	Gender	Status	School location[1]	School size[1]	Eco School status
Jane	F	New teacher	Semi-urban	Large	Bronze
John	M	Head teacher	Rural	Small	Bronze
Cathy	F	Head teacher	Rural	Small	Green flag
Cherry	F	Principal teacher	Rural	Small	Green flag
Kate	F	Probation teacher	Urban	Large	Registered
Kriss	M	Head teacher	Semi-urban	Medium	Silver
Helen	F	Principal teacher	Semi-urban	Medium	Green flag
Barbara[3]	F	Head teacher	Rural	Small	Silver

[1]Classifications of school location and size are based on researchers own assessment. School with population below 50 were classified as small; between 50 and 300 medium and above 300 large. Rural, urban and semi-urban classifications were based on the nature of activities in the schools location.
[2] The names are simply pseudonyms and bear no resemblance to any of the respondents.
[3] It was not possible to obtain transcripts for this participant due to technical problems with the tape recordings.

7.5. Data Collection

The method of data collection used in this qualitative phase was in-depth interviews as this was the best method for obtaining the required information from participants. As a popular method of data collection in qualitative research, interviews involve the researcher asking one or more participants general open-ended questions and recording their responses to the questions (Creswell, 2005). Interviews can be structured, semi-structured or unstructured. An unstructured interview was used in this study. Here, the researcher uses interview schedules (see next section for explanation) containing open-ended questions that direct the questions to be asked during the interview. There is a great element of flexibility with this approach in that the researcher is free to vary the order of question presentation, rephrase questions where necessary and use neutral probes to explore issues in-depth. The approach offers researchers the opportunity to cover issues not covered in the interview schedule (Sarantakos, 2005). This is different from the other two approaches where

an element of rigidity is employed with minimal flexibility given to the researcher. Interviews are particularly useful for acquiring detailed personal information from participants especially in a situation where a direct observation is impossible (Creswell, 2005). In this particular study, information on participants' attitude, teaching behaviours, constraints, power hierarchy, past experiences and so on can best be explored in-depth through interviews. The nature of questioning enables participants to voice their experiences unconstrained as well as giving participants the freedom to create their response to the question without being forced into specified response categories. Furthermore, interviews offer researchers the opportunity to have a better control over the type of information they receive as they are in a position to ask specific questions and seek further clarifications from participants. This opportunity is unavailable when using other methods of data collection. A problem with using interviews is that they only provide information that is "filtered" through the view of the interviewee (Creswell, 2005). In other words, interview data may be deceptive in that only the perspective that the interviewee wants the researcher to hear is provided. The next section presents an overview of the interview schedule and the source of questions that were posed to participants. This is followed by a description of the actual interview process and the various strategies that were employed.

7.5.1. Construction of Interview Schedule

An interview schedule, also known as interview protocol, was constructed to guide the process of data collection. This is a list detailing instructions for the interview process and the questions to be asked when talking to interviewees (Creswell, 2005; Lofland & Lofland, 1995). The main purpose of the interview schedule was to serve as a reminder of the important questions that need to be asked and to refocus on the purpose of the interview especially if the interviewee strays from the topic of interest. It was also a means of structuring the interview process to ensure a smooth transition from one issue to the other. Finally, the schedule helped to cast the interview process in a positive light with interviewees and to demonstrate preparedness instead of fidgeting with thoughts on what to ask next or asking

questions that had already been answered. The interview schedule, however, was not an exhaustive list and flexibility was built into the process so as to allow participants to elaborate on issues raised even if they were not originally included in the schedule. Questions for the interview were structured on the three-stage framework of the soft systems methodology (SSM) process discussed earlier. That is, the finding out stage, the systems thinking stage and the comparison stage. These served as the main framework for generating questions. Some questions were also included as a result of preliminary analysis of questionnaires used for the quantitative phase with the aim of clarifying and further exploring some responses. The next section describes these stages of the methodology and how they influenced questions asked during the interview.

Finding out Stage

This stage involves investigating and producing a comprehensive map of the problem situation. The aim is to obtain a wide range of views about the area of concern from people who play a role in the problem situation. According to Checkland (1999), the definition of the problem situation should include elements of slow-to-change *structure* and continuously-changing *process*, and their relationship with the problem situation. Issues regarding structure that were explored with participants include power hierarchies within schools and who had the power to influence how different interests are accommodated. Process questions were around the main issues participants' grapple with when deciding to teach EE and how that influences their choice EE topics. Cultural analysis was carried out by exploring political issues such as support from the government, social norms regarding what constitutes commitment to EE and possible interventions that participants thought will increase their motivation to EE. As noted by Checkland, a critical aspect of the finding out stage is to analyse what role the researcher and those who sponsored the research play in the problem situation. Since the research was sponsored and was being carried out by a teacher training institution, participants views were sought about their pre-teacher preparation to teach EE. Other issues explored include motivations, strategies and constraints relating to the teaching of environmental education.

Systems Thinking Stage

This stage usually involves two main activities. The first known as the root definition is a definition of precise relevant changes that will help improve the problematic situation. The choice of a relevant change represents a particular view of the problem, and carefully defining it makes this view explicit and provides a base upon which the chosen view can be developed. The root definition helps to clarify the area of concern in two ways; firstly, to identify the 'soft' problem or what requires to be addressed, and secondly identifying the system in which analysis will be done, that is, which human activity system is of concern (Patel, 1995). For example the relevant system for this study could be a system to promote teacher commitment to teaching EE, a system to train more EE teachers, a system to make more teachers interested in environmental issues or a system to ensure teachers teach EE effectively. For a root definition to be comprehensive, it should incorporate six elements known in mnemonics terms as CATWOE. Some of these elements are related to the issues explored in the finding out stage. The CATWOE elements are listed below and explanation of how they influenced questions explored in the interview is given.

C - Customers represent those affected both directly and indirectly by the system. In this case participants were asked about how changes in the system will affect teacher commitment as a whole.

A - Actors are those who need to perform the activity that will bring the improvement in solution. This is related to the issue of power and authority. Here, participants were asked to state those who have the power to improve teachers' commitment to EE.

T - Transformation is the changes that need to be made and the result of these changes on the system. Participants were asked to name actions that will increase their commitment to EE and the extent to which the named changes will affect them.

W - Worldview represents why a particular transformation is of importance. In this case participants were asked to express how the named transformation will affect them.

O – Owners or decision makers are those with authority and responsibility over the system. This is related to the action of actors above and also represents political power that affects teachers' commitment to EE.

E – Environmental constraint represents possible constraints to the proposed transformation. This issue was explored by asking participants to state any drawbacks to their proposed solution.

The second activity in this stage is conceptual modeling which in a full SSM procedure involves building of conceptual models to achieve the proposed transformations (T). The models are basically logical steps to achieve the transformation defined in the root definition above. The aim is to use these models to stimulate questioning and structure debate regarding the problem situation, and propose desirable changes. However, in this thesis no models were built. Fundamentally, modeling is about justifying and explaining how the transformations will improve the problem situation. This was explored during the interview by asking participants to justify their proposed solutions and how the solution would work to improve teachers' commitment to EE.

Comparison and Recommendation Stage

In the comparison stage, models developed in the systems thinking phase are used to question and debate what goes on in the real world. This is the stage where the models that were developed to achieve a desired transformation are compared with what currently exists. This comparison is aimed at generating debates that will eventually lead to possible changes to improve the situation. The debate engendered at the comparison phase leads to a definition and discussion of possible changes that must meet two criteria. They should be *desirable* and culturally *feasible*. The changes should also take into account the current attitudes and power structures with regards to the history of the situation under examination (Checkland, 1999). It is noted that changes will only occur if perceived as meaningful within that culture. Perception of meaningful change within a culture might range from a small incremental change to a revolutionary one. Cultural feasibility hence refers to changes being regarded as meaningful within the culture in question (Checkland & Scholes, 1990). To achieve feasible and desirable solutions, recommendations for change were sought directly from participants and not only based on outcomes of problem analysis. This approach can be insightful because people in a problem

situation can sometimes recommend solutions that have no direct link to their overt problems thereby revealing other aspects of the problem.

The final interview schedule (see Appendix K) was divided into six main parts based on the interrelatedness of the questions. The first part was an introduction to the interview process and an open question to set the interview in motion. The second group of questions explored motivational issues and what can be done to increase participants' commitment to EE. Questions in the third section were used to explore the major constraints faced by teachers and how that affects their commitment to EE. The fourth section covered the social norms governing what is regarded as commitment to EE whiles the fifth section dwelt on the issues of power and politics. The final questions were a mix of issues raised by participants during the interview and a follow-up on issues of curriculum development. It should be noted that other issues that were not included in the initial schedule were also explored and the way in which questions were presented varied from interview to interview.

7.5.2. Interview Process

Prior to the interview, several texts (e.g. Mason, 1996; Oppenheim, 1992) were consulted to help carry out an effective and successful interview process. All interviews were conducted in schools and were one-on-one with participants. The interviews began with a brief explanation about the aims of the research and what the interview process aims to achieve. This initial introduction also sought to demonstrate the significance of the study and stress the significance of the respondent's participation (Sarantakos, 2005). After assurances of confidentiality and anonymity were offered, permission was then sought from participants to tape the interview to which they obliged. This was to ensure an accurate record of the conversation while enabling the entire interview process to flow smoothly. The interview proceeded with a question asking participants to talk about interesting EE activities they had and were carrying out with their pupils. This question served as a 'grand tour' to relax participants and motivate them to talk. It was also designed to open up broad issues and to make participants comfortable before launching into

more personal issues (Creswell, 2005). Since this was a non threatening question, it helped establish rapport with participants quickly and the interviewer was trusted as showing interest in participants' achievement. It also allowed the interviews to proceed according to responses provided by the participants. During the interview, hand-written notes were also taken. Probes were used to obtain additional information, clarify points and to have interviewees elaborate on ideas. The interview lasted between 45minutes to 1:30minutes.

Some class and school observations were also conducted either before or after interviews with participants. The main focus of observation was to get a general feel of the activities carried out by teachers during the day which will enable for an empathic understanding of the data. Also, the observation served as some form of data triangulation to gauge the practical environmental education activities in the school and somehow compare that with what participants reported. The observation was however not a structured one and this was not meant to be an alternative form of data source. The main focus of observation was the practical environmental education activities carried out in school. In some cases the researcher sat through and participated in part of the classroom activity and was later taken round by pupils or participant. Opportunity was also provided by some teachers to talk to pupils about the study and country of origin of the researcher which was warmly received by pupils and teachers. Each interview was completed by thanking interviewees for their time and interest in the study. Subsequently, an official letter was sent to all participants after the interview thanking them for their invaluable contribution and promising to send summarised reports of the study when completed.

7.6. Data Analysis

The goal of the qualitative data analysis was to identify emergent themes that provide an explanatory and predictive insight into teachers' commitment to environmental education. Characteristically, all qualitative data analyses deal with data that is presented in words. Analysis is therefore often aimed at transforming and interpreting the data in a concise, rigorous and scholarly manner. Although no single

approach to analysing qualitative data exist (Sarantakos, 2005; Miles & Huberman, 1994; Dey, 1993), several guidelines that share a common elements of a descriptive content analysis are available. Miles & Huberman (1994) for instance grouped the qualitative analytic process under three concurrent flows of activities namely data reduction, data display and conclusion drawing. These flows of activities are for instance similar to the six steps of analysis espoused by Creswell (2005), which is, preparing and organising the data, exploring and coding the database, describing findings and forming themes, representing and reporting findings, interpreting meaning of findings, and validating accuracy of findings. The process of data analysis in this study was a blend of the two processes described above. The analytic activity was however an interactive and cyclical process rather than a linear process. In other words, there was a constant shuttling between the different steps during analysis. The analytic steps employed in the current study are presented in the next section.

Preparing and Organising the Data

This was the first step in the analytic process. Data from the interviews were organised and converted from audiotape recordings into a text data, a process known as transcription. Each interview was typed verbatim into a Microsoft word document. Transcripts were individually labelled with complete details about the particular interview. After the initial transcription, the tapes were played whiles at the same time looking at the transcripts with the aim of locating any mistakes made during the transcription process. Also, where the transcribed text did not make sense, the respective tape was consulted to rectify the mistake. All tapes were transcribed by the researcher. In all, full transcripts were obtained for all but one participant due to a technical problem with the tape which made transcription impossible. The field notes taken during the interview therefore served as the main source of information for this particular participant. Thus, the main analysis was carried out on seven participants with only minor supporting ideas drawn from the field notes of the eighth participant.

Exploring and Coding the Database

The process of data reduction was the next step in the analysis and this continued throughout the analysis. The aim of data reduction is to sharpen, sort, discard and organise the data so as to draw and verify final conclusions (Miles & Huberman, 1994). A qualitative analysis software program, NVivo 2.0 was used for the data reduction process. All transcribed files were transformed from a Microsoft word document into a rich text format and entered into NVivo for analysis. Data reduction was carried out through a process of coding. Specifically, each transcript was divided into several segments and labelled with codes. All codes were operationally defined and clear guidelines written to guide the process.The coding helped to open-up and break down the data into smaller chunks thereby allowing similar themes that run through different codes to be easily located (Sarantakos, 2005).

Forming Emergent Themes

The aim of this step was to come out with emergent themes from the data. Initial codes were further explored by reading all codes line by line while examining the codes for overlap and redundancy. Subsequent codes were narrowed down by collapsing and aggregating similar codes to derive emerging themes and sub-themes from the data. The emergent themes were then verified with the data to see if new themes will emerge. The overall strategy was to derive a minimum but comprehensive set of themes that thoroughly explains and captures the nature of teachers' commitment to environmental. This is described as an inductive process whereby the initial data is narrowed down to a few themes (Creswell, 2005). It should be noted that the process of data reduction and derivation of final themes presented within the thesis did not end at any stage but continued even during the write-up of results. Throughout analysis, memos in the form of ideas, concepts, explanations, themes and sub-themes were kept. These memos were invaluable during the write-up stage.

Describing, Interpreting and Validating Emergent Themes

The final process in analysis was describing and interpreting the emergent themes, and validating the accuracy of the findings. The focus of the description and

interpretation was geared towards the provision of answers to the major research questions and presenting an in-depth explanation of teachers' commitment to environmental education. In explaining each theme, multiple perspectives from participants and contrary evidence were taken into account in order to convey the complexity of the theme. Thematic explanations were supported with short quotes from the interviews to bring realism to the descriptions (Creswell, 2005). Each theme was thoroughly explored until the point of saturation where no new information could be added to the theme. In explaining the themes, additional rigour and insight was provided through layering and interconnecting themes. The layering process was carried out by organising themes into major themes and sub-themes using an interconnected level of themes. These themes and sub-themes were interconnected to display the complex relationship among the themes and how they influence each other to shape teachers' commitment to environmental education. Various graphical displays in the form of networks and hierarchical tree diagrams were employed to grasp the interconnectivity among emergent themes.

The validation of themes was carried out by critically thinking about the emergent themes during the write-up and making excursions back to the transcript to double check assertions. Effort was also made to test the emergent themes with the data for their plausibility, sturdiness and confirmability (Miles & Huberman, 1994). Validation was also explored later in the discussion chapter of the thesis through the process of triangulation by comparing the emergent themes with the quantitative results.

7.7. Conclusion

The methodological processes used in the qualitative phase of this thesis were presented in this chapter. The main design was soft systems methodology although the study was not entirely based on this approach. An overview of the soft systems methodology and justification of choosing this approach were initially discussed. This was followed by the research questions that the qualitative phase aimed to answer. Methods of data collection focusing on instrument design and process were

also elucidated. This was followed in the final section by an account of the data analyses strategy that was used and how results were presented.

CHAPTER EIGHT

Qualitative Results

8.1. Introduction

The strategies and procedures used in the qualitative phase have been provided in the preceding chapter. As indicated in the previous chapter, the soft systems methodology was mainly used as a framework for conducting interviews and it is the analyses of these interviews that are presented in this chapter. The findings are presented in the form of emergent themes and sub-themes. Each theme and sub-theme is discussed with reference to how it influences teachers' commitment to EE, and where possible the theme is connected to previous literature. The findings are grouped into four main sections in line with the research questions of the qualitative phase. An overview of teachers' commitment to EE is presented in the first section. This is followed in the second section by an account of the factors that motivates teachers to be committed. Barriers to commitment are explored in the third section followed by recommendations necessary for increasing commitment in the final section. A general summary of all the findings are presented at the end of the chapter.

8.2. Overview of Teachers Commitment to EE

Results on the general overview of teachers' commitment to EE cover three main areas. These are teachers' current level of commitment, the main strategies employed in teaching EE, and teachers' perception of what constitutes commitment to EE.

8.2.1. Level of Commitment

Participants' account of the various EE lessons they have carried out with their pupils was used to gauge their current commitment to teaching EE. Analysis from the interviews shows teachers to be generally committed to EE activities although the level of commitment varied greatly among participants. For instance while the majority of respondents described themselves as highly committed to the teaching of

EE in their school, two of the participants were of the view that they will not describe themselves as highly committed but were doing their best. An example of this variation in commitment level is exemplified in one of the participant's response to the question as to whether she was interested in EE or not. (Jane) a fairly new teacher said: "Yes, mostly. I think they are not kind of top of my agenda but they are kind of high up there." She went further to explain that "...we are all responsible for the world we live in and that you know we should take care of it." This comment suggests that although some teachers consider EE relevant, they do not rank it among the group of important subjects. The nature of subject ranking is therefore important in influencing what level of attention teachers give to it.

8.2.2. Strategies for Teaching EE

The variation in commitment was also evident from the different strategies used by teachers during EE lessons. Apart from the different teaching strategies reported by participants, personal observation at schools during the research also confirmed the diverse strategies employed by teachers. The general trend seems to follow a strategy that aims to make EE practical for pupils. The most common strategies involve the use of recycling activities, building of wormeries, tending to school gardens, ponds and green houses, and after school wildlife clubs. Two schools visited went a step further and installed a wind turbine to generate part of the energy used in the school. One participant pointed out that the wind turbines also served a symbolic educational purpose in demonstrating to pupils how green energy can be produced in a real sense without incurring costs transporting pupils to a resource centre to see how wind energy is produced. In another school, the head teacher who was a member of the Royal Society for the Protection of Birds (RSPB) established a children's wing of the society in the school.

In addition to the practical nature of EE, most schools adopted some form of holistic approach in the teaching of EE. This was mainly in the form of a whole school approach or holistic teaching strategy. The whole school approach was in the form of environmental codes followed by the entire school. In one example, a participant

who was the head teacher said the school only buys rechargeable batteries and folders made from recycled cardboard. The Eco School programme particularly encouraged a whole school approach to EE. The holistic strategy of teaching on the other hand focused on cross-curricular approaches where teachers tend to de-compartmentalise subjects. An example was demonstrated in a school's art class where pupils made objects that reflected the flora and fauna of the area.

About half of participants (4/8) also made a link between EE and the broader area of sustainability. Most of this was focused on encouraging pupils to be involved in the global aspects of sustainability. Examples included close collaboration with schools mostly in developing countries. There was also one school where pupils were encouraged to run a fair trade society that raised money for their partner school. The general conclusion drawn from observation and interviews indicate that teachers made an effort to make EE as practical as possible for their pupils. However, the extent to which this is carried out in schools varied greatly. Whiles some schools did a lot in promoting EE, very limited environmental activity existed in others.

8.2.3. Teachers' Perception of Commitment to EE

Congruent with social analysis in the finding out stage of SSM, teachers' perception of what constitutes commitment to EE was explored. This social analysis constitutes the acceptable roles and a norm among those engaged in the purposeful activity and is useful in judging whether the definition of commitment to EE in the research conforms to what teachers perceive it to be. This is important for evaluating the feasibility and usefulness of recommendations for improvement. The common perception among participants was that a teacher committed to EE should integrate a lot more environmental concepts within the curriculum. The core roles of a committed teacher should include motivating pupils to learn about environmental issues and making EE practical to pupils so that they can easily relate to it. One participant added that such a teacher should also discuss controversial issues like nuclear energy with pupils so that they can be in a position to make independent decisions regarding the environment. On the strategy for teaching, most respondents

said teachers committed to EE should use cross-curricular strategies that allow EE as a thread connecting other subjects. A few participants also added that committed teachers need to be innovative in adapting local resources for EE activities. These views generally falls within the broad definitions of a committed teacher employed in the thesis. An observation from the interviews and all the schools visited showed that most successful environmental education programmes (mainly in the form of whole school approaches like the Eco Schools programme) depended on the effort of one or a few teachers although support from other teachers was necessary. In most cases, the head teacher or a senior member of staff was the main catalyst for such programmes.

8.3. Motivating Factors of Teacher Commitment

A wide range of factors were mentioned by participants as motivating their current commitment to EE. These factors have been grouped as positive attitude toward EE (5/7), school and community support (6/7) and past experiences (5/7).

8.3.1. Positive Attitude toward EE

Positive attitude toward environmental education was one of the major factors that motivate teachers to be committed to EE. Research shows that teachers who hold favourable attitude toward EE try to teach more EE even if barriers to doing so exist (Ko & Lee, 2003). The main belief underlying teachers' positive attitude was a sense of responsibility toward protecting the earth and the need to take care of it (4/7). There was a belief among some participants that "...all we have is the environment and we must look after it" (John). Generally, respondents were of the view that the responsibility for the earth should lie with everybody rather than being down to a few people:

> I feel that we are all responsible for the world we live in and that you know we should take care of it. I feel that it's kind of a duty kind of thing. ...

> I personally feel that if everybody does their own little bit, then that generally is quite helpful and it shouldn't be down to the one or two of the crusaders to get things changed. It should be everybody's job (Jane).

The belief that everybody should get involved is particularly insightful in understanding the core beliefs that influence attitude change toward the teaching of EE. This is because one of the teachers whose view is expressed above earlier stated that she does not consider EE on top of her agenda. However, she acknowledges that she has a role to play in bringing about the necessary resolution to the earth's problem. This belief in individual effort can somehow be promoted to make more teachers committed to EE to counter the view that individual effort will not make any difference.

The recognition that it is important to teach EE to pupils was another belief underlying teachers' positive attitude to EE. For instance, in response to the question of what motivates his interest in EE, (John) said: "I become more and more convinced that it's absolutely vital that we engage children in the environment and lead them to appreciate how important it is to look after it". These sentiments are further supported by another participant who said: "...it's quite important to teach children early so that they then start to pick up" (Kate). This belief is particularly vital because EE in the early stages of life is important as it is at this stage that attitudes and knowledge that shape later thinking in adolescent and adulthood are developed (Leeming et al., 1995).

A notable belief underlying positive attitude identified by one participant was religion. In response to the question "what drives you", (Kriss) a head teacher who has done a lot of work to promote EE in his school responded:

> I will be perfectly honest with you it's my Christian faith and I believe that we are meant to be stewards of this world and to take care of it for future generations and that is the ultimate driving force and am so much energised in that direction everyday so that gives me the energy I suppose.

This provides a different perspective about the beliefs that make people develop positive attitude toward EE. It also ties in with the earlier belief identified by other respondents regarding a responsibility toward the earth. Similar findings regarding the influence of religion has been observed in studies into significant life experiences of practicing environmental educators (Palmer & Suggate, 1996). Understanding the core beliefs that motivate teachers' commitment to EE is of importance in developing programmes that aims to change teachers' attitude toward EE.

8.3.2. School and Community Support

Support from education authorities, fellow teachers, pupils, parents and the community formed another major source of motivation for teachers' commitment to EE. Most notable was the Scottish Executive which was particularly identified as being supportive of EE activities. One participant observed:

> The Scottish Executive are really keen for schools to become environmentally aware and are interested in promoting environmental issues in schools especially through the Eco School initiative... (Cathy).

This political support is backed by the provision of teaching learning resources and finance for EE activities. However, not all schools seem to have the needed resources as some respondents cited the absence of adequate resources as a hindrance to EE. Personal observation at schools visited confirmed this variation in resource availability. While some schools have enough funds and resources or are effective in looking for them, others are not aware of where to locate these funds and resources.

The support received from pupils and fellow teachers was also a significant motivation for teachers' commitment to EE. Pupils have been described as 'enthusiastic' about EE, 'enjoyed' EE lessons and 'very receptive' to EE. Support from fellow teachers has mainly been in the form of volunteering for whole school EE activities, supporting colleagues in teaching certain specialised aspects of EE, and more experienced teachers being a role model for others. For instance, the actions of

other teachers keen on EE seem to have influenced some respondents to be motivated towards EE:

> Generally I will say this school is not fantastic in EE but there are a lot of positive role models here. And I think it's good to have kind of positive role models" (Jane).

The importance of other teachers keen on EE serving as role models especially for new teachers was described by (Kate), a probation teacher who had a different experience in her school:

> I haven't seen any other teacher teaching environmental studies as such but I think it does help if I go to another class to watch them doing a writing lesson or sometimes it does have an impact on your practice. You pick up tips and things. So I think if teachers were sharing ideas of what they were doing when teaching EE and we got the opportunity to see others teach or just a team teaching, I think it would be a benefit and you have kind of more coordinated approach so as children are moving into the school they are going to get same methods of teaching about the environment.

These sentiments reflect how the concept of apprenticeship through observational learning can be vital for mentoring other teachers to get involved in more EE activities. As suggested by Firestone and Pennell (1993), opportunity for learning and collaboration among teachers which foster sharing of ideas increases commitment to teaching. Thus, the commitment of more experienced teachers can be used to mentor and motivate new and other less efficacious teachers. Most of the head teachers with teaching responsibility particularly appreciated the support from their staff as a major factor in their motivation towards EE.

Another source of support for teachers' commitment is the help and support provided by parents and the school community. Several accounts by participants point to the invaluable contribution of parents and organisations within the community to the

delivery of EE. Support has mainly been in the form of finance for field trips, volunteering time as resource persons and taking care of school gardens during holidays. Community help has come in the form of companies providing funding and resource persons, and community organisations like farmers supporting EE programmes in schools. The following accounts illustrate the multi-faceted help provided by parents and communities:

> A very important part of our school life and learning is our school garden and this was established two to two and half years ago now and it came about through effort from parent, pupils, teachers and the community. And there was a lot of fund raising and funding by parents and we had a training programme for unemployed people who carried out the heavy work for us…
>
> …and parents as well are very aware of what we are doing and we've had a lot of support from parents. They help the children tend the garden and even in summer the parents help look after the garden and water the produces…
>
> …The school board and the PTA here are very much behind what we do as a school. We've got parents whose environmental awareness is quite high and they appreciate what we are doing. And the garden has been great boost for the children not just in the curriculum but play time and so on. (Kriss, a head teacher).

> Well it would have to be the enthusiasm of the pupils and the parents of the school. It is a united thing. It was a partnership that happened in school. And the next door neighbour who you met [Mrs M] is totally committed to environmental issues and our school garden area so we've just got a total partnership (Cathy, a head teacher).

These extracts however shows the sources of support for teachers engagement in EE are numerous and no single factor can be said to be the sole motivating factor.

8.3.3. Past Experiences

Various past experiences were recounted by respondents as influencing their commitment to EE. Notable among them was outdoor experiences like gardening (3/7), and bird watching (1/7). Gardening was particularly cited by most respondents with one participant reasoning that the process of growing something instilled into her a sense of taking care of the environment:

> …being a gardener from a very early age. I always wanted an area of my own garden wherever I lived, I had my own wee area that I could plant and I always got a great deal of pleasure from planting and I've been fortunate enough to have had advisors, role models in life that also were keen in gardening and were able to support and help me. And that has led to an understanding and appreciation of the importance of looking after our environment and the place that we live (Helen).

The above statement shows that significant life experiences related to environmental issues is likely to result in the development of positive attitudinal beliefs towards the teaching of EE (Shuman & Ham, 1997). It also highlights the role played by significant others in influencing behaviour (Ajzen & Fishbein, 1980)

Other experiences cited by respondents include education, that is, previous educational studies in nature related subjects (2/8) and influences by primary school teacher (1/7). Travelling abroad to experience other cultures (2/7), reading a book (1/7) and publicity of environmental issues by media (1/7) were also mentioned as experiences that influenced current commitment. Most participants however mentioned more than one experience, an indication that teachers' commitment to EE is influenced by multiple experiences. For example (Kriss) a head teacher noted various factors in accounting for experiences that influenced his commitment:

> My past degree is in geography ...but even in primary school I was very interested in nature and the world at large and so on and I would say I was influenced by my primary teacher who I thought was very good and nurtured

> an interest in me. And probably by my mother who introduced me to gardening before I went to school and my grandparents who had a farm and I use to work on the farm… but reading in general too. And in terms of the world view as well…

An issue worthy of note is that, only the experienced teachers recounted some form of past experience as motivating their interest in EE. The two new teachers (Jane and Kate) were not able to pin-point any past experience. They either said they cannot remember any such experiences or do not think there was any experience that influenced them. Interestingly however, they mentioned that they are driven by their personal belief to do their part to promote environmental education. This again highlights the different experiences of both experienced and new teachers and what influences their commitment to EE.

8.4. Barriers to Teachers' Commitment

The main factors identified by teachers as constraining their commitment to environmental education were classified broadly as institutional, resource, and educational barriers. These factors however do not stand alone but are interwoven with each other and other issues raised by participants. This section discusses how the factors operate to hinder teachers' commitment to EE.

8.4.1. Institutional Factors

The institutional barriers identified by participants are categorised into three main themes. These are autonomy (7/7), meeting targets (5/7) and instability of initiatives (3/7). They are known as institutional barriers because they emanate from the activities of the established body or institution that controls the functioning of the educational system.

Teacher Autonomy

An absence of teacher autonomy was the main institutional barrier identified by teachers as hindering their commitment to EE. This absence of autonomy result from

a restricted and compartmentalised curriculum and the need for teachers to justify the amount of time spent on each subject area. Teachers perceive the current curriculum as restrictive in that it sets out rigid requirements for teachers to teach subjects to cover specific time periods over a week or term. This is further compounded by the need for teachers to provide a day by day breakdown of the amount of minutes spent on specific subjects and to justify their chosen time plan during school inspections by the Her Majesty's Inspectors (HMI) of schools. With this restricted time schedule, there is pressure on teachers to cover so many topics and subjects in a week. According to respondents, the pressure to justify makes teachers more concerned with 'ticking boxes' and loosing valuable time justifying what and how they are teaching. Participants see these restrictions as an imposition. One participant (John) notes that he does "not have control over the imposed curriculum" when asked what the barriers to his commitment were.

Another point raised by participants as exacerbating the compartmentalisation of topics is the frequent introduction of new initiatives into schools which teachers are expected to carry out and justify. Participants noted that most of the time some of these new initiatives were already going on in schools. However with their re-introduction as special initiatives teachers now use the time they would have been treating these topics filling forms to justify they are being carried out. (Cathy) a head teacher gives an example with enterprise education:

> …And it is not just filling boxes but the new enterprise demands it like this whereas we were doing it before. We were actually doing lots of enterprise things but that came out and now we've got to prove that we are doing it so in the time that you will normally be doing it, you are actually filling forms to say that you are doing it. So you are loosing time.

This comment shows that the absence of autonomy makes teachers become more concerned with providing justifications through a 'tokenism approach' of covering subjects. The lack of teacher autonomy particularly affects the teaching of EE which is not a stand alone subject through the closing of opportunity for cross-curricular

teaching. Respondents also reasoned that the imposition of topics and rigid separation between subjects based on time requirements means that subjects like EE that do not have specific time slots but cut across the curriculum tend to be ignored and if treated at all not in-depth. In most cases, respondents observed EE is normally taught in a rushed manner and pupils usually don't get enough from it. An example is given by (Jane) when she was explaining the EE activities she carried out with her pupils:

> …The other thing we did this year is a science thing we had a topic to do with renewable energy sources and which again we had to rush through. …and you know I personally didn't feel that it was done as well as it should have been done. The kids didn't get as much out of it as they should have. But by then you've got pressure from other places saying do this, do that, do the next thin…Well fine that's done! We've done that, you know it's done!

This extract shows teachers frustration of not having control over how and what they teach their pupils. It also demonstrates the tendency of teachers to feel helpless and powerless in influencing their professional duty. Furthermore, putting subjects in compartments closes down opportunity for teachers to be innovative in engaging in cross curricular activities. This is detrimental to EE which cuts across the curriculum and flourishes better when teaching is cross-curricular.

Apart from the effect on teachers' commitment to EE, absence of autonomy also affects general teaching and learning in schools. Most participants pointed out that the rigid time frame forces teachers to stop subjects in the middle if the time allotted to them is over in order to move to the next subject. This sudden ending of topics frustrates pupils as they never get the opportunity to finish a class that they are enjoying to its logical conclusion. Additionally, the imposed topics take away the sense of innovation and decision making from teachers thereby reducing them to 'robotic implementers'. An illustration of this phenomenon is evident in (Jane's) voice when she said:

> ...I am also motivated to get through what I am told to get through and it can be very hard to say No! I am not doing that because this is more important especially this time of the year when you've got reports to write and targets to meet... (Jane).

On a more general note, the absence of autonomy creates conflict within a teacher because teachers sometimes do not consider the suggested topics as appropriate for their pupils. The way in which this conflict is dealt with seems to depend on experience. More experience teachers and head teachers stated they sometimes ignore the restrictive directives whiles new teachers tend to be especially affected by it. These findings concur with previous studies which suggest that absence of flexibility in the curriculum prevent teachers from engaging in cross-curricular activities within which EE can be taught (Robertson & Krugly-Smolska, 1997).

Pressure for Attainment and Targets

Closely connected to teacher autonomy is pressure on teachers to meet attainment targets. This pressure, mostly emanating from education authorities and some parents is another institutional barrier to teachers' commitment to EE. According to some participants, most teachers are under pressure to 'push children through levels and exams', and to demonstrate accountability particularly in key subject areas of literacy and numeracy. The effect is that teachers become obsessed achieving set targets in these special subjects as they are perceived as failures if they do not meet the set targets. In other words, teachers tend to be motivated to meet these goals and are driven to concentrate on pupil's assessment. As noted by Condie (2003), these pressures also forces teachers to sub-divide subjects into individual components to meet national expectations instead of engaging in cross curricular activities like EE. This restrictive view of what is valuable to be assessed makes it difficult for teachers to spend time on areas like EE which are not assessed. Thus, the teaching of EE tends to depend on whether it crops up in the targeted subject areas or not. (Kate) a probation teacher exemplified how a restrictive curriculum and pressure for attainment target constraints her commitment to EE:

> ...I don't really have control over at the moment the amount of time you spend on it because you are so restricted with you have to teach so many hours of language, so many hours of maths and you are constantly under pressure for national testing and to take your time to spend on other things like environmental education at the moment is very difficult. You need to try and fit it in and to spend a good amount of time on it so that you are actually giving it some kind of status, I don't think that teachers have got much... we do we don't, you could decide you could make that decision that okay I am going to give up that maths time and am going to do this but you do feel under a lot of pressure from management .... Always people are given targets for tests and it's difficult to make the time for other subjects.

The above extract shows how influential pressure from those with power is in determining what subject areas teachers focus on in their teaching. It also shows how the perceived rank of a subject area is influenced by significant others and the subsequent priority that teachers give to it. The issue regarding what subjects are important is what Barrett (2007) refers to as dominant discourses of what counts as legitimate knowledge which tend to hinder even a motivated teacher teaching EE. The issues raised above reflect the absence of teachers having control and autonomy over what and how teachers teach.

Instability of Initiative

The instability of different initiatives introduced by the government into schools was another institutional barrier identified by participants as affecting teaching and learning in schools. Teachers were particularly concerned about the frequency at which new initiatives are introduced into schools and the frequency at which they disappear. One participant (Cathy) noted that the education authority "wants to be involved in so many things" making schools overburdened with different initiatives. Although this indicates the dynamic nature of schools, what respondents lament is the inadequate time given to these initiatives to take root. They described the education authority as "very much inclined to hopping from one initiative to another without ever making sure that anything embeds itself" (Cherry). This observation is

supported by (John) who notes that "it just seems to happen all the time. Initiatives come in for a period of the month for a certain length of time and they just start to disappear". Respondents see this instability as a 'haphazard' way of doing things. The effect of this is that old initiatives tend to 'plateaux' as teachers have to change priority and re-focus on a new initiative just as the old one is taking root. The effect on EE was illustrated by one participant who said that they had to slow down their Eco School project after a new priority was introduced. This particular issue also impacts on teachers' level of autonomy and the ability to be flexible in organising and planning their teaching activities.

8.4.2. Resource Barriers

The absence of resources (4/7) for EE was also identified by participants as constraining their commitment. The major concerns raised were availability of teaching learning resources in schools, accessibility of practical resources within or out-with schools and adequate finance for engaging in EE. It is worth noting that most participants acknowledged having adequate amount of teaching learning resources. The concern among some respondents however is an absence of up-to-date materials for EE. Thus although there might be some resources in a school they seem to be old and not something that the pupils could easily relate to. (Jane) for instance gave a description of the EE resources in her school as against what she would have wanted:

> I think a lot of stuff we've got on environmental issues you know is as old as the ark. Some of the stuff I was looking at when I was trying to prepare is BP [British Petroleum oil spillage] stuff that had come years and years ago. None of them was relevant anymore and I think if am going to do something on EE I want it to be relevant. I want it to be relevant to the kids where they are and to their community but I also want it to be kind of timely. Not something that has happened ages ago.

Of particular concern to some participants is the absence of practical activities that engages their pupils' attention during EE. Although most teachers have books for teaching EE, absence of practical activities that children could engage in makes the teaching of EE difficult. This according to one participant is important because her pupils learn better by doing than sitting and listening:

> I think for myself I found out quickly that there wasn't any resource in the school to help you. I don't know if that's true of all schools but in this school anyway, there wasn't any resources to guide you on how to start off. I would have like some practical ideas of what to do. I think that my particular class learn better when they are doing something. They can't sit and listen they need to be doing something. I didn't have a lot of ideas myself but I tried to be creative about how to get started on it. … I think if there have been more resources in the school I could even just taken ideas from or draw upon them. I think it would have been easier to keep it going for longer. It was a lot of work to try and be creative at that and get activities for the children. As I said, that will mean something to them. There were books and things but no activities…. (Kate).

One issue relating to the availability of practical activities is teachers' awareness of where to find these resources in their locality. Some participants observed that even in situations where they think there is an EE resource centre in the locality, they do not know their location and how to make contact with such centres. In some cases the level of environmental activity in the local authority is low and schools that attempt practical activities like recycling are frustrated because they have nowhere to send them. This discourages both teachers and pupils from continuing with such activities.

Absence of financial resources for EE also featured as one of the constraints for EE. This is especially vital when teachers need to go on field trips with their pupils or buy resources for practical EE activities. It is worthwhile to note that the views regarding resource availability is not widespread in all schools visited. Most

respondents claimed they have adequate resources for EE activities and practical activities were mostly available in schools with the Eco School program. Respondents with longer teaching experience also seem to be aware of where and how to obtain resources for EE. The effect of resource absence also varied greatly. When asked how the absence of resources affects their choice of topic or strategy, most of the respondents said it does not really affect their teaching as they are innovative in finding alternatives. However they acknowledged it takes the flair out of what they are teaching since their teaching strategy is affected and the pupils equally miss out on the 'wow factor'.

One notable finding is the experiences of (Kate and Jane) who were both fairly new teachers. They seem to have been affected most by the resource constraint. Their experience is noteworthy because it shows that although lots of resources are developed by different organisations to guide EE, teachers in training and those new to the field are not aware of this. The availability of finance is also varied among respondents. Findings indicate that some schools have enough finance to cover EE especially for field trips while others are not able to solicit funding for such activities.

8.4.3. Educational Barriers

Absence of background knowledge in environmental issues and inadequate teacher preparation in EE make up the main educational barriers constraining commitment to EE. While background knowledge relates to teachers' knowledge of the subject matter to effectively teach EE, issues of teacher preparation concern the acquisition of effective strategies for teaching EE during training.

Background Knowledge

Relevance of teachers' ecological knowledge and its effect on EE has been demonstrated in previous studies (e.g. Cutter & Smith, 2001). Participants noted that EE sometimes require a lot of specialist background knowledge in various subjects. This is because issues in EE have a social, economic and scientific interconnection

and the absence of background knowledge in these areas makes it difficult to effectively discuss environmental issues. According to respondents this broad nature of EE means that more time is needed for preparing lessons in EE and in topics they are not familiar with. Considering the time constraints in schools, teachers therefore tend to see EE as a daunting task:

> ...and I think a lot of these things necessitate an awful lot of background knowledge and in an already overcrowded curriculum where you've got very limited time to prepare in the week and you've got to know everything there is to know ... it can be quite a daunting kind of work load to undertake all these things and to do it properly (Jane).

A profound impact of this absence of necessary knowledge is mostly felt when teachers attempt to discuss controversial environmental issues. Respondents pointed out that this makes it difficult to discuss controversial issues such as nuclear energy or morally related issues like energy conservation. This is because they might not have all the facts for an effective discussion with pupils. Also, such issues evoke a lot of emotions and could potentially result in a teacher sermonising his or her pupils a situation some teachers found uncomfortable. Moreover some participants feared a discussion of these controversial issues sometimes spirals out of control and takes away time from other lessons which might make some teachers shy away from it. Extracts from (Jane) provides a description of this phenomena:

> I think sometimes these things are quite controversial and it can be a case of well I don't really want to go down that road because people have such feelings about it. And then sometimes it does take over the whole curriculum and it can be 'I don't really want to start that because it could just grow arms and legs and ooh it will just take over everything and I won't have time to do it justice...I think even on a very kind of small scale if you are talking about energy and things like that that can be. If you are trying to get over the message that it's important to conserve energy then you are by default telling people who leave their computer on over night

> or put their TV on standby that they are wrong! And I think that can be quite hard. You can encourage people to make the right decision and say its good to this or that but I just think there is an awful lot of an opportunity there for criticising a class's way of life even on a very kind of small scale and I think that can be quite uncomfortable.

It is worth noting that some respondents view it as a healthy exercise to engage their pupils in controversial issues but point out the absence of knowledge to engage in it can sometimes serve as a hindrance to doing so.

Teacher Preparation

The educational input into preparing teachers for teaching EE was mostly perceived as inadequate. Although only the two new teachers had any experience of EE at college, most respondents believe there is usually an inadequate training of teachers in EE at college in comparison to training in reading, writing and arithmetic. This they said make some teachers feel less confident in engaging in certain aspects of EE. (Kate and Cherry) provided an example of this phenomenon:

> I think when you are at college yourself you are thought a lot about how to teach language, maths, reading writing, these kinds of things? Don't get me wrong I did get some workshops on teaching environmental studies but two or three over the whole year that I did my training so maybe teachers don't feel confident that they know enough themselves to teach it. I know myself if I don't feel confident in something then I don't like teaching it. You try to avoid it. …I don't think a lot of teachers are as confident in teaching something like this as they are with reading or writing (Kate).

> …But I think we don't (training colleges) give training teachers enough experience of the environment. We are very busily training them how to teach maths and how to teach language and how to teach very expressive arts and I don't actually think teacher training colleges actually concentrate enough on using the environment as the foundation for these all other things (Cherry).

The above extracts show that teachers will avoid teaching EE if they do not feel confident about it. This is because knowledge of subject matter reflects teachers' perception of control [self-efficacy] and the lack of ecological knowledge have been found to be a significant barrier impeding teachers' implementation of EE (Ernst, 2007; Cutter-Mackenzie & Smith, 2003; May, 2000). In other words, relevant teacher preparation in EE is important in building the confidence that teachers will need to teach EE. However, given the duration of the one year teacher training program in particular, it will be quite unrealistic to expect all aspects of subject areas to be thoroughly covered.

8.5. Increasing Commitment

Several recommendations for increasing commitment were made by teachers. These are flexibility in the curriculum (6/7), more priority to EE (5/7) accessibility to resources (4/7) and training teachers on EE (5/7). These recommendations proposed by teachers represent what is known as transformation within the soft systems methodology. It also helps to ensure that interventions to increase commitment are desirable and feasible (Checkland & Scholes, 1990).

8.5.1. Flexibility/Freedom in the Curriculum

Flexibility or freedom in the curriculum was recommended by most respondents as the way forward to increase teachers' commitment to EE. Flexibility in the curriculum will be used for the sake of consistency and to reflect the terminology most used by respondents. Flexibility in the curriculum was described as the characteristic of a curriculum framework that gives teachers and schools 'scope and autonomy' to choose their own topics and to tailor them to the interest of the pupils. In the words of (Jane), "it is about the freedom to be able to choose your own topic and to tailor the content to what's interesting and what's appropriate to your kids."

Respondents note that this flexibility should also reflect freedom to make time table decisions to achieve learning goals. In other words, flexibility is the situation where teachers are not bound by strict and rigid time-table requirements for each subject

and learning is not compartmentalised. One respondent stated that flexibility implies: "not having to be tied to you must teach 25 minutes per day of this, and an hour of that and three-quarters of an hour of the next thing, and its got to be done at this time on that day" (Cherry). Another stated that it is: "having the confidence to cross boundaries, cross curricular areas and seeing that you can merge things" [Helen]. Consequently, respondents want the freedom that enables them to freely structure their timetable and teach subjects or topics without worrying too much about time table restrictions to stop and move to the next subject area, as long as arrangement is made to cover other aspects of the curriculum:

> It is a matter of taking any particular topic and whether environmental or not as far as you need to …not to have artificial barriers to going any further … Let projects carry on till they reach their natural conclusion. Not worrying too much about covering everything every week. Over a section you can arrange to cover everything but being a bit more relaxed about how they do it….In any case when you are doing your environmental study that can involve all sorts of other aspects of the curriculum. Mathematical, language, values etc. You can probably base the entire curriculum on environmental activities (John).

As evident from the above extract, an important component of flexibility is breaking the boundary between subject areas. One participant described it as "getting away from this everything in a box education" (Cherry). Thus, it is 'de-structuring the curriculum.' This de-structuring or de-compartmentalisation of the curriculum will encourage teachers not to see subjects as separate entities and to teach more holistically. Respondents believe this will free-up creativity and build confidence in teachers that they can be creative. The ability to engage in cross-curricular teaching is a vehicle through which environmental education can flourish. This is for the reason that it will enable hitherto broad topics like EE which had no specific slots in the timetable to be comfortably blended through cross-curricular teaching. A flexible approach will help counter the current situation where the rigid time frame set for topics and subjects is detrimental to EE because it is not stand alone subjects.

Generally, participants' discussion of flexibility in the curriculum was closely linked to the framework for a new curriculum in Scotland known as *A Curriculum for Excellence* (Scottish Executive, 2004). The new curriculum aims to provide teachers with broad guidelines and to allow schools freedom to decide content and structure. Teachers were especially excited by this new framework to curriculum development as they perceived its introduction will promote flexibility regarding what and how they structure their lesson in order to achieve the set goals of education. They saw this new curriculum as a vehicle through which environmental education can flourish. Their excitement about the new curriculum is reflected in (Helen's) voice: "We are at a very exciting time in Scotland and we are at the edge of a new curriculum, the curriculum for excellence, and I would hope very much that environmental education will be a strong part of that".

It is important to state that reference to the new curriculum was not necessarily in response to any specific question regarding it. The mention of the new curriculum cropped up at various stages of discussion on different questions and it is only then that this was explored further. In the face of this excitement however, some participants were sceptical about whether the new curriculum will be implemented. Some expressed doubt since from their experience, new and well intended programmes like this fizzle out shortly after introduction. (John) a head teacher with teaching responsibilities was particularly sceptical about the new curriculum when asked about his views:

> I think it's an expression of good intentions I don't think it will change anything at all. I think its all politically based and not based on reality. You can look at the document and say oh yes I can't disagree with much in it, I don't think it will make any difference at the end of the day. I have seen these things come and go over the years nothing really changes.

(Cherry) a deputy head also expressed her doubt based on her experience of seeing different policies that are not allowed to take root before they are ditched for another:

> I really do feel that if this could be implemented and I doubt if it can be, I feel that with all innovations not enough time will be given to this. You have to allow an innovation up to 50 years to mature and getting the balance right but so often oh it's not working throw it out start something else and I think we're very much inclined to hopping from one initiative to another without ever making sure that anything embeds itself.

All participants were however optimistic that if the new curriculum is successfully implemented it will make a difference to their commitment to environmental education. They were however careful to point out that the flexibility or '…curriculum for excellence, is not a free-for-all or it is not anything goes but it is an opportunity to create a curriculum framework that gives the teachers scope and autonomy to take things forward with their class more' (Kriss). By this, respondents were keen to point out that flexibility does not mean absence of monitoring and evaluation of their teaching.

8.5.2. More Priority to EE

Another recommendation to increase teachers' commitment is to make EE prominent is the curriculum as teachers mostly work within the framework that they are given by the education authority. Moreover, the perceived priority given to a subject area by the education authority influences how important that subject area is ranked by teachers. The current fragmented nature of EE in the curriculum therefore does not make it a focus of attention. In other words, making it more prominent will make more teachers pay a closer attention to it:

> At the moment from what I have seen this year it only comes up here and there in different projects. It's not really thought as a stand alone subject that is continues… If it was more of a stand alone subject I think maybe it will motivate teachers more because they will have to go and do something about it and then children will learn more as a result. (Kate)

These recommendations possibly contradict participant's previous demand for flexibility. On one hand they want flexibility and on the other hand they want to see the priorities of the education authority/government so they can work accordingly. Responding to this concern regarding an apparent contradiction, some participants defended both views and said the issues were compatible:

> I don't really think it is. I think you have your basic list of requirements; children should have opportunity to engage in this and that and what you do with that should be boiled down to you in terms of making the content flexible and how you apply it to the city that you live and community that you work in and I think that is the flexibility part of it. And if *an activity* is covered through *one project then you don't have to do it again in another project … For example* we don't need to do a project on recycling if we have already talked about sustainability somewhere else. Or if the whole school is doing a project then everybody doesn't need to do one in revision two (Jane…*Italics that of the researcher*)

The above extract thus seems to indicate how both recommendations are reconcilable. What respondents wanted therefore was for the education authorities to set out the priorities which should include EE and the nitty-gritty of how that is carried out should be left to the schools and teachers.

Apart from making EE have a continuous role in the curriculum, respondents also recommended the Scottish Executive raising its profile in schools. This could be through making whole school programmes such as the Eco Schools statutory and encouraging more schools to participate. (Kate) illustrated why the need for a whole school approach following the experience in her school:

> I think it has to be really a whole school thing rather than just one class. At that time it was only my class and they were putting up posters and they were putting up things on the light switches to remind them to switch off the light but if its just one class doing that I don't think it will work… so you are going

> to have to really get all the teachers on board and all the children which I think could be difficult to coordinate. We will never have the same momentum the same effect as if everybody has been involved so if we going to do it again in the future we have to look at it as being a whole school approach.

Other recommendations to increase the profile of EE includes encouraging after school programmes, media attention, speaking to parents and having resource persons in school.

8.5.3. Resource Accessibility

The provision of teaching learning resources was mentioned as a necessary condition for increasing commitment. Participants called for more money to spend at the local authority level to provide enough resources for EE. Focus should particularly be put on providing resources that can be used for practical EE activities in order to engage pupils' attention. This, participants note is important given that teachers are interested in continuing topics that pupils find engaging and interesting.

Some participants (2) also called for the provision of an electronic database that pulls EE resources together. This will be helpful to keep a tab on EE resources out there and would particularly benefit newly qualified teachers and those who do not know where to find them. Such a resource would reduce the time needed for preparing and finding materials for EE lessons thereby motivating more teachers to teach EE:

> I think with the internet as well and a lot of our resources are more and more becoming electronic. I think there needs to be means of keeping tabs on what is out there. I bet a kind of directory, a better kind of cross referencing thing. Something you could type into some kind of data base and saying that am doing a project on this, what are the appropriate resources and where do I get it. That doesn't necessarily exist. I know there are a lot of places that have an awful lot of resources but people aren't necessarily aware of them. How you

do that in real terms other than some kind of computer data base thing I don't know. Whether its places that you can take your kids and it gives contact details, or somebody who can help you or come into schools. Because a lot of the time, some of these things are kind of based on contacts. With organizations such as the police it's kind of straight forward because you can ask of the community liaison officer and request someone to come to school to help. But if you are talking about wind farms or organic farming then you have to go to addresses and ask you have a farm do you know anybody that would come in and I think that is difficult (Jane).

The platform for building such a database already exists. Most local authorities already have some form of electronic database. Hence it should be easy to build on it and to pull all EE resources together:

> ....the council have their own internet and on it they have sections for different subject areas and there are kind of interesting links there. To me why don't they add on to that and say here you are doing stuff about renewable energy sources here are a couple of farms in your area these people have got wind farms why not go and speak to them or whatever. I think the infrastructure is almost there and its not that it is a ridiculous request (Jane).

8.5.4. Training in EE

Providing more training for teachers on how to teach EE is another way to increase their commitment. This should be in the form of inculcating core environmental values in the pre-service training curriculum in order to motivate and equip teachers with skills needed for teaching EE. Some respondents also called for in-service training in EE for teachers who do not feel confident about it. One participant observed that teachers in her school don't teach it because they do not know how to go about it and called for training to boost their confidence:

> I think probably give teachers some training on how to go about starting off teaching it. I know a lot of teachers in this school don't teach it often probably because they are not very sure on how to go about it. So give them some training ... I think that the key will be to give teachers more information on it so that they are more equipped themselves to then go and make up their own resources even. But then they have to get the competence first to go about teaching it (Kate).

One head teacher called on fellow school head teachers to encourage teachers to take advantage of training opportunities in EE that come to schools.

8.5.5. Political Analysis

An integral consideration in soft systems methodology is the analysis of the power structure. This relates to evaluating whom participants perceived as having the power to effect the proposed changes needed to improve a situation (Checkland, 1999). All participants mentioned the education department/Scottish Executive as having power to influence changes in teachers' commitment to EE. They noted that as the ultimate administrative power formulating education policies, they can influence EE through the new curriculum review, directives and funding targeted at EE. One participant for instance stated that "if the Scottish executive will say we are going to have a national project on EE or ESD and we are going to allocate small grants for action research that will be a very good catalyst" (Kriss).

Apart from the education department, respondents also mentioned the local authority as having the power to decide what is good for schools in their authority. One participant mentioned the training colleges and universities as vital in influencing teacher commitment because this is where new teachers are trained and their view of EE can be influenced:

> I think it needs to start right back at the colleges and universities where training the teachers. I suppose, I think it will be quite a good place to start

> then you are getting new wave of teachers coming out every year who have the ideas there who could then be passing that on to teachers who they then work with. I will say that will be quite a good place to start will be where they are training the teachers. … I think the university will be a good place to start anyway (Kate).

Most of the respondents said teachers had the power to influence what goes on in schools and by extension their commitment to EE. However, they were quick to point out the limitation to this power. Teachers believe they are mostly ignored by policy makers. According to (John) a head teacher, 'nobody in the local authority pays much attention to class teachers. Subsequently class teachers feel they are barely given any consideration at all.' This view was supported by [Jane] another teacher:

> I would like to say we do. That it's the teachers and kids and I do think there are many opportunities for teachers to say how they feel about the curriculum and to engage in information gathering and opinion gathering with those engaged in the curriculum of excellence but how far our opinions will be taken I don't know.

Most respondents however mentioned a combination of different people or organisations as having the power to influence changes that will lead commitment to EE. Participants generally called for changes at various levels of the power spectrum.

8.6. Conclusion

The conclusion from the qualitative analysis indicates that teachers are generally committed to EE although variations in levels of commitment exist. These variations are somehow influenced by the perceived rank of EE among other subject areas. In terms of strategies for teaching EE, most teachers used approaches aimed at making EE practical for their pupils. Participants made several suggestions regarding the

roles of a committed teacher which falls within the definition of teacher commitment used in this thesis.

The main findings of the qualitative phase were grouped into three broad sections that answer the research questions. These are the current factors that motivate teachers to be committed to EE, hindrances to their commitment, and recommended actions that will increase teachers' commitment. Results of the themes and sub-themes are summarised in Table 8.1. It can be seen from the table that teachers' current commitment to EE is influenced by their positive attitude to EE, support from school and community and past experiences connected to environmental issues. Participants identified various institutional, resource and educational barriers that prevent some teachers from being committed to EE. Recommendations for increasing commitment include flexibility in the curriculum, giving more priority to EE, provision of resources and training teachers in strategies for teaching EE.

Power to influence the suggested changes was noted by participants to rest with the Scottish Executive as they are the ultimate administrative power that formulates and funds educational policies. However, local authorities, training colleges, head teachers and teachers were also identified as having some level of power to influence more commitment towards EE.

Table 8.1: Summary of findings on current motivations, barriers, and strategies for increasing teacher commitment to EE

Motivations	**Barriers**	**Increasing Commitment**
Positive attitude to EE 1. Sense of responsibility toward protecting the earth 2. Important to teach EE to pupils 3. Religious belief as stewards of the earth	Institutional 1. Absence of teacher autonomy 2. Pressure for attainment and targets 3. Instability of initiatives	Flexibility in the Curriculum 1. giving teachers scope and autonomy to choose topics and tailor lessons 2. Freedom to make timetable decisions 3. de-compartmentalising subjects
School-community support 1. Support from government to engage in EE 2. Availability of EE teaching learning resources 3. Support from pupils and teachers 4. Support from parents and community	Resource Barriers 1. Absence of up-till date teaching EE learning resources 2. Absence of practical EE activities 3. Low awareness and support for environmental activities in local authority 4. Absence of financial resources for EE programs	More priority 1. Making EE prominent in the curriculum 2. Raising profile of whole-school environmental activities 3. More media attention to EE
Past Experiences 1. Outdoor experiences of gardening 2. Past educational experiences 3. Experiences from travelling abroad 4. Reading a book 5. Publicity of environmental issues by media	Educational Barriers 1. Background knowledge on environmental issues 2. Inadequate pre-teacher training in teaching EE	Resource accessibility 1. More practical resources for EE 2. Provision of an electronic database to pull EE resources together Training in EE 1. Core EE values in teacher training curriculum 2. In-service/CPD training in teaching EE 3. Head teachers encouraging teachers to take advantage of training opportunities

CHAPTER NINE

Research Discussion and Conclusions

9.1. Introduction

This final chapter integrates and discusses findings from the qualitative and quantitative analysis with the aim of highlighting the contributions of the study to our understanding of teacher commitment. An overview of the thesis is presented in the first section. This is followed by a discussion of the major conclusions reached on the research questions presented in Chapter five and seven. In this second section, discussion is focused on teachers' current level of commitment in relation to their intentions. The utility of the theoretical model in understanding teachers' commitment is then evaluated followed by an analysis of the significant predictors of commitment and the relationship between these factors. The third section presents the benefits of using a mixed methods approach. Practical and policy implications of the study are presented in the fourth section. Limitations of the current study are explored in section five. A brief summary of major findings and significant contributions of the thesis are presented in section six. The chapter concludes with recommendations for future research.

9.2. Overview of the Thesis

The main aim of this thesis was to understand the nature of primary school teachers' commitment to teaching EE. Specifically, the study tried to provide an explanation of why some teachers are more committed to teaching EE than others. To achieve this goal, both quantitative and qualitative approaches were used to explore a theoretical framework that captures influential determinants and to investigate how these factors interact with each other to shape teachers' commitment to EE. The context of the study was set out in chapter two where a discussion of the historical development of EE policy was presented. It was realised from this discussion that, there is a rhetoric–reality gap between environmental education policies and the conditions that are available to teachers to engage in EE in schools. Thus, it was found that the success

of EE programs largely depends on the individual commitment of teachers. In chapter three, various social psychological factors that determine teachers' commitment were reviewed. This chapter also presented the model of environmental education commitment (MEEC; Shuman & Ham, 1997) as the theoretical framework within which data was collected and analysed. Chapter four presented an argument for the choice of a mixed methods approach. The quantitative procedure was described in chapter five. This was followed by the quantitative analysis and results in chapter six. In this chapter structural equation modelling techniques were used to explore and test the theoretical model specified in chapter three. Results indicated that, the specified model provided a useful insight into why some teachers are more committed to teaching EE than others. The soft systems methodology on which the qualitative procedure was based was discussed in chapter seven. This was followed by the qualitative analysis and results in chapter eight. The findings from this chapter confirmed and gave insight into the quantitative results. It also highlighted aspects of teachers' commitment that were not considered during the quantitative phase. In the following sections of this chapter, the major findings, implications, limitations and conclusions drawn from this thesis are presented.

9.3. Teacher Commitment: Motivations and Barriers

The major findings of the thesis are presented in this section. The discussion first focuses on the current level of teachers' commitment as against their intention to teach EE. The second phase examines the predictive power and utility of the model hypothesised to explain teachers' commitment. In the third and final phase of this section, the predictive power of each determinant in explained in addition to how the factor influences or is influenced by other factors. In presenting these discussions, findings from the quantitative and qualitative analysis are integrated and every effort is made to elucidate how one method confirms, diverges or elaborates on another.

Average responses from the quantitative survey in chapter 6 indicate that teachers have very high intentions to teach EE and overall, were moderately committed to teaching it. Ko and Lee (2003) in a study with secondary science teachers in Hong

Kong obtained similar results where teachers' intention to integrate EE into the science curriculum was significantly higher than their actual practice. Descriptive results indicated that within the core EE contents scale, teachers' intended to and actually placed more emphasis on teaching 'pupils to develop respect for the beliefs and opinion of others' and 'to be more sensitive towards the environment.' Thus teachers' intended and actual practice of EE, emphasised the development of attitudes, a finding different from other studies where teachers' tended to emphasise knowledge, although their preferred emphasis was attitude (Ko & Lee, 2003).

Various approaches and methods that allowed for education 'in' 'about' and 'for' the environment were employed by teachers. The use of local examples for EE lessons was the main approach of choice while going on fieldtrips and participating in outdoor activities was the method most favoured. However, teachers intended approach and method of choice was to actively involve pupils in classroom learning activities and to engage pupils in experiments respectively. The differences between intended and actual commitment in terms of approach and method choice can however not be described as significant. The least emphasised content area in terms of commitment is 'teaching pupils to become more involved in resolving environmental issues' although the intention to achieve this goal was high. This finding is similar to those of Lane and Wilke (1994) who reported that although teachers in their survey agreed that pupils should be provided with opportunity to gain actual experience in resolving environmental issues, the extent to which these goals were accomplished was low. If one of the core aims of EE is to change behaviour then efforts must be made to enable teachers to put their intention of bringing about behavioural change into action.

These quantitative findings were generally supported by the qualitative results in chapter 8 where a moderately high commitment to EE was evident through the various activities that teachers were currently carrying out with their pupils. Explanation for the overall moderate commitment was provided through the interview results in which some teachers were of the view that although they were committed to the teaching of EE, it was not on top of their agenda. Results from both

personal observation and discussion with teachers confirmed a variation in commitment in terms of the strategies that were used for teaching EE. The general trend however suggested that teachers were inclined to use approaches that made EE hands-on for their pupils. This is an important aspect of EE as it offers pupils the opportunity to gain practical experiences of dealing with environmental issues. One possible explanation for the presence of practical activities in some schools is that they are involved in the Eco School programme and benefit from the resources available to its members. It appears from the analysis that, teachers views about what constitutes commitment to EE and how it should be taught fall within the internationally agreed goals of environmental education (see e.g. Palmer, 1998) and those provided by the 5-14 curriculum (Scottish Executive, 2000). However, as will be highlighted later, several barriers prevent teachers from effectively carrying this out.

9.3.1. Utility of the MEEC in Explaining Teachers Commitment

Overall results indicate that the revised model of environmental education commitment (MEEC) provides a significant explanation for what makes teachers committed to teaching EE. In all, the model explained about 59.1% of variance in teachers' commitment. The predictive power of the model in explaining teachers' commitment to EE is generally higher than average explanation of other behaviours in which only the theory of planned behaviour variables were used (Armitage & Conner, 2001; Ajzen, 1991). However, the theory of planned behaviour has been observed to explain above 60% of the variance in other behaviours such as leisure activities (Ajzen, 1991) and 71.1% of the variance in reported use of cannabis among prospective students (Conner & McMillan, 1999). Of the few known applications to understanding teaching behaviour, the theory of planned behaviour variables have been observed to explain about 25% of the variance in science teachers' commitment to integrating EE in the science curriculum (Ko & Lee, 2003), and 18% of variance in teachers' implementation of educational technology in the classroom (Czerniak et al., 1999). However, it is worth stating that Ko and Lee (2003) did not test all the theory of planned behaviour variables while Czerniak et al. (1999) predicted

behaviour only from intention but not from perceived behavioural control. Since not many models applying the theory of planned behaviour to understanding teacher commitment measure actual behaviour, it is difficult to make any comparisons in the field. The significant explanatory power of the MEEC however means that an intervention based on the proposed model is likely to result in improvement in teachers' commitment to teaching EE. However, it is important to state that the model does not capture all the possible influences on commitment and further understanding of the factors specified in the model were only obtained through qualitative procedures.

The qualitative support for the model was evident through confirmation of the determinants specified in the model. The findings from both the quantitative and qualitative results revealed that teachers' perception of control and autonomy, intention, subjective norm, attitude, and life experiences connected to environmental issues provide a significant explanation for why some teachers are more committed than others. Although this finding may seem obvious, what is important from this study is that it has provided information about the relative strength of these factors, the paths through which they influence commitment as well as the dynamic relationships between these factors. These issues are discussed in the next section.

9.3.2. Strength and Influences on Intentions to Teach EE

The finding from this study supports the hypothesis that teachers who hold a strong intention to teach EE actually go on to teach EE. Intention indicates how hard people are willing to try or how much effort they are willing to exert, in order to perform behaviour (Ajzen, 1999). Thus teachers' who were willing to try hard to teach EE actually taught more EE. The strength of the intention construct in influencing teachers' commitment was moderately high. Compared with the other determinants, intention was the third strongest predictor after perceived behavioural control and significant life experiences. Since the predictive power of intention on commitment depends on the extent to which the behaviour in question is under volitional control (see e.g. Armitage & Conner, 2001), it would appear from the moderate influence

that, there were not enough supportive structures to enable teachers carry out their intention. In other words, the presence of barriers to teaching environmental education explains why intention was not the most significant predictor of commitment as is generally the case of behaviours under volitional control.

To understand how teachers' intentions influence their commitment, it is necessary to evaluate the determinants of intention. Results from the quantitative analysis shows that pressure from significant others and positive attitudes toward EE have an influence on how hard teachers are willing to try to teach EE. Overall, subjective norms had the most influence on teachers' intention, confirming Zint's (2002) observation that normative pressure is of significantly higher influence on teachers' intention than in most other populations on which the theory of planned behaviour is applied. A possible explanation for this might be that teachers have a strong identification with a group or referents (e.g. local authority or education department) which make them weigh normative pressure more heavily when making behavioural decisions (Trafimow & Finlay, 1996). Although teachers' attitude was a significant predictor of intentions, it was less influential than subjective norm. This finding differs from most applications of the theory of planned behaviour where attitude toward the behaviour is generally a stronger predictor of teachers' intentions (e.g. Zint, 2002). However, Czerniak et al. (1999) in a study with teachers also found attitude to be less predictive of teachers' intentions than subjective norms. Thus, the findings of this study show that teachers' intention to teach EE is more dependent on pressure from referents than on their attitude. To increase intention therefore, interventions should show that the education department, local authorities, fellow teachers, head teachers, pupils, parents and other individuals that primary school teachers' perceive as important are supportive of EE in schools and that teachers will benefit or be recognised from complying with these referents (Zint, 2002). The significance of normative pressure was equally demonstrated through the qualitative analysis where teachers identified support from referents (e.g. provision of resources) as increasing their commitment, and alternatively pressures (e.g. attainment targets in key subject areas) as hindering their commitment.

In contrast to findings from most studies applying the theory of planned behaviour to gauge teachers' intentions (e.g. Zint, 2002; Astrom & Mwangosi, 2000; Czerniak et al., 1999), teachers' perception of control was not found to be a predictor of their intention to teach EE. This is despite the suggestion that perception of control have motivational implications for intentions, that is, people are unlikely to form a strong intention to perform behaviour if they feel that they lack enough resources or opportunity to perform the behaviour. However, as suggested by Ajzen (1991), the strength of perceived behavioural control in predicting intention is dependent on the strength of subjective norm and attitude. Thus, because teachers have positive attitudes toward EE and feel strong normative pressure to teach it, it is possible that perceived behavioural control (PBC) is less predictive of their intentions to teach EE. Since PBC was the most significant predictor of commitment but not of intention, it may appear that the path between PBC and intention which suggests a perception of control rather than actual control is not relevant to formation of intentions. However, the results from this study cannot be taken to mean that PBC has no relationship with intentions as a moderately strong correlation exists between these two factors.

Life experiences connected to environmental issues had an overall significant influence on teachers' intention to teach through two indirect paths. The first path shows that teachers who have had outdoor and environmental education experiences are likely to evaluate referents' pressure to teach EE more positively. This finding concurs with that found by Shuman (1995) in an analysis of elementary school teachers' in the United States. The suggestion from this finding is that, teachers who have had experiences related to environmental issues may actually share the same values and concerns about the environment and by so doing agree with referents pressure to teach EE. Examples of this path of influence was recounted by some participants who indicated during the interview that experiences like travelling to poor countries abroad made them agree with issues like using less resources. However, teachers who have not had experiences concerned with environmental issues may not share concerns about the environment with their referents. Thus they may construe referents pressure to teach EE as interference and not be motivated to comply with such demands. The second path of influence of life experiences on

intention indicates that relevant environmental experiences make teachers develop positive attitudes toward the teaching of EE which intend makes teachers want to teach EE. This result concurs with findings in environmental psychology that nature related experiences influences the development of positive attitude to EE (Kaiser et al., 2007). Some participants during the interview for instance gave an example of how gardening has instilled in them a spirit of taking care of the environment. This indicates a positive attitude toward the environment in general may drive interest in EE.

In summary, findings from this study suggest that the teachers who intend to teach EE make significant efforts to teach it. Intention on the other hand depends on normative pressure that supports the teaching of EE and positive attitudes towards EE. Having life experiences connected to environmental issues indirectly influences intentions by making teachers agree with referents pressure to teach EE and through the formation of positive attitudes towards environmental issues.

9.3.3. Strength and Influences on Teacher Control and Autonomy

Overall results from this study indicate that perceived behavioural control (PBC) is the most significant determinant of primary school teachers' commitment to EE. That is, control factors such as availability of resources, freedom in the curriculum and teachers' conviction that they can successfully teach EE are the most important factors that determine commitment. Ajzen (1988) claimed that the direct path between PBC and behaviour can be taken to represent the extent of actual control. The fact that PBC was not a predictor of intentions suggests that, it is not a perception of control per se that influences commitment, but rather having actual control that makes teachers committed to teaching EE. Consequently, PBC being the most important predictor of commitment suggests a lack of control on the side of teachers in deciding whether to teach EE or not. This is because the control variable is most significant in situations where barriers to performing the behaviour exist (Armitage & Conner, 2001; Ajzen, 1991). Considering that participants in the study only reported a moderate level of control, the gap between intentions and

commitment can therefore be explained as due to an absence of control over teaching EE contrary to the findings of Ko and Lee (2003). This study's findings therefore concurs with previous findings that barriers to teaching EE are responsible for inhibiting teachers from translating their intentions into actual classroom behaviour (Barrett, 2007; Ernst, 2007; Kim & Fortner, 2006; Ham & Sewing, 1988). It also provides some support to the sociological conceptualisation of teachers' commitment which states that teachers respond to structures and processes within the school and it is these conditions that influence their commitment (Reyes, 1990).

The qualitative results elucidated the current barriers that hinder teachers' commitment. These barriers were generally grouped into institutional, resource and educational barriers. It appears from the findings that the institutional barriers were considered by teachers as the most problematic. Prominent among these is the absence of autonomy on the part of teachers in deciding whether to teach EE or not. This lack of autonomy has been blamed mainly on the curriculum which teachers viewed as compartmentalised and not offering opportunities for cross-curricular activities that foster the teaching of EE. The curriculum also demands that teachers devote specific times for specific subjects and justify that this is done. This curriculum barrier in terms of strict time allocations for specific subjects gives no opportunity for teachers to make time timetable decisions. In other words, teachers are hindered from engaging in cross-curricular activities such as EE which have no specific time slots. It also takes away the sense of innovation that is needed for integrating EE into other subjects and in a sense reduces teachers to 'robotic implementers'. This finding is backed by the results from the quantitative analysis where teachers rated freedom in the curriculum to teach EE as the variable they had least control over. Similar reasons were identified for the poor implementation of 5-14 environmental studies guidelines (Condie, 2003). Studies in EE have established that flexibility in the curriculum is crucial for the integration of EE into lessons (Robertson & Krugly-Smolska, 1997; May, 2000). Notably, absence of flexibility in the 5-14 curriculum was among the main reasons for the Scottish Executive launching the current review of the curriculum, that is, the Curriculum for Excellence (Scottish Executive, 2004). Considering that EE is supposed to be treated as a cross-

curricular subject, it can be concluded that conditions are at best at odds with policy and represents the rhetoric-reality gap within which teachers operate (Stevenson, 2007). Another institutional barrier in addition to the absence of autonomy is pressure from the Scottish Executive and parents for attainments and targets in key subject areas of Arithmetic and Reading which makes teachers spend less time on EE which is not assessed. This is because, these attainment targets influence teachers' perception of how important a subject is and since EE is not part of those subjects teachers generally rank it as less important and therefore spend less time teaching it. This finding is consistent with previous research that pressure for attainment targets prevents teachers from spending time on EE (Ernst, 2007).

The qualitative findings on resources overall indicates an availability of resources in schools although the distribution of such resources are uneven. While some teachers were effective in locating resources for EE, other teachers, particular new ones were unaware of where to find these resources. Other concerns about resources include the absence of up-to-date resources in some schools and practical EE activities that can be used to engage the attention of pupils. It appears that teachers who were in schools that actively participated in the Eco Schools programme and those with longer teaching experiences had more assess to and were effective in finding resources for EE.

The educational barriers include absence of ecological knowledge and inadequate pre-service preparation. Although, the quantitative result showed participants rating of their efficacy to engage in EE to be generally high, the qualitative analysis suggests an absence of 'pedagogical content knowledge' prevented some teachers from teaching certain aspects of EE. This supports other findings in the literature that teachers' ecological knowledge influences their decisions and ability to teach EE (Ernst, 2007; Kim & Fortner, 2006; May, 2000). Kim and Fortner (2006) found out that although teachers usually perceive external logistic barriers to be more important to their teaching of EE, content pedagogical knowledge is more related to actual teaching. A possible explanation for the absence of pedagogical content knowledge is inadequate pre-service and in-service preparation in EE. As indicated by Lane and

Wilke (1994) having adequate pre-service preparation in EE is important for subsequent teaching because this influences teachers' perception of their own competence to teach EE. Thus, some teachers see EE as a daunting task and for this reason avoid it. Particularly, teachers tended to shy away from those topics which are controversial and would require more preparation time. This is because they are not sure how to handle such sensitive topics and are sometimes afraid the discussion might spiral out of control and take away time from other lessons which needs to be taken care of in the time slot.

The above discussions have shown the importance of control factors in influencing teachers' commitment. Whilst the quantitative analysis provided evidence for its efficacy, the qualitative analysis gave depth to the salient issues that form the control variable and how these issues currently operate to either promote or hinder teachers' commitment to teaching EE. To understand how these control beliefs are formed, the determinant of control specified in the model was examined. The findings show that, teachers' perception of control is significantly influenced by life experiences connected with environmental issues. It appears from the model that, these experiences makes teachers have confidence in their ability to teach EE (self-efficacy) as well as enable them to overcome barriers to their commitment. For instance, teachers who have had EE and nature related experiences are more likely to posses strategies for integrating EE into the curriculum and be aware of where to find resources to teach EE. Lane and Wilke (1995) for instance found that attending courses focused on environmental issues influences teachers' perceived competences, attitude and the amount of class time devoted to EE.

9.3.4. Strength and Influences on Teacher Attitudes toward EE

The hypothesised path in the quantitative model that positive attitudes toward EE indirectly contribute to a teachers' commitment was confirmed. Overall, teachers had a positive attitude toward the teaching of EE. Evidence from the qualitative analysis confirms that a positive attitude toward environmental issues in general motivates teachers' commitment to EE. The findings show a general belief among teachers in

the value of sense of responsibility toward protecting the earth and taking care of it. Thus by teaching EE to their pupils some teachers believe they will be contributing towards the resolution of EE problems. The prevalence of this belief suggests that some teachers perceive their commitment to teaching EE as a form of 'nonactive' pro-environmental behaviour (Stern, 2005). This finding provides another useful perspective through which positive attitudes toward the teaching of EE can be promoted by reinforcing the belief that teaching of EE is an equally valued pro-environmental behaviour.

Overall, the influence of attitude on commitment is small and the quantitative result shows that it is the least predictor among all the variables specified as determinants of commitment. This finding is contrary to most other applications of the theory of planned behaviour where attitude is usually a stronger influence of behaviour (e.g. Armitage & Conner, 2001). In a similar study however, Ko & Lee (2003) found a significant relationship between attitude toward environmental education and teachers' intention but not with actual commitment. A possible explanation for this weak influence might be that, teachers do not have volitional control over the teaching of EE and therefore are unable to translate the 'I want to perform the behaviour' drive into action (Ajzen, 1991). This assertion is supported by the strong influence of perceived behavioural control on commitment. Thus, in line with the suggestions by the ABC theory, the predictive power of teachers' positive attitude toward environmental education is limited by constraints hindering the teaching of EE (Guagnano et al., 1995). It is also possible that the lack of pedagogical content knowledge about environmental issues cited by teachers account for the discrepancy between their attitude and commitment to EE (Summers et al., 2001).

As indicated in previous explanations under intention (see page 214 above), the life experiences variable significantly predicts teachers' attitude towards EE. It appears from this finding that teachers who have had experiences connected to environmental issues (e.g. outdoor experiences, EE experiences) are more likely to develop positive beliefs about teaching EE which subsequently drives their commitment. The qualitative result shows that experiences like growing things instil into teachers a

general sense of belief in taking care of the environment. This belief is important in influencing teachers' commitment to EE. The relationship between experiences connected to EE and individuals' attitude to environmental issues is backed by current evidence in the environmental psychology literature which suggest that people's environmental attitude can reliably be traced to their self-reported conservation behaviours (Kaiser et al., 2007). Based on these findings, it is can be said that teachers who have had such experiences related to environmental issues are much more likely to develop a positive attitude to the teaching of EE than those who have not had such experiences.

9.3.5. Strength and Influences of Teachers' Evaluation of Referents

The finding of this thesis appears to support previous studies (e.g. Zint, 2002) that subjective norms are more important and predictive of teachers' commitment to teach EE than in other populations (e.g. Conner & McMillan, 1999). Subjective norms had significant indirect effects on teachers' commitment to EE. In other words, normative pressure from significant others to teach EE and the perception that significant others actually engage in EE motivates teachers to be committed to EE. A reason for this significant finding might also be due to the use of multi-item measures which has been found to increase the predictive power of subjective norms (Armitage & Conner, 2001). The qualitative findings indicate that teachers receive mixed messages from their referents regarding the importance of EE. On the positive side, there is support in the form of resources from the education department, enthusiasm of pupils towards EE, help from fellow teachers for whole-school EE activities, and financial, time, and educational support from parents and organisations within the community. These findings confirm the evidence in the teacher commitment literature that teachers with greater administrative support from their principals and instructional support from peers and other persons are more likely to be committed to teaching in general as well as to school goals and values (Riehl & Sipple, 1996; Firestone & Pennell, 1993). However, on the negative side, teachers identified normative pressures from the school and educational authorities that hinder their commitment to EE. These include pressures to focus on key subjects, the need

to justify time allocation for subjects, and the pressure to meet attainment targets in key subject areas. This result from the qualitative analysis indicates how subjective norms can influence teachers' perception of control by either reducing or imposing barriers to teachers' commitment to EE. This finding concurs with similar findings in teacher training institutions where political administrators posed a challenge to the incorporation of EE by not institutionalising it (Heimlich et al., 2004). Overall, the qualitative findings create a deeper understanding of the relationships specified in the quantitative model. Considering the strong normative influence reported in this study, it is important that subjective norms are seen to be motivating the teaching of EE rather than putting barriers that prevent teachers' commitment.

As discussed in the section under intentions, life experiences related to environmental education had a significant influence on teachers' perception of normative pressure to teach EE. Similar to previous findings (Shuman, 1995), such experiences are likely to make teachers' respond positively to requests from referents to teach EE as a result of similarity between the teachers' values about environmental issues and those of his or her referents.

9.3.6. Strength of Environmentally Related Experiences

The significant life experience variable was the addition made by Shuman and Ham (1997) to the theory of planned behaviour. Results from the study confirmed the hypothesis that life experiences connected to environmental issues significantly influence the development of core beliefs that underlie teachers' commitment to EE. These findings support previous qualitative work that such experiences influence the development of concern for environmental issues (Chawla, 1999; Palmer & Suggate, 1996). Significantly, these influences lead to a substantial explanation of why some teachers are more committed to EE than others. The most significant path is through an influence on teachers' perception of control. Evidence from the quantitative analysis show that life experiences connected to environmental issues lead to the development of control beliefs that makes teachers more committed to teaching EE. A possible explanation as elucidated under perceived behavioural control above is

that, these experiences equip teachers with the necessary knowledge and skills which make them have the confidence that they can actually teach EE (self-efficacy). Also, these significant environmental experiences enable teachers overcome barriers to their commitment by knowing where to locate the resources needed for EE. Although it is not possible to state which specific experiences influence perceived behavioural control, the nature of the experiences identified through the qualitative analysis leads to the suggestion that more practical life experiences like gardening, engaging in outdoor experiences, reading nature related books, taking nature related courses and participating in EE activities are more likely to influence control beliefs. Overall, findings of the study however indicate only moderate levels of such experiences, and considering their significance, it would seem to be important to provide opportunities for teachers to participate in environmentally related activities.

Results from the qualitative analysis supported the findings that significant life experiences influences the development of beliefs that underlie commitment to EE. However, the quantitative result indicated that younger teachers could not pin-point any specific environmentally related experiences that influence their commitment. On the other hand, their commitment was based on 'action experiences' (Shuman, 1995) such as a desire to make a difference to the state of the environment.

9.4. Relevance of Mixing Methods

This study has applied a mixed method strategy to unearth the complexity in teachers' commitment to environmental education. Overall findings from both quantitative and qualitative analysis show that perception of control or autonomy is the most significant factor that influences teachers' decision to engage in EE. However, other factors are necessary and important in ensuring a sustainable commitment. For example, the quantitative analysis shows subjective norms have a significant influence on teachers' intentions to teach EE. The influence of referents is further elucidated through the qualitative analysis which shows that what and how teachers teach is dependent on what referents prescribe and consider important. In their proposed solution, the influence of normative pressure was considered as

important in bringing about the necessary changes needed for increasing teacher commitment. Other significant determinants of commitment to EE include the belief in the importance of teaching EE to pupils and certain life experiences. As pointed out by May (2000), the factors affecting teachers commitment are numerous and act synergistically to affect commitment.

The use of a mixed methods approach has expanded our understanding of teacher commitment to EE. While the survey provided us with an opportunity to gauge the determinants of commitment in the general population and their significance, the SSM allowed us to acquire a rich and in-depth analysis of these factors. In other words, the quantitative data provided breadth and the qualitative data provided depth (Mason, 1996). The confirmation of findings from both methods also gives credence to the final result.

Furthermore, the mixed methods approach enabled an understanding of different layers of each factor affecting commitment bringing the complexity of these factors into focus. For instance the survey shows perceived behavioral control as the most significant influence on commitment among the general population of teachers but the way in which the factor currently operates is only elucidated through the SSM. In-depth analyses from the SSM show that perception of control in Scotland relates to the flexibility or inflexibility of the curriculum. Another way in which mixing methods has been useful in understanding elements of complexity is by pointing to the influence of multiple factors affecting commitment even if some are more significant than others. Taking these factors together and considering them in any program to improve commitment will produce better results. Using a single method would have given us only one perspective thereby reducing any potential benefits of an intervention.

In all, this study has shown the efficacy of mixed methods in understanding the different levels of complexity in social behavior. The study also contributes to the development of mixed methods research by demonstrating how either quantitative or qualitative findings can be overlaid on each other to achieve a better integration of

results. This will to some extent provide an exemplar on how to integrate quantitative and qualitative findings during results write-up.

9.5. Policy and Practical Implications for Increasing Teacher Commitment to EE

The practical and policy implications are gleaned both from specific findings of the proposals by teachers during the qualitative phase and major findings from the quantitative analysis. The findings of this study generally indicate a need for educational policy changes that bridges the rhetoric-reality gap regarding the teaching of EE in schools. As was evident from both the quantitative and qualitative analysis, there is a dichotomy between how teachers are expected to teach EE and what the curriculum allows teachers to do. While both international policies and the 5-14 curriculum guidelines called for EE to be treated as a cross-curricular subject, the curriculum that is presented to them is seen as highly compartmentalised and does not allow teachers to cross subjective boundaries. As proposed by participants there should be efforts to develop a flexible curriculum that gives teachers scope and autonomy to design and tailor their lessons. This flexibility should enable teachers to make time table decisions to achieve learning goals as these conditions would encourage teachers to break the strict subject boundaries, be more creative and comfortably blend EE into their lessons. Results from this study therefore support the Curriculum for Excellence framework which is aimed at introducing a flexible curriculum that will give scope and autonomy to teachers (Scottish Executive, 2004).

Also, the government's educational policy should raise the profile of EE within primary school by giving it a continued role in the curriculum. Teachers must be made to feel that the Scottish education department support EE activities and that EE is an important curricular area. Some suggestions for this include continued support for the Eco School programme, encouraging and supporting after school EE programmes, more media attention to environmental issues and having more resource persons in schools. These activities are important because teachers work within the framework that is owned by the education department and therefore place

more importance on what the education department says. In other words, support by the education department for EE will make teachers feel a greater normative approval to engage in EE.

On a more practical note, education departments must make efforts to provide hands-on EE resources or information about how to find these. As is evident from the findings, some teachers are not aware of how to locate these resources. One way of bridging the gap is to encourage and support more schools taking part in whole school activities like the Eco School programme which helps to provide practical EE resources to schools. In addition, provision of an electronic database that pulls EE resources together can help teachers to easily locate materials for their EE lessons. These resources would also serve to boost teachers' knowledge and confidence in their ability to teach EE as well as reduce the lengthy preparation time that makes EE daunting for most teachers. The platform for doing this already exists in most local authorities.

Furthermore, more should be done to increase teachers' perception of control through inculcating core EE values and teaching methods in pre-service and in-service teacher training programmes. There should be a focus on increasing teachers' pedagogical content knowledge in environmental issues in addition to skills for dealing with controversial issues. The overall finding from this study suggest that both pre-service and in-service EE programmes should give teachers the opportunity to experience environmentally related activities as this is crucial in the development of beliefs that promote teachers' commitment to EE in the face of barriers. Such experiences should include participating in outdoor activities, exposure to environmental issues and disasters through site visits or audiovisual media, and engaging in hands-on pro-environmental behaviours like recycling, energy saving etc. As suggested by Calderhead & Robson (1991), such events are likely to create vivid episodic memories that teachers fall back on in their future practices.

Finally, although attitude seems to be a weak predictor of commitment, it is still important and efforts to promote positive beliefs about EE should be incorporated in

any intervention to promote commitment. These beliefs should focus around the importance of EE to pupils' future decision making, and the belief that teaching EE is itself a form of pro-environmental behaviour. Thus, there should be effort to promote the belief among teachers that they are directly and indirectly contributing towards the resolution of EE problems by teaching more EE to pupils.

Although the recommendations are presented separately, it is the belief of this thesis that issues of teacher commitment should be addressed from a holistic perspective through programmes of intervention that give consideration to all the major elements in the model and not just focusing on one issue. This is because the factors influencing commitment are interrelated and have an influence on each other.

9.6. Limitations of the Study

The findings of this thesis are limited by various considerations including the use of self-report measures, measurement problems, sampling and sample size, and limitations of the structural equation modelling (SEM) technique. Self-report measures are generally limited by the tendency of participants to respond in a socially desirable manner to questions. Considering that environmental issues are currently top of most social and political discussions, it is highly probable that respondents would tend to report both positive attitudes and behaviours about their engagement in EE. There is evidence in the literature to show that self-report measurement procedures are prone to self-presentational biases (Gaes, Kalle & Tedeschi, 1978). In a meta-analysis, Armitage and Conner (2001) found a significant difference in the amount of variance explained by the theory of planned behaviour between observed and self-reported behaviour. When self-reported measures were used the amount of variance in behaviour explained was 11% more than when observed measures of behaviour were employed. Hence a weaker but similar relationship might have been found if an objective measure of teachers' commitment to teaching EE was employed. However, this phenomenon is common with any measure of psychological construct that uses self-report. Also, the use of self-reports is almost unavoidable for some of the constructs like attitude and subjective norm

employed in the study, although an objective measure of commitment would have been useful.

Another limitation of this study relates to certain measurement variations and problems encountered in the quantitative analysis. It is normally assumed that observed items adequately measure the psychological constructs used in any study. In testing this assumption with a confirmatory factor analysis, it was realised that the subjective norm construct that was proposed did not fit the data. Although this construct has generally been the most problematic of the theory of planned behaviour variables (see e.g. Armitage & Conner, 2001; Conner & McMillan, 1991) it was still kept in the analysis in order to ensure a complete exploration of the model. This situation means that there is a lot of uncertainty regarding the exact nature and influences of the subjective norms variable since its dimensionality is not known. Conclusions drawn about this variable therefore could later be found to be incorrect. However, based on subsequent findings from the qualitative data, it is likely that the subjective norm is vital to some extent in influencing teachers' commitment to EE. Additionally, there are measurement variations in the current study that makes it different from most applications of the theory of planned behaviour thereby making it difficult to draw concrete comparisons. Firstly, this study has employed an additional variable to the theory of planned behaviour constructs and secondly multi-item measures were used to measure all constructs. For instance, most applications of the theory of planned behaviour have relied on single-item measures for both intention and behaviour. However, multi-item measures were used in this study. Also, for intention, the measurement in most previous studies was based on asking participants if they intended to engage in the behaviour. In this study however, participants were asked to rate their ideal behaviour which was taken to be their intention and to rate their current behaviour which was taken to measure commitment. In general, it is expected that the multi-item measurement approaches adopted in the present study rather increased the reliability of measurement compared to if single-item measures were used (e.g. Nunnally, 1978).

Various sampling and sample issues also pose limitations to the study. Although attempts were made to ensure a broad selection of participants, it is still probable that only teachers who were interested or committed to EE responded to the questionnaire or volunteered for the interview process. This largely amounts to a self-selection bias. In other words, the views of non-respondents might not be strongly represented in this study. These problems are however unavoidable in studies that rely on voluntary consent of participants. Furthermore, the sample sizes for both the quantitative and qualitative study are relatively small and the response rate of 38.6% for the survey can at best be described as fair. SEM is generally a large sample technique and a sample size of 182 is considered medium. Such small to medium samples are likely to affect the stability of fit indices which might lead to a rejection of good models or an acceptance of a poor model. Findings from this study might therefore not be representative of the entire population of Scottish teachers. A much larger sample size would therefore be appropriate to determine the representativeness of the results in the study. The qualitative sample of seven is also not adequate to represent all possible views of teachers. As indicated in the qualitative methodology, most of the teachers were from small to medium size schools and their experiences might be different from those in large size urban schools.

The statistical techniques employed in this study also pose limitations to the study. Firstly, it is important to state that the application of SEM was from a purely exploratory perspective. Secondly, although the language of causality has been used throughout the presentation of quantitative findings, the statistical techniques are rooted in correlational processes and therefore care must be taken in drawing any cause-effect conclusions. However, the confirmatory techniques are powerful in separating the individual influence of one variable from another. In other words, paths in a model reflect the unique influences of the factors on teacher commitment. Thirdly, the various modifications made to the model are liable to capitalisation on chance and therefore there is a need to validate the model with an independent population. Fourthly, the recursive SEM techniques used in the study are restrictive in that they do not include possible feedback effects that might exist within the variables. Other SEM techniques (e.g. recursive techniques) which allows for

estimation of feedback relationships would have been useful. However, the exploratory nature of the study and the small data set does not meet the assumptions for running such an analysis (Kline, 2005). Fifthly, it is possible for other models based on different hypothesised relationships among the variables to provide an adequate and even better fit for the data. Thus, in the absence of testing such alternate models, one cannot conclude that this is the best model for teacher commitment. Finally, specific emphasis has been placed on aggregate level constructs than on individual items. This presents a problem of losing out on specific details. However, this approach is in line with the study's objective which is to examine a broad theoretical framework that provides a comprehensive explanation for these numerous specific issues

Although most of the limitations recounted above focus on the quantitative study, it is important to state that qualitative analysis is potentially problematic and the themes and results presented in this thesis will generally differ if the same data is analysed by another researcher. The general limitations of the study has been including the use of self-report measures, measurement problems, sampling and sample size, limitations of the structural equation modelling (SEM) technique, and problems of qualitative analysis.

9.7. Summary of Major Findings and Significant Contributions of this Thesis

From the on going discussions, the major findings of this thesis can be summarised as follows:

- The model of environmental education commitment provides a useful framework for evaluating teachers' commitment and for understanding why some teachers are more committed to teaching EE than others. Thus, an intervention programme based on this framework is likely to lead to significant increases in teachers' commitment to teaching EE.

- The most significant determinant of Scottish teachers' commitment to EE is their perception of control over teaching EE. Teachers in Scotland generally perceive an absence of control over teaching EE through lack of autonomy, absence of pedagogical content knowledge, and a lack of resources for practical EE activities. To bridge the gap between teachers' current intention and commitment, there should be a provision of flexible curriculum framework that increases teacher autonomy, and pre-service and in-service training in how to teach EE.
- Significantly, providing teachers the opportunity to experience environmentally related events through pre-service and in-service programmes may increase their self-efficacy and ability to overcome barriers posed by the curriculum.
- The views of teachers' referents significantly influence their commitment to EE. This is mainly through influencing the importance that teachers place on EE and the opportunities that are created for teaching EE within the curriculum.
- Teachers' attitude toward EE suggests that interventions should explicitly promote the belief that teaching EE is a form of pro-environmental behaviour.
- Life experiences related to environmental issues significantly influence the development of positive beliefs toward teaching EE, positive evaluation of normative pressure to engage in EE, and predispose teachers to the knowledge and skills for overcoming barriers to their commitment.
- A holistic approach should be adopted in any interventions aimed at increasing teachers' commitment to EE in order to achieve a more comprehensive result.

Overall, this thesis has made original and significant contributions to the understanding of teacher commitment to teaching EE and to research in the field of EE. These contributions are discussed in relation to the usefulness and modifications made to the MEEC, originality of the methodology used in the thesis and additions to the literature.

Taken as a whole, the thesis provide a theoretical framework for understanding teacher commitment to EE as well as a model for framing policy interventions that can help bridge the rhetoric–reality gap in EE. The revised MEEC offers the structure within which interventions that consider multiple interacting factors can be planned. This holistic approach to policy implementation is likely to lead to more desired outcomes and bridge the gap between EE policies and what pertains in schools. This is because, policy interventions based on the model will not adopt a piecemeal approach that result in limited success but rather take into account all relevant factors at the same time. For instance, the MEEC would suggest that providing policy documents that calls for the integration of EE as a cross-curricular subject would only succeed if teachers are given autonomy and control over their teaching. In other words, a single policy intervention calling for integrating subjects would fail if it is not considered in relation to monitoring policies that asks teachers to justify how many hours they spend on each subject. Furthermore, the MEEC provides a framework for bridging the gap between what teachers intend to do and what they actually do. The model suggests that the gap between teachers' intended and actual behaviour depend on the amount of control they have over their teaching. Thus, to bridge this gap, teachers must have actual autonomy and control over their teaching. Also, the thesis provides evidence from both quantitative and qualitative findings which suggest that pre-service or in-service training programmes based on the framework is likely to result in a significant increase in commitment.

Another significant contribution of the thesis is the specific modifications that were made to the MEEC resulting in a more refined and parsimonious model. These modifications have potential implications for subsequent policy and practical interventions. Firstly, unlike Shuman and Ham (1997), the term commitment in the modified model was operationally defined as actual teaching behaviour rather than intended behaviour. In other words, the degree to which teachers currently teach EE constitutes commitment. This application of the theory to measure actual behaviour also allowed for a more powerful test of the theory compared with an application to measure behavioural intentions (Gotch & Hall, 2004). This modification means that

when we talk about interventions for commitment, the outcomes of such interventions will be overt and covert behaviours rather than intentions which might or might not be translated into actual behaviour. This also has implication for how commitment is measured as it might lead to an attempt to move away from using only questionnaire instruments to a more objective and concrete measurement of teacher commitment. Secondly, in the original specification of the MEEC (Shuman, 1995), perceived behavioural control was specified to directly influence only intentions but not actual behaviour. However, the model in this thesis suggests that control factors have a significant direct effect on teacher commitment but not intentions. The implication of this relationship is that, interventions can be targeted at providing teachers with greater control in an attempt to directly increase commitment.

Apart from the unique contributions of the model, the thesis also makes significant contributions through the expansion of methodological approaches to EE research and to a larger extent education research. As noted in the introduction to this thesis, very few studies in EE combine both quantitative and qualitative methods with recent studies mainly skewed in favour of qualitative approaches (Reid & Scott, 2006). This thesis thus demonstrates the usefulness of mixing methods in order to unearth the different levels of complexity involved in EE related issues. In all, the methodology used in the thesis contributes to the development of mixed methods research and addresses some of the challenges of this approach by showing how either quantitative or qualitative findings can be overlaid on each other to achieve a better integration of results. This to some extent answers Brymans' (2007) call for exemplars of how to integrate quantitative and qualitative findings during results write-up. Furthermore, the thesis is original by using an innovative qualitative methodology, soft systems methodology, and a quantitative approach based on structural equation modelling techniques, both rarely used in education research. It is hoped that by demonstrating the usefulness of these approaches, educators would be encouraged to be innovative and to move away from using only traditional methodologies that can sometimes limit the scope of what is studied. Education is a complex phenomenon and researchers in the field need to be aware of other

approaches that can bring a richer understanding of the problem studied. They should also be confident to apply them in whatever manner that helps improve the teaching and learning process. Finally, this thesis provides an example of mixed methods research in environmental education.

Another methodological contribution is that, the thesis provides the basis for further quantitative work that examines the structure of psychological constructs applied in EE research. Constructs like self-efficacy, attitude and commitment are mostly used by EE researchers with little information provided on the validity and reliability of these measures. Thus, two studies employing the same construct might have different items and methods for measurement making it difficult to compare results. The confirmatory factor analysis technique used in testing the various constructs in the thesis therefore provides an example of how EE researchers might validate and standardise their instruments for measuring these psychological constructs. This will make it easier to compare two studies applying the same constructs and to build solid evidence about the nature of EE based on comparable studies.

Additionally, the thesis contributes to the literature on teacher commitment to EE and the nature of EE in Scotland. For instance, the quantitative framework for analysis provided a quantitative support for some of the findings unearthed through earlier qualitative works. Specifically, this thesis is the second known work after that of Shuman (1995) to use a quantitative approach in testing the effect of life experiences on teachers' commitment. This quantitative analysis will help to complement existing qualitative studies and expand our knowledge of the life experience variable. Furthermore, although previous studies have identified life experiences as important in shaping commitment to environmental issues, they do not provide an explanation of how this takes place. This thesis therefore builds on the evidence for a theoretical link between life experiences related to environmental issues and development of beliefs that influence teachers' commitment to EE. This approach is significant because it shows how life experiences are translated into commitment and how interventions based on exposure to such experiences might work to influence commitment. It is important to know these paths of action in order to ensure an

appropriate evaluation of intervention programmes. This is because theoretical models indicate what the direct and probable indirect effects of an intervention would be and the outcomes that should be measured. Also, whilst previous qualitative exploration of life experiences was mainly focused on those who can be classified as active environmentalist, the current study investigated the extent to which these life experiences are important in influencing the general population of teachers who teach subjects other than EE. Finally, the thesis helps to fill the knowledge gap on the implementation of EE in Scotland. This is the only known study that has attempted to evaluate the social psychological factors influencing teachers' commitment to EE in Scotland.

9.8. Recommendations for Future Research

The current study set the basis for further work aimed at understanding teachers' commitment to teaching EE. Firstly, it is recommended that further exploration and test of the theoretical model be carried out on a larger sample to validate the paths of influence suggested in this thesis. The use of structural equation modelling for such exploration is expected to expand our understanding as well as provide a solid framework on which more committed teachers can be trained. Also, a larger sample study would allow for multiple group analysis as for example testing the difference between those with stronger and weaker attitudes. Non-recursive modelling techniques can also be employed to explore the feedback relationship among variables.

Secondly, most studies on teacher commitment like this one focus on unearthing the determinants on commitment. However, very few intervention studies exist to test these findings. It is therefore suggested that future studies should look at intervention programmes that will enable a direct test of these suggested paths in the theoretical model. For instance, evidence for the relationship between life experiences and teachers' commitment is based on self reports and deductive reasoning. It will therefore be worthwhile to carry out a longitudinal study focused on pre and post evaluation of teachers' commitment to EE after attending programmes that exposes

them to such experiences. The only problem however is that, the postgraduate certificate in education course is over a short duration and there is limited time to carry out extended environmentally related activities. A way of resolving this is to run follow-up programmes for participants in such a study when they are posted to schools.

Thirdly, most psychological constructs used in EE research have not undergone any rigorous evaluation to ascertain their reliability. Constructs like attitudes, beliefs, and self-efficacy and so on are found in the EE literature. However, there are no standardised and validated measures for these constructs. In other words it is difficult if not impossible to make any kind of comparison between studies applying the same constructs since they mostly employ different items. It will therefore be useful for future studies to further explore and test the dimensionality of these constructs in order to have some kind of benchmark for measuring such constructs. Research into more objective methods of measurement other than self-reports should also be explored. However, such studies should avoid the use of item pairs when using Confirmatory Factor Analysis in order to avoid numerous modifications that result from item redundancy.

Fourthly, further quantitative exploration of the life experience variable would be useful to add to the existing qualitative body of work. This study is the second attempt to achieve this after Shuman's (1995) initial exploration. It will therefore be useful for subsequent explorations that would help expand our understanding of how this construct influences commitment to environmental issues. Of particular importance will be further exploration to ascertain the dimensionality of the life experience construct.

Finally, it would be useful to conduct comparative studies in other countries to ascertain if the factors unearthed in this study are universal. An interesting perspective might be to examine the nature of teacher commitment in countries where there is a greater amount of teacher autonomy to see if that makes a difference to commitment to EE. Also, a comparative study with countries where EE is

compulsory and a core subject within the curriculum might provide a useful perspective in terms of how that influences the perceived rank given to EE by teachers and the influence on commitment.

REFERENCES

Acock, A. C. (2005). Working with missing values. *Journal of Marriage and Family, 67*(4), 1012–1028.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Ajzen, I. (1988). *Attitudes, personality, and behaviour*. UK: Open University Press.

Ajzen, I. (2002). *Constructing a TpB Questionnaire: Conceptual and methodological considerations*. Retrieved July 16, 2005, from http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Madden, T. J. (1986). Prediction of goal directed behavior: Attitudes, intentions and perceived behavioral control. *Journal of Experimental Social Psychology, 22*, 453–474.

Anderson, D. R., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*, 411–423.

Arbuckle, J. L. (2005). Amos 6.0 [Computer software]. Chicago: SPSS Inc.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology, 40*, 471–499.

Armitage, C. J., & Conner, M. (1999). The theory of planned behaviour: Assessment of predictive validity and 'perceived control'. *British Journal of Social Psychology*, *38*, 35–54.

Armitage, C. J., Conner, M., Loach, J., & Willets, D. (1999). Different perceptions of control: Applying an extended theory of planned behavior to legal and illegal drug use. *Basic and Applied Social Psychology*, *21*(4), 301–316.

Astrom, A. N., & Mwangosi, I. E. (2000). Teachers' intention to provide dietary counselling in Tanzanian primary schools. *American Journal of Health Behavior*, *24*, 281–289.

Babbie, E. (2007). *The practice of social research* (11th ed.). Belmont, CA: Thomson.

Bagozzi, R. P. (1992). The self-regulation of attitudes, intentions and behavior. *Social Psychology Quarterly*, *55*, 178–204.

Bagozzi, R. P., & Warshaw, P. R. (1990). Trying to consume. *Journal of Consumer Research*. *17*(2), 127–140.

Ball, D. L. (1991). Research on teaching mathematics: Making subject-matter knowledge part of the equation. In J. Brophy (Ed.), *Advances in Research on Teaching* (Vol. 2, pp. 1–48). London, England: Jai Press Inc.

Banathy, B. H. (1996). *Designing social systems in a changing world*. NY: Plenum Press.

Banathy, B. H. (1991). *Systems design of education: A journey to create the future*. Englewood Cliffs, N.J: Educational Technology Publications.

Bandalos, D. L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling*, *9*(1), 78–102.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Barrett, M. J. (2007). Homework and fieldwork: Investigations into the rhetoric-reality gap in environmental education research and pedagogy. *Environmental Education Research*, *13*, 209–223.

Benton, J. E., & Daly, J. L. (1991). A question order effect in a local government survey. *Public Opinion Quarterly*, *55*, 640–642.

Bernard, T. J., Paoline, E. A., & Pare, P. P. (2005). General systems theory and criminal justice. *Journal of Criminal Justice*, *33*, 203-211.

Biggs, J. (1993). From theory to practice: a cognitive systems approach. *Higher Education Research and Development*, *12*(1), 73–85.

Boldero, J. (1995). The prediction of household recycling of newspapers: The role of attitudes, intentions, and situational factors. *Journal of Applied Social Psychology*, *25*, 440–462.

Boomsma, A. (2000). Reporting analyses of covariance structures. *Structural Equation Modeling*, *7*(3), 461–483.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.

Bryman, A. (2007). Barriers to integrating quantitative and qualitative research. *Journal of Mixed Methods Research, 1*(1), 8–22.

Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications and programming*. Mahwah, NJ: Lawrence Erlbaum.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conception of classroom practice. *Teaching and Teacher Education, 7*(1), 1–8.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin, 56*(2), 81–105.

Capra, F. (1996). *The web of life: A new synthesis of mind and matter*. Hammersmith, London: Flamingo.

Carlsen, W. S. (1991). Subject-matter knowledge and science teaching: A pragmatic perspective. In J. Brophy, (Ed.), *Advances in Research on Teaching* (Vol. 2, pp. 115–143). London, England: Jai Press Inc.

Chawla, L. (1999). Life paths into effective environmental action. *The Journal of Environmental Education, 31*(1), 15–26.

Checkland, P. (1999). *Systems thinking, systems practice: Includes a 30-year retrospective*. Chichester, England: John Wiley.

Checkland, P., & Scholes, J. (1990). *Soft systems methodology in action*. Chichester, England: John Wiley.

Cheung, G. W. & Lau, R. S. (in Press). Testing mediation and suppression effects of latent variables: Bootstrapping with structural equation models. *Organizational Research Methods*.

Chou, C. P., & Bentler, P. M. (1995). Estimates and tests in structural equation modeling. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 1–15). Thousand Oaks, CA: Sage.

Cohen, J. (1990). Things I have learned (so far). *American Psychologist, 45*(12), 1304–1312.

Coladarci, T. (1992). Teachers' sense of efficacy and commitment to teaching. *Journal of Experimental Education*, *60*(4), 323–337.

Condie, R. (2003). Environmental Studies. In T. G. K. Bryce & W. M. Humes (Eds.), *Scottish Education: Second edition: Post-devolution* (pp. 385–389). Edinburgh: Edinburgh University Press.

Connell, S. (1997). Empirical-analytical methodological research in environmental education: Response to a negative trend in methodological and ideological discussions. *Environmental Education Research*, *3*, 117–132.

Conner, M., & McMillan, B. (1999). Interaction effect in the theory of planned behaviour: Studying cannabis use. *British Journal of Social Psychology*, *38*, 195–222.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology*, *28*, 1429–1464.

Conner, M., Martin, E., Silverdale, N., & Grogan, S. (1996). Dieting in adolescence: An application of the theory of planned behaviour. *British Journal of Health Psychology*, *1*, 315–325.

Constas, M. A. (1992). Qualitative data analysis as a public event: The documentation of category development procedures. *American Educational Research Journal*, *29*, 253–266.

Corral-Verdugo, V., & Frias-Armenta, M. (2006). Personal normative beliefs, anti-social behavior, and residential water conservation. *Environment and Behavior*, *38*(3), 406–421.

Cotton, D. R. E. (2006). Teaching controversial environmental issues: Neutrality and balance in the reality of the classroom. *Educational Research*, *48*(2), 223–241.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, NJ: Pearson.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches*. Thousand Oaks, CA: Sage.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: Sage.

Cutter-Mackenzie, A., & Smith, R. (2003). Ecological Literacy: The 'missing paradigm' in environmental education (part one). *Environmental Education Research*, *9*, 497–524.

Cutter, A., & Smith, R. (2001). Gauging primary school teachers' environmental literacy: An issue of 'priority'. *Asia Pacific Education Review*, *2*(2), 45–60.

Czerniak, C. M., Lumpe, A. T., Haney, J. J., & Beck, J. (1999). Teachers' beliefs about using educational technology in the science classroom. *International Journal of Educational Technology*, *2*, 1–18.

Denscombe, M. (2002). *Ground rules for good research: A 10 point guide for social researchers*. Buckingham: Open University Press.

Denzin, N. K., & Lincoln, Y. S. (2003). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Collecting and interpreting qualitative materials* (2nd ed., pp. 1–45). Thousand Oaks, CA: Sage.

Denzin, N. K., & Lincoln, Y. S. (2005). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln, (Eds.), *Handbook of qualitative research* (3rd ed., pp. 1–32). Thousand Oaks, CA: Sage.

Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. London: Routledge.

Dillman, D. A. (2000). *Mail surveys: The tailored design method*. New York: John Wiley & Sons.

Dillon, J., & Arjen, W. (2006). On the danger of blurring methods, methodologies and ideologies in environmental education research. *Environmental Education Research*, *12*, 549–558.

Eagly, A. H., & Chiaken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.

Efron, B., & Tibshirani, R. J. (1993). *An introduction to the bootstrap*. New York: Chapman and Hall.

Ernest, P. (1989). The knowledge, beliefs and attitudes of the mathematics teacher: A model. *Journal of Education for Teaching*, *15*(1), 13–33.

Ernst, J. (2007). Factors associated with K-12 teachers' use of environment-based education. *The Journal of Environmental Education*, *38*(3), 15–31.

Evans, M. G. (1991). The problem of analysing multiplicative composites: Interactions revisited. *American Psychologists*, *46*, 6–15.

Field, A. P. (2005). *Discovering statistics using SPSS*. London: Sage.

Fien, J. (1995). Teaching for a sustainable world: The environmental and development education project for teacher education. *Environmental Education Research*, *1*(1), 21–33.

Firestone, W. A., & Pennell, J. R. (1993). Teacher commitment, working conditions and differential incentive policies. *Review of Educational Research*, *63*(4), 489–525.

Fortner, R. W., & Corney, J. R. (2002). Great Lakes educational needs assessment: Teachers' priorities for topics, materials, and training. *Journal of Great Lakes Research*, *28*(1), 3–14.

Fortner, R. W., & Meyer, R. L. (2000). Discrepancies among teachers' priorities for and knowledge of freshwater topics. *The Journal of Environmental Education*, *31*(4), 51–53.

Fresko, B., Kfir, D., & Nasser, F. (1997). Predicting teacher commitment. *Teaching and Teacher Education*, *13*(4), 429–438.

Gaes, G. G., Kalle, R. J., & Tedeschi, J. I. (1978). Impression management in the forced compliance situation: Two studies using the bogus pipeline. *Journal of Experimental Social Psychology*, *9*, 491–501.

González-Gaudiano, E. J. (2006). Environmental education: A field in tension or in transition? *Environmental Education Research*, *12*, 291–300.

Gotch, C., & Hall, T. (2004). Understanding nature related behaviours among children through a theory of reasoned action approach. *Environmental Education Research*, *10*(2), 157–177.

Graham, J. M., Guthrie, A. C., & Thompson, B. (2003). Consequences of not interpreting structure coefficients in published CFA research: A reminder. *Structural Equation Modeling*, *10*(1), 142–153.

Greene, J. C. (1994). Qualitative program evaluation: Practice and promise. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 530–544). Thousand Oaks, CA: Sage.

Grob, A. (1995). A structural model of environmental attitudes and behavior. *Journal of Environmental Psychology*, *15*, 209–220.

Grosch, W. N., & Olson, D. C. (2000). Clergy burnout: An integrative approach. *Journal of Clinical Psychology*, *56*, 619–632.

Grossman, P. L. (1995). Teachers' knowledge. In L. W. Anderson, (Ed.) *International Encyclopaedia of Teaching and Teacher Education* (2nd ed., pp. 20–24). Cambridge, UK: Cambridge University Press.

Grube, J. W., & Morgan, M. (1990). Attitude-social support interactions: Contingent consistency effects in the prediction of adolescent smoking, drinking and drug use. *Social Psychology Quarterly*, *53*, 329–339.

Grube, J. W., Morgan, M., & McGree, S. (1986). Attitudes and normative beliefs as predictors of smoking intentions and behaviours: A test of three models. *British Journal of Social Psychology*, *25*, 81–93.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behavior relationship: A natural experiment with curbside recycling. *Environment and Behavior*, *27*(5), 699–718.

Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (3rd ed., pp. 191–215). Thousand Oaks, CA: Sage.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin, & Y. S. Lincoln, (Eds.), *Handbook of qualitative research* (pp. 105–117). Thousand Oaks, CA: Sage.

Hackman, J. R., & Oldham, G. R. (1980). *Work redesign*. Reading, MA: Addison-Wesley.

Hall, R. J., Snell, A. F., & Foust, M. S. (1999). Item parceling strategies in SEM: Investigating the subtle effects of unmodeled secondary constructs. *Organizational Research Methods*, *2*(3), 233–256.

Ham, S. H. & Sewing, D. R. (1988). Barriers to environmental education. *Journal of Environmental Education*, *19*(2), 17–24.

Hargreaves, A., & Goodson, I. F. (1996). Teachers' Professional lives: aspirations and actualities. In I. F. Goodson & A. Hargreaves (Eds.), *Teachers' professional lives* (pp. 1–27). London: Falmer Press.

Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta-analysis. *Journal of Sport and Exercise Psychology*, *19*, 36–51.

Heimlich, J. E., McKeown-Ice, R., Braus, J., Barringer-Smith, L., & Olivolo, B. (2004). Environmental education and preservice teacher preparation: A national study. *The Journal of Environmental Education*, *35*(2), 17–21.

Hoban, G. F. (2002). *Teacher learning for educational change: A systems thinking approach*. Buckingham: Open University Press.

Hoban, G. F. (2000). Using a reflective framework to study teaching-learning relationships. *Reflective Practice*, *1*, 165–182.

Hoyle, R. H. (1995). The structural equation modeling approach: Basic concepts and fundamental issues. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 1–15). Thousand Oaks, CA: Sage.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 158–176). Thousand Oaks, CA: Sage.

Hu, L-T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55.

Jensen, B. B. (2002). Knowledge, action and pro-environmental behaviour. *Environmental Education Research*, *8*, 325–334.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly*, *24*, 602–611.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14–26.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112–133.

Joreskog, K. G. (1993). Testing structural equation models. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 294–316). Newbury Park, CA: Sage.

Juster, F. T., & Smith, J. P. (1997). Improving the quality of economic data. Lessons from the HRS and AHEAD. *Journal of American Statistical Association*, *92*, 1268–1278.

Kaiser, F. G., Oerke, B., & Bogner, F. X. (2007). Behavior-based environmental attitude: Development of an instrument for adolescents. *Journal of Environmental Psychology*, *27*, 242–251.

Kakoko, D. C., Astrom, A. N., Lugoe, L. W., & Lie, G. T. (2006). Predicting intended use of voluntary HIV counselling and testing services among Tanzanian teachers using the theory of planned behaviour. *Social Science and Medicine*, *63*, 991–999.

Keith, T. Z. (2006). *Multiple regression and beyond*. Boston, USA: Pearson.

Kim, C., & Fortner, R. W. (2006). Issue-specific barriers to addressing environmental issues in the classroom: An exploratory study. *The Journal of Environmental Education*, *37*(3), 15–22.

King, G., Hopnaker, J., Joseph, A., & Scheve, K. (2001). Analyzing incomplete political science data: An alternative algorithm for multiple imputation. *American Political Science Review*, *95*(1), 49–69.

Kishton, J. M., & Widaman, K. F. (1994). Unidimensional versus domain representative parceling of questionnaire items: An empirical example. *Educational and Psychological Measurement, 54*, 757–765.

Kline, R.B. (2005). *Principles and practice of structural equation modeling*. New York, USA: The Guilford Press.

Ko, A. C., & Lee, J. C. (2003). Teachers' perceptions of teaching environmental issues within the science curriculum: A Hong Kong perspective. *Journal of Science Education and Technology, 12*, 187–204.

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmental and what are the barriers to pro-environmental behaviour. *Environmental Education Research, 8*, 239–260.

Kyridis, A., Mavrikaki, E., Tsakiridou, H., Daikopoulos, J., & Zigouri, H. (2005). An analysis of attitudes of pedagogical students towards environmental education in Greece. *International Journal of Sustainability in Higher Education, 6*, 54–64.

Lane, J., & Wilke, R. (1995). Strength and weaknesses of teacher environmental education preparation in Wisconsin. *Journal of Environmental Education, 27*(1), 36–45.

Lane, J., & Wilke, R. (1994). Environmental education in Wisconsin: A teacher survey. *The Journal of Environmental Education, 25*(4), 9–17.

Lavery, A. H., & Smyth, J. C. (2003). Developing environmental education, a review of a Scottish project: International and political influences. *Environmental Education Research, 9*(3), 359–383.

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2005). *SPSS for intermediate statistics: Use and interpretation*. Mahwah, New Jersey: Lawrence Erlbaum.

Leeming, F. C., Porter, B. E., Dwyer, W. O., Cobern, M . K., & Oliver, D. P. (1997). Effects of participation in class activities on children's environmental attitudes and knowledge. *Journal of Environmental Education*, *28*(2), 33–42.

Leeming, F. C., Dwyer, W. O. & Bracken, B. A. (1995). Children environmental attitude and knowledge scale: Construction and validation. *Journal of Environmental Education*, *26*(3), 22–32.

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the questions, weighting the merits. *Structural Equation Modeling*, *9*(2), 151–173.

LTS. (2004). *Sustainable development education in England, Wales, Northern Ireland and Scotland: Research study for the sustainable development education liaison group*. Dundee: Learning and Teaching Scotland.

Lincoln, Y. S., & Guba, E. G. (2000). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin, and Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 163–188). Thousand Oaks, CA: Sage.

Lin, W.-S., & Wilson, J. T. (1998). Science Teachers' intention to teach about HIV/AIDS. *Proceedings of the National Science Council, ROC(D)*, *8*, 77–85.

Lofland, J., & Lofland, L. H. (1995). *Analyzing social settings: A guide to qualitative observation and analysis* (3rd ed.). Belmont, CA: Wadsworth.

MacCallum, R. C., & Austin, J. T. (2000). Application of structural equation modeling in psychological research. *Annual Review of Psychology*, *51*, 201–226.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*, 84–99.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research*, *39*, 99–128.

Marsh, H. W., & Hau, K. T. (1999). Confirmatory factor analysis: Strategies for small sample sizes. In R. H. Hoyle (Ed.), *Statistical strategy for small sample research,* (pp. 252–282). Thousand Oaks: Sage.

Marsh, H. W., & Hocevar, D. (1988). A new, more powerful approach to multitrait-multimethod analyses: Application of second-order confirmatory factor analysis. *Journal of Applied Psychology*, *73*, 107–117.

Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comments on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers of overgeneralizing Hu & Bentler's (1999) findings. *Structural Equation Modeling*, *11*(3), 320–341.

Mason, J. (1996). *Qualitative researching*. London, UK: Sage.

May, T. S. (2000). Elements of success in environmental education through practitioner eyes. *Journal of Environmental Education*, *31*, 4–12.

McDonald, R. P., & Ho, M.-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, *7*(1), 64–82.

McKeown-Ice, R. (2000). Environmental education in the United States: A survey of preservice teacher education programs. *Journal of Environmental Education*, *32*(1), 4–11.

McKeown, R., & Hopkins, C. (2005). EE and ESD: Two paradigms, one crucial goal. *Applied Environmental Education and Communication*, *4*, 221–224.

Mesjasz, C. (1988). Applications of systems modelling in peace research. *Journal of Peace Research*, *25*, 291–334.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Mingers, J., & Taylor, S. (1992). The use of soft systems methodology in practice. *The Journal of the Operational Research Society*, *43*(4), 321–332.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, *1*(1), 48–76.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, *19*, 317–328.

Noar, S. M. (2003). The role of structural equation modeling in scale development. *Structural Equation Modeling*, *10*(4), 622–647.

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw- Hill.

Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement*. London: Pinter Publishers.

Orr, D. W. (1994). *Earth in mind: On education, environment and the human prospect*. Washington DC: Island Press.

Orr, D. W. (1992) *Ecological literacy: Education and the transition to the post modern world.* Albany: State University of New York.

Oulton, C., Day, V., Dillon, J., & Grace, M. (2004). Controversial issues – teachers' attitudes and practices in the context of citizenship education. *Oxford Review of Education*, *30*(4), 489–507.

Pajares, F. M. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*(3), 307–332.

Pallant, J. (2005). *SPSS survival manual: A step by step guide to data analysis using SPSS for windows* (Version 12). Maidenhead: Open University Press.

Pal, K., Rise, J. Sutton, S. & Roysamb, E. (2005). Perceived difficulty in the theory of planned behaviour: Perceived behavioural control or affective attitude? *British Journal of Social Psychology*, *44*, 497–496.

Palmer, J. A. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise*. London, UK: Routledge.

Palmer, J. A., & Suggate, J. (1996). Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research*, *2*, 109–122.

Palmer, J. A., Suggate, J., Robottom, I., & Hart, P. (1999). Significant life experiences and formative influences on the development of adults' environmental awareness in the UK, Australia and Canada. *Environmental Education Research*, *5*(2), 181–200.

Patel, N. V. (1995). Application of soft systems methodology to real world process of teaching and learning. *International Journal of Educational Management*, *9*, 13-23.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Paulhus, D. L., Lysy, D. C., & Yik, M. S. M. (1998). Self-report measures of intelligence: Are they useful as proxy IQ tests? *Journal of Personality*, *66*(4), 525–554.

Phelps, R., & Hase, S. (2002). Complexity and action research: Exploring the theoretical and methodological connections. *Educational Action Research*, *10,* 507- 524.

Pirrie, A., Elliot, D., McConnell, F., & Wilkinson, J. E. (2006). Evaluation of Eco Schools Scotland. *SCRE Research Report,* No. 124.

Plevyak, L. H., Bendixen-Noe, M., Henderson, J., Roth, R. E., & Wilke, R. (2001). Level of teacher preparation and implementation of EE: Mandated and non-mandated EE teacher preparation states. *Journal of Environmental Education*, *32*, 28–37.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903.

Powers, A. L. (2004). Teacher preparation for environmental education: Faculty perspectives on the infusion of environmental education into preservice methods courses. *Journal of Environmental Education*, *35*(3), 3–11.

Raghunathan, T. E. (2004). What do we do with missing data? Some options for analysis of incomplete data. *Annual Review of Public Health*, *25*, 99–117.

Reyes, P. (1990). *Teachers and their workplace: Commitment, performance and productivity*. Newbury Park, CA: Sage.

Reyes, P., & Pounder D. (1993). Organizational orientation in private and public schools and teacher outcomes. *Journal of Educational Research*, *87*, 86–93.

Reid, A., & Scott, W. (2006). Researching education and the environment: Retrospect and prospect. *Environmental Education Research*, *12*, 571–587.

Riehl, C., & Sipple, J. W. (1996). Making the most of time and talent: Secondary school organizational climates, teaching task environment, and teacher commitment. *American Educational Research Journal*, *33*(4), 873–901.

Robertson, C. L., & Krugly-Smolska, E. (1997). Gaps between advocated practices and teaching realities in environmental education. *Environmental Education Research*, *3*(3), 311–326.

Rodriguez-Ulloa, R., & Paucar-Caceres, A. (2005). Soft systems dynamic methodology (SSDM): Combing soft systems methodology (SSM) and systems dynamic (SD). *Systemic Practice and Action Research*, *18*(3), 303–334.

Rose, J. (1997). Soft systems methodology as a social science research tool. *Systems Research and Behavioral Science*, *14*(4), 249–258.

Rowe, K. (2006). *The measurement of composite variables from multiple indicators: Applications in quality assurance and accreditations systems-childcare.* Background paper prepared for the National Childcare Accreditation Council. Retrieved April 11, 2006, from http://www.ncac.gov.au/report_documents/composite_variables.pdf

Rubin, A., & Babbie, E. A. (2005). *Research method for social work* (5th ed.). Belmont, CA: Thomson.

Rushton, J. P., Brainerd, C. J., & Pressley, M. (1983). Behavioral development and construct validity: The principle of aggregation. *Psychological Bulletin*, *94*, 18–38.

Sarantakos, S. (2005). *Social Research* (3rd ed.). Basingstoke, Hampshire: Palgrave Macmillan.

Scottish Executive. (2006a). *Learning for our future: Scotland's first action plan for the UN decade of education for sustainable development*. Edinburgh: Scottish Executive.

Scottish Executive, (2006b). Statistical publication. Retrieved September 12, 2006, from http://www.scotland.gov.uk/Resource/Doc/99843/0024183.pdf

Scottish Executive. (2004). *A curriculum for excellence: The curriculum review group*. Edinburgh: Scottish Executive.

Scottish Executive. (2000). *Environmental studies, society, science and technology: 5-14 national guidelines*. Glasgow: Learning Teaching Scotland.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action*. London: Ashgate.

Schwandt, T. A. (2000). Three epistemological stances for qualitative inquiry: Interpretivism, hermeneutics, and social constructionism. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 189–213). Thousand Oaks, CA: Sage.

SEEC. (1998). *Learning to sustain* (J. C. Smyth Ed.). Stirling: Scottish Environment Education Council.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*(4), 422–445.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, *57*(1), 1–22.

Shuman, D. K., & Ham, S. H. (1997). Toward a theory of commitment to environmental education teaching. *Journal of Environmental Education*, *28*, 25–33.

Shuman, D. K. (1995). *Factors that influence commitment to teaching environmental education: Development and test of a causal model.* Unpublished PhD Thesis. University of Idaho: USA.

Smith, D. S., & Neale, D. C. (1991). The construction of subject-matter knowledge in primary science teaching. In J. Brophy, (Ed.), *Advances in research on teaching* (Vol. 2, pp. 187–243). London, England: Jai Press Inc.

Smyth, J. C. (1995). Environment and education: A view of a changing scene. *Environmental Education Research*, *1*(1), 3–20.

Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behaviour-assessing the role of identification with green consumerism. *Social Psychology Quarterly*, *55*, 388–399.

Sparks, P., Guthrie, C. A., & Shepherd, R. (1997). The dimensional structure of the 'perceived behavioral control' construct. *Journal of Applied Psychology*, *27*, 418–438.

Sparks, P., Shepherd, R., Wieringa, N., & Zimmermanns, N. (1995). Perceived behavioural control, unrealistic optimism and dietary change: An exploratory study. *Appetite*, *24*(3), 243–255.

Stern, P. C. (2005). Understanding individuals' environmentally significant behavior. *Environmental Law Report, 35*, 10785–10790.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424.

Stern, P. C., Dietz, T., & Guagnano, G. A. (1995). The new ecological paradigm in social-psychological context. *Environment and Behavior, 27*, 723–743.

Stevenson, R. B. (2007). Schooling and environmental education: Contradictions in purpose and practice. *Environmental Education Research, 13*(2), 139–153.

Stevenson, R. (2002). Conclusion. Education and sustainable development: Perspectives and possibilities. In D. Tilbury, R. Stevenson, J. Fien & D. Schreuder (Eds.), *Education and sustainability: Responding to the global challenge* (pp. 187–196). Cambridge: IUCN.

Stutzman, T. N., & Green, S. B. (1982). Factors affecting energy consumption: Two field tests of Fishbein-Ajzen model. *Journal of Social Psychology, 117*, 183–201.

Summers, M., Kruger, C., Childs, A., & Mant, J. (2001). Understanding the science of environmental issues: Development of a subject knowledge guide for primary teacher education. *International Journal of science Education, 23*, 33–53.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Boston, USA: Allyn and Bacon.

Tajino, A. (2002). Transformation process models: A systemic approach to problematic team-teaching situations. *Prospect: An Australian Journal of TESOL, 17*(3), 29–44.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Taylor, S., & Todd, P. (1997). Understanding the determinants of consumer composting behaviour. *Journal of Applied Social Psychology*, *27*(7), 602–628.

Thacker, J. W., Fields, M. W., & Tetrick, L. E. (1989). The factor structure of union commitment: An application of confirmatory factor analysis. *Journal of Applied Psychology*, *74*(2), 228–232.

Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. *Environmental Education Research*, *1*(2), 195–212.

Trafimow, D., & Finlay, K. A. (1996). The importance of subjective norms for a minority of people: Between subjects and within-subjects analyses. *Personality and Social Psychology Bulletin*, *22*, 820–828.

Trauer, T., & Mackinnon, A. (2001). Why are we weighting? The role of importance ratings in quality of life measurement. *Quality of Life Research*, *10*, 579–585.

Ullman, J. B. (2001). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (pp. 653–771). Boston, USA: Allyn and Bacon.

Umeh, K., & Patel, R. (2004). Theory of planned behaviour and ecstasy use: An analysis of moderator interactions. *British Journal of Health Psychology*, *9*, 25–38.

UNCED. (1992). *Agenda 21: Earth summit 1992* (J. Quarrie Ed.). London: The Regency Press.

WCED. (1987). *Our common future*. Oxford: Oxford University Press.

Weston, R., & Gore Jr., P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719–751.

Yung, Y.-F., & Chan, W. (1999). Statistical analyses using bootstrapping: Concepts and implementation. In R. H. Hoyle (Ed.), *Statistical strategy for small sample research* (pp. 81–105). Thousand Oaks, CA: Sage.

Zhu, W. (1997). Making bootstrap statistical inferences: A tutorial. *Research Quarterly for Exercise and Sports, 68*, 44–55.

Zint, M. (2002). Comparing three attitude behaviour theories for predicting science teachers' intentions. *Journal of Research in Science Teaching, 39*, 819–844.

APPENDICES

Appendix A

Letter to Local Authorities

ES/SC

Date as postmark

Director of Education

Dear Sir/Madam

A STUDY OF TEACHERS' MOTIVATIONS TOWARDS ENVIRONMENTAL EDUCATION

As part of a wider research project by the Faculty of Education into the nature of environmental education, some schools within your local authority have been chosen to participate in a survey that will help us gain insight into current practices in teaching environmental education with respect to curriculum goals.

The study is aimed at exploring personal motivation and issues that confront teachers when teaching environmental education to primary school pupils. The objective is to create a strategy that will make the subject more interesting for teachers and children. There is also a wider need to promote sustainability issues among children by considering the benefits to their welfare through securing a good and safe environment for their future.

I would therefore appreciate your help in kindly granting me permission to contact schools as part of this study. I enclose a draft copy of the letter and questionnaire, which I would like to send to schools by 15 February 2006, for your approval. I would also be interested in carrying out a small follow-up interview and observation with a few interested schools.

I would like to assure you that no attempt will be made to identify individual local authorities in the report. However, I am happy to report my findings directly back to your authority, and to discuss and work towards strategies for improvement with you, as required.

If you have any questions or would like further information about the study, please feel free to contact the Head of Sport, Culture and the Arts, Dr Angus McWilliam [T: 0141 950 3124 or E: a.mcwilliam@strath.ac.uk].

I trust I can rely on your usual cooperation and will look forward to hearing from you soon.

Best wishes

Yours sincerely

Edward Sosu
PhD Student
T: 0141 950 3419
E: edward.sosu@strath.ac.uk

Appendix B

Questionnaire for Primary School Teachers

TEACHERS' MOTIVATIONS TOWARDS ENVIRONMENTAL EDUCATION

Thank you very much for volunteering to participate in this study that will help improve environmental education in Scotland.

- This questionnaire is part of a study aimed at exploring personal motivation and issues that confront teachers when teaching environmental education to primary school pupils

- I would be grateful for your assistance to kindly complete and return it to me in the enclosed stamped, self addressed envelop.

- The questions **are simple and straight forward**

- Please **circle the number** that best describes you.

- Please be assured that **no names** are required and all responses will be completely confidential.

- If you are willing to help us further, please provide a contact on a separate piece of paper and we will contact you for a brief interview and discussion.

Thank you very much for your help.

Edward Sosu
PhD Student
Sport Culture and the Arts
Faculty of Education
University of Strathclyde
G13 1PP, Glasgow, U.K.
T: 0141 950 3419
E: edward.sosu@strath.ac.uk

By teaching environmental education, we mean:

Teaching of environmental issues (litter, waste minimisation, water, energy, school grounds, health and wellbeing, biodiversity and transport) within the primary curriculum this year with the aim of developing pupils' knowledge, skills, attitudes and experiences that will enable them develop an informed and responsible environmental behaviour.

How many years have you been teaching? _____Years

What class do you teach? _____

Are you; Male Female

Does your school have a green flag? Yes No If No...

Is your school in the process of getting a green flag? Yes No

Does your school have an environmental club? Yes No

A1: Teaching Practice
What is your **Current** and **Ideal** emphasis on teaching environmental education?
Ideal practice which means, **what you would like to teach**
Current practice, which means **what you actually teach**

(Pleases circle one from ideal and another one from current practice as appropriate)

After attending my Class this year:

1. Pupils will have good understanding of environmental concepts and issues

Ideal Practice
No some strong
1 2 3 4 5 6 7

Current Practice
No some strong
1 2 3 4 5 6 7

2. Pupils will have more knowledge on the impact of their behaviour on the environment

Ideal Practice
No some strong
1 2 3 4 5 6 7

Current Practice
No some strong
1 2 3 4 5 6 7

3. Pupils will have better understanding of their belief, attitudes and values regarding environmental issues

Ideal Practice
No some strong
1 2 3 4 5 6 7

Current Practice
No some strong
1 2 3 4 5 6 7

4. Pupils will be more sensitive toward the environment

Ideal Practice
No some strong
1 2 3 4 5 6 7

Current Practice
No some strong
1 2 3 4 5 6 7

5. Pupils will have gained actual experience in solving environmental issues

Ideal Practice
No some strong
1 2 3 4 5 6 7

Current Practice
No some strong
1 2 3 4 5 6 7

6. Pupils will become more involved in resolving environmental issues

Ideal Practice

No some strong
1 2 3 4 5 6 7

Current Practice

No some strong
1 2 3 4 5 6 7

7. Pupils will develop respect for the beliefs and opinions of others

Ideal Practice

No some strong
1 2 3 4 5 6 7

Current Practice

No some strong
1 2 3 4 5 6 7

A2: How well do the following statements describe your Current and Ideal teaching approach, which means, **how you would like to teach environmental education** and **how you actually teach it.**

8. My pupils are actively involved in classroom learning activities

Ideal Practice

Disagree Agree
1 2 3 4 5 6 7

Current Practice

Disagree Agree
1 2 3 4 5 6 7

9. I invite and involve resource persons (outside personnel) in teaching my class

Ideal Practice

Disagree Agree
1 2 3 4 5 6 7

Current Practice

Disagree Agree
1 2 3 4 5 6 7

10. I use local examples when teaching my pupils

Ideal Practice

Disagree Agree
1 2 3 4 5 6 7

Current Practice

Disagree Agree
1 2 3 4 5 6 7

A3: Which of the following methods **would you like to use** OR **have you used effectively** in teaching environmental education

11. Going on field trips or outdoor activities with my pupils

Ideal Practice

Never some always
1 2 3 4 5 6 7

Current Practice

Never some always
1 2 3 4 5 6 7

12. Supporting and allowing pupils to design and carryout their own investigations

Ideal Practice

Never some always
1 2 3 4 5 6 7

Current Practice

Never some always
1 2 3 4 5 6 7

13. Engaging pupils in experiments

Ideal Practice

Never some always
1 2 3 4 5 6 7

Current Practice

Never some always
1 2 3 4 5 6 7

14. Using audiovisual materials and methods

Ideal Practice

Never some always
1 2 3 4 5 6 7

Current Practice

Never some always
1 2 3 4 5 6 7

15. Others (please specify).....

B: Personal Life Experiences

This section asks about your personal experiences. Firstly, indicate how often you had a particular experience. Secondly, circle how influential the experience was (is) in motivating how and what you teach today.

1. I have taken part in class(es) and school activities that focused on the environment as a student

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

2. I have participated in outdoor activities (camping, hiking, skiing, walking, cycling etc) alone, with my family or close friends

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

3. I have participated in environmental clean-ups or restoration projects

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

4. I have been a member of a club involved in environmental or outdoor activities

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

5. I have engaged in gardening/farming or growing of things

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

6. I have read books, magazines or poetry about the environment

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

7. I found out more about the environment through the media

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

8. I had a teacher who was concerned and committed to nature/environment when I was a student

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

9. I observed changes that significantly affected the environment (environmental destruction/pollution)

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

10. I have worked or volunteered in natural resources/environmental organisations

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

11. I have participated in environmental education workshops and conferences

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

12. I wanted to make a difference in the state of the environment

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

13. I participated in environmental projects in school as a student or teacher

Never 1 2 3 4 5 6 7 Often

Not Influential 1 2 3 4 5 6 7 Extremely Influential

This section is asks how you feel about teaching environmental education to your primary pupils. Please be assured there are no right or wrong answers, so give your honest opinion. **(For each question, please circle the number that clearly represents how you feel)**

C1: If I teach environmental education to my primary pupils ...

1. they will become aware of environmental concepts, problems and sustainability issues

Unlikely 1 2 3 4 5 6 7 Likely

2. it will enable my pupils to acquire strategies for solving environmental problems

Unlikely 1 2 3 4 5 6 7 Likely

3. it will bring about changes in my pupils attitude and behaviour toward the environment

Unlikely 1 2 3 4 5 6 7 Likely

4. it will make my pupils active and committed citizens in the environmental sector

Unlikely 1 2 3 4 5 6 7 Likely

5. they will develop good social and interaction skills

Unlikely 1 2 3 4 5 6 7 Likely

6. my pupils will be prepared with skills for future coursework and vocation

Unlikely 1 2 3 4 5 6 7 Likely

C2: Please indicate how you feel about the following statements as a primary school teacher. (*Be assured there are no right or wrong answers*).

7. Making my pupils aware of environmental concepts, problems and sustainability issues is

Not Important 1 2 3 4 5 6 7 Very Important

8. Teaching my pupils to acquire strategies for solving environmental problems is

Not Important 1 2 3 4 5 6 7 Very Important

9. Bringing about changes in my pupils attitude and behaviour toward the environment is

Not Important 1 2 3 4 5 6 7 Very Important

10. Training my pupils to be active and committed citizens in the environmental sector is

Not Important 1 2 3 4 5 6 7 Very Important

11. Helping my pupils develop good social and interaction skills is

Not Important 1 2 3 4 5 6 7 Very Important

12. Preparing my pupils with skills for future coursework and vocation is

Not Important 1 2 3 4 5 6 7 Very Important

13. Teaching environmental education to my primary pupils this year is ...

Bad	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Good idea** for me
Unpleasant	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Pleasant** for me
Unfavourable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	***Favourable*** for me
Harmful	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Beneficial** for me
Hard	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Easy** for me
Negative	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Positive** for me

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D: This section is about what other people think about you teaching environmental education. **(Firstly, circle a number that represents your feeling about what others think. Secondly, circle how important that feeling is to you).**

1. Non governmental organizations (NGOs e.g. WWF, Friends of the Earth, Charities, Health Promoting Groups) think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

2. How important is it that you teach like NGOs want you to teach

Not at all 1 2 3 4 5 6 7 Very much

3. Fellow teachers think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

4. How important is it that you teach like fellow teachers want you to teach

Not at all 1 2 3 4 5 6 7 Very much

5. School/education authorities think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

6. How important is it that you teach like school/education authorities want you to teach

Not at all 1 2 3 4 5 6 7 Very much

7. The government and its agencies responsible for environmental issues think I

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

8. How important is it that you teach like government *and its agencies* want you to teach

Not at all 1 2 3 4 5 6 7 Very much

9. Traditional/local communities think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

10. How important is it that you teach like traditional/local communities want you to teach

Not at all 1 2 3 4 5 6 7 Very much

11. Student's parents think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

12. How important is it that you teach like your student's parents want you to teach

Not at all 1 2 3 4 5 6 7 Very much

13. Pupils think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

14. How important is it that you teach like your pupils want you to teach

Not at all 1 2 3 4 5 6 7 Very much

15. Most people who are important to me think I ...

Should not 1 2 3 4 5 6 7 **Should** teach environmental education

16. How important is it, that, you teach like people that are important to you want you to teach

Not at all 1 2 3 4 5 6 7 Very much

17. Please indicate the extent to which you think any of the following groups actually engage in environmental education

People who are important to you	**Never 1 2 3 4 5 6 7 Frequently**
NGO's	**Never 1 2 3 4 5 6 7 Frequently**
Fellow teachers	**Never 1 2 3 4 5 6 7 Frequently**
School/education authority	**Never 1 2 3 4 5 6 7 Frequently**
Government agencies	**Never 1 2 3 4 5 6 7 Frequently**
Traditional/local communities	**Never 1 2 3 4 5 6 7 Frequently**
Student's parents	**Never 1 2 3 4 5 6 7 Frequently**
Pupils	**Never 1 2 3 4 5 6 7 Frequently**

E1: This section is about how much control you feel you have over teaching environmental education to your primary pupils this year

1. How much control do you think you have over whether or not you teach environmental education to your primary pupils this year?

Very little control 1 2 3 4 5 6 7 Complete control

2. For me, teaching environmental education to my pupils this year is

Difficult 1 2 3 4 5 6 7 Easy

E2: This section is about some things which may influence (help or hinder) your ability to teach environmental education to your primary pupils this year

3. Freedom in the curriculum and sense of ownership to teachers rather than strict rigid content

Not influential 1 2 3 4 5 6 7 **Extremely Influential**

4. Please indicate whether you have enough freedom in the curriculum

Never 1 2 3 4 5 6 7 Always

5. The availability of teaching learning resources

Not influential 1 2 3 4 5 6 7 **Extremely Influential**

6. Please indicate whether you have sufficient teaching learning resources

Never 1 2 3 4 5 6 7 Always

7. Opportunity to organise and go on fieldtrips with my pupils

Not influential 1 2 3 4 5 6 7 **Extremely Influential**

8. Please indicate whether you have the opportunity to send your pupils for fieldtrips

Never 1 2 3 4 5 6 7 Always

9. Having resource persons to assist or share their knowledge with me

Not influential 1 2 3 4 5 6 7 **Extremely Influential**

10. Please indicate whether you have access to resource persons to assist you

Never 1 2 3 4 5 6 7 Always

11. Support from fellow teachers

Not influential 1 2 3 4 5 6 7 **Extremely Influential**

12. I have enough support from fellow teachers

Never 1 2 3 4 5 6 7 Always

E3: Finally, describe yourself on the following statements.

13. I have the necessary skills to teach environmental education

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

14. I understand environmental education concepts well enough to be effective in teaching environmental education

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

15. I can generally teach environmental education effectively

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

16. I teach environmental education as well as I do most subjects

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

Thank you very much for taking the time and effort to complete this survey.

Appendix C

Letter to Head Teachers

The Head Teacher

Date as postmark

Dear Sir/Madam

A STUDY OF TEACHERS' MOTIVATIONS TOWARD ENVIRONMENTAL EDUCATION

As part of a wider research project by the Faculty of Education into the nature of environmental education, your school has been chosen to participate in a survey that will help us gain insight into current practices of teaching environmental education with respect to curriculum goals.

The study is aimed at exploring *personal motivation and issues that confront* teachers when teaching environmental education to primary school pupils. The objective is to create a strategy that will make the subject more interesting for teachers and children. There is also a wider need to promote sustainability issues among children by considering the benefits to their welfare through securing a good and safe environment for their future.

In order for the strategy to be successful, we recognize the relevance of the views of teachers who are at the forefront and play a crucial role in educating children on environmental issues. Their contribution is therefore of utmost importance in highlighting the issues that affect motivation and how this can be addressed.

I would be grateful for your assistance in passing the enclosed questionnaire to one of your Primary 6 teachers. It would be appreciated if the questionnaire is completed and returned to me in the enclosed stamped, self-addressed envelope. Permission to conduct this study has been sought from your local authority.

I would like to assure you that individual response to questions will not be disclosed as analysis will be reported as part of a group (e.g. "... 25% of the respondents said..."). Also all responses will be anonymous, in that no names are required and no attempt will be made to identify any of the respondents. The code on the questionnaire is only needed for administrative purposes and does not compromise the guarantee of anonymity.

To gain a deeper understanding of the issues, we will also be undertaking a brief follow up interview and school observation. I would be grateful if you would provide contact details on a separate piece of paper if you would like your school to be contacted for this brief follow-up session. We will be happy to share some of our problem-solving strategies, which can be used by individual schools, during this visit.

If you have any questions or would like further information about the study, please feel free to contact the Head of Sport, Culture and The Arts, Dr. Angus McWilliam [T: 0141 950 3124 or E: a.mcwilliam@strath.ac.uk].

I trust and can rely on your usual cooperation and will look forward to hearing from you soon.

Best wishes

Yours sincerely

Edward Sosu
PhD Student
T: 0141 950 3419
E: edward.sosu@strath.ac.uk

Appendix D

Descriptive Statistics and CFA Parameter Estimates for Commitment

Appendix D.1: Descriptive statistics (*SD*, Skew, Kurtosis) and correlation matrix of commitment

	CP1	CP2	CP3	CP4	CP5	CP6	CP7	CA8	CA9	CA10	CM11	CM12	CM13	CM14
CP1	1.00													
CP2	.661**	1.00												
CP3	.627**	.630**	1.00											
CP4	.557**	.641**	.650**	1.00										
CP5	.399**	.499**	.524**	.514**	1.00									
CP6	.376**	.474**	.575**	.516**	.776**	1.00								
CP7	.320**	.347**	.449**	.499**	.322**	.390**	1.00							
CA8	.338**	.411**	.404**	.432**	.522**	.405**	.555**	1.00						
CA9	.287**	.382**	.369**	.349**	.386**	.423**	.292**	.467**	1.00					
CA10	.335**	.440**	.364**	.389**	.501**	.492**	.531**	.597**	.624**	1.00				
CM11	.268**	.433**	.345**	.396**	.432**	.400**	.230**	.454**	.525**	.520**	1.00			
CM12	.167*	.318**	.342**	.328**	.391**	.424**	.362**	.562**	.485**	.551**	.568**	1.00		
CM13	.130	.325**	.311**	.309**	.406**	.365**	.351**	.438**	.367**	.418**	.572**	.725**	1.00	
CM14	.205**	.292**	.299**	.313**	.290**	.367**	.289**	.359**	.466**	.410**	.378**	.473**	.417**	1.00
Mean	*4.93*	*5.05*	*4.90*	*5.16*	*4.51*	*4.23*	*5.41*	*5.38*	*5.01*	*5.44*	*5.05*	*4.84*	*5.01*	*4.99*
SD	*.90*	*.97*	*1.0*	*.96*	*1.4*	*1.4*	*1.1*	*1.2*	*1.7*	*1.3*	*1.4*	*1.2*	*1.2*	*1.2*
Skew	*.11*	*.04*	*-.02*	*-.02*	*.09*	*.01*	*-.51*	*-.39*	*-.59*	*-.69*	*-.90*	*-.33*	*-.52*	*-.41*
Kurtosis	*-.30*	*-.32*	*.68*	*-.24*	*-.73*	*-.40*	*.00*	*-.31*	*-.52*	*-.05*	*.83*	*.01*	*.30*	*.25*

Significant correlations ** $p < .01$; * $p < .05$; *SD* = Standard deviation

D. 2: CFA Parameter Estimates, Standard Error and Critical Ratio of Commitment

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Core EE content	CP1	1.060	.166	6.391
	CP2	1.293	.189	6.835
	CP3	1.451	.206	7.053
	CP4	1.316	.189	6.962
	CP56	1.597	.242	6.591
	CP7	1.00	-	-
Current Teaching Approach	CA8	.808	.081	9.978
	CA9	1.123	.116	9.646
	CA10	1.00	-	-
Current Teaching Method	CM11	1.478	.212	6.983
	CM12	1.535	.199	7.718
	CM13	1.403	.189	7.444
	CM14	1.00	-	-

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix E

Descriptive Statistics and CFA Parameter Estimates for Intention

E. 1: Descriptive statistics (*SD*, Skew, Kurtosis) and correlation matrix of Intention

	IP1	IP2	IP3	IP4	IP5	IP6	IP7	IA8	IA9	IA10	IM11	IM12	IM13	IM14
IP1	1.00													
IP2	.715**	1.00												
IP3	.633**	.639**	1.00											
IP4	.663**	.736**	.627**	1.00										
IP5	.506**	.398**	.483**	.414**	1.00									
IP6	.494**	.405**	.502**	.438**	.832**	1.00								
IP7	.507**	.558**	.537**	.486**	.436**	.430**	1.00							
IA8	.457**	.435**	.318**	.427**	.466**	.405**	.400**	1.00						
IA9	.371**	.311**	.164*	.218**	.419**	.432**	.194**	.500**	1.00					
IA10	.446**	.417**	.311**	.383**	.440**	.452**	.335**	.506**	.495**	1.00				
IM11	.138	.147*	.070	.099	.283**	.163*	.111	.327**	.357**	.314**	1.00			
IM12	.202**	.172*	.196**	.246**	.306**	.265**	.232**	.367**	.415**	.388**	.510**	1.00		
IM13	.268**	.190**	.163*	.129	.322**	.289**	.233**	.411**	.437**	.295**	.498**	.644**	1.00	
IM14	.168*	.119	.067	.095	.095	.080	.094	.236**	.275**	.226**	.348**	.422**	.363**	1.00
Mean	*6.28*	*6.45*	*6.30*	*6.51*	*6.14*	*6.07*	*6.58*	*6.45*	*6.34*	*6.44*	*6.17*	*6.25*	*6.29*	*5.96*
SD	*.84*	*.71*	*.84*	*.64*	*.92*	*.91*	*.65*	*.69*	*.79*	*.68*	*.85*	*.76*	*.76*	*.84*
Skew	*-1.0*	*-1.3*	*-1.5*	*-1.1*	*-1.2*	*-.96*	*-1.7*	*-1.2*	*-1.2*	*-.92*	*-.73*	*-.83*	*-.93*	*-.54*
Kurtosis	*.68*	*1.6*	*3.5*	*.70*	*1.3*	*.75*	*3.0*	*1.3*	*1.3*	*.08*	*-.27*	*.36*	*.52*	*.08*

Significant correlations ** $p < .01$; * $p < .05$; *SD* = Standard deviation

E. 2: CFA Parameter Estimates, Standard Error and Critical Ratio of Intention

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Core EE content	IP1	1.664	.179	9.324
	IP2	1.457	.154	9.488
	IP3	1.521	.175	8.702
	IP4	1.248	.137	9.142
	IP56	1.257	.175	7.168
	IP7	1.00	-	-
Intended Teaching Approach	IA8	.967	.112	8.664
	IA9	1.118	.128	8.753
	IA10	1.00	-	-
Intended Teaching Method	IM11	1.287	.223	5.773
	IM12	1.477	.232	6.374
	IM13	1.403	.223	6.287
	IM14	1.00	-	-

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix F

Descriptive Statistics and CFA Parameter Estimates for Attitude

F.1: Descriptive statistics (*SD*, Skew, Kurtosis) and correlation matrix of Attitude

	IA1	IA2	IA3	IA4	IA5	IA6	DAa	DAb	DAc	DAd	DAe	DAf
IA1	1.00											
IA2	.775	1.00										
IA3	.723	.687	1.00									
IA4	.685	.756	.789	1.00								
IA5	.643	.627	.669	.756	1.00							
IA6	.608	.597	.517	.595	.640	1.00						
DAa	.496	.516	.513	.520	.454	.386	1.00					
DAb	.444	.424	.493	.495	.406	.346	.764	1.00				
DAc	.418	.478	.485	.519	.472	.431	.727	.875	1.00			
DAd	.273	.386	.420	.460	.320	.314	.568	.697	.734	1.00		
DAe	.307	.386	.289	.411	.308	.340	.407	.356	.345	.308	1.00	
DAf	.403	.415	.478	.457	.370	.339	.613	.748	.712	.782	.457	1.00
Mean	*6.40*	*5.68*	*6.03*	*5.70*	*5.96*	*5.66*	*5.95*	*5.92*	*5.80*	*5.77*	*5.03*	*5.88*
SD	*.80*	*.97*	*.83*	*.93*	*.78*	*.98*	*.99*	*1.1*	*1.1*	*1.2*	*1.3*	*1.1*
Skew	*-.94*	*-.59*	*-.82*	*-.67*	*-1.0*	*-1.2*	*-.74*	*-1.2*	*-.94*	*-1.1*	*-.60*	*-1.3*
Kurtosis	*.49*	*-.03*	*.35*	*.25*	*1.6*	*2.4*	*-.10*	*2.1*	*1.1*	*1.8*	*.35*	*2.6*

All correlations significant ** p < .01

F. 2: CFA Parameter Estimates, Standard Error and Critical Ratio of Attitude

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Indirect Attitude	A1	1.009	.100	9.963
	A2	1.189	.119	11.113
	A3	1.064	.102	10.464
	A4	1.295	.117	10.001
	A5	.953	.096	10.046
	A6	1.0	-	-
Direct Attitude	D13a	.886	.070	12.598
	D13fd	1.0	-	-
	D13c	1.161	.074	15.752
	D13b	1.138	.071	16.073

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant (p < .05).

Appendix G

Descriptive Statistics and CFA Parameter Estimates for Subjective Norm

G.1: Descriptive statistics (*SD*, Skew, Kurtosis) and correlation matrix of subjective norm

	S1	S2	S3	S4	S5	S6	S7	S8	DNa	DNb	DNc	DNd	DNe	DNf	DNg	DNh
S1	1.00															
S2	.400**	1.00														
S3	.222**	.443**	1.00													
S4	.029	.135	.082	1.00												
S5	.167*	.376**	.387**	.177*	1.00											
S6	.172*	.402**	.287**	.184*	.637**	1.00										
S7	.256**	.324**	.349**	.236**	.424**	.543**	1.00									
S8	.302**	.399**	.321**	.216**	.410**	.533**	.514**	1.00								
DNa	.111	.063	.010	.162*	.263**	.256**	.250**	.524**	1.00							
DNb	.316**	.184*	.184*	.121	.255**	.210**	.253**	.341**	.340**	1.00						
DNc	.211**	.298**	.205**	.144	.129	.166*	.222**	.313**	.278**	.319**	1.00					
DNd	.216**	.252**	.339**	.089	.188*	.229**	.133	.323**	.233**	.435**	.564**	1.00				
DNe	.155*	.297**	.298**	.159*	.172*	.164*	.107	.222**	.156*	.357**	.377**	.690**	1.00			
DNf	.211**	.237**	.097	.109	.445**	.343**	.197**	.254**	.309**	.372**	.172*	.441**	.523**	1.00		
DNg	.107	.309**	.085	.241**	.413**	.511**	.273**	.327**	.410**	.322**	.203**	.319**	.376**	.594**	1.00	
DNh	.210**	.242**	.197**	.236**	.243**	.345**	.492**	.378**	.411**	.309**	.533**	.357**	.200**	.327**	.490**	1.00
Mean	*5.36*	*5.01*	*5.91*	*5.16*	*5.21*	*5.07*	*5.58*	*5.44*	*4.53*	*5.37*	*5.40*	*5.26*	*4.78*	*4.47*	*3.83*	*5.06*
SD	*1.1*	*1.2*	*1.0*	*1.2*	*1.1*	*1.2*	*1.0*	*1.1*	*1.6*	*1.4*	*1.2*	*1.3*	*1.4*	*1.3*	*1.4*	*1.6*
Skew	*-1.1*	*-.17*	*-1.1*	*-.30*	*-.24*	*-.44*	*-.36*	*-.49*	*-.32*	*-.61*	*-.63*	*-.81*	*-.68*	*-.27*	*-.04*	*-.54*
Kurtosis	*2.4*	*-.76*	*1.3*	*-.65*	*-.68*	*-.16*	*-.63*	*-.44*	*-.60*	*-.26*	*.37*	*.70*	*.52*	*.12*	*-.35*	*-.38*

Significant correlations ** $p < .01$; * $p < .05$; *SD* = Standard deviation

G. 2: CFA Parameter Estimates, Standard Error and Critical Ratio of Subjective Norm

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Injunctive Norms	S2	.867	.130	6.661
	S3	.630	.107	5.890
	S5	1.026	.124	8.252
	S6	1.159	.130	8.943
	S7	.873	.112	7.764
	S8	1.0	-	-
Descriptive Norms	DN17a	.819	.151	5.414
	DN17b	.865	.141	6.153
	DN17c	.721	.118	6.101
	DN17d	.998	.137	7.274
	DN17e	.959	.140	6.856
	DN17f	.929	.134	6.953
	DN17g	.985	.114	6.859
	DN17h	1.0	-	-

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix H

Descriptive Statistics and CFA Parameter Estimates for Perceived Behavioural Control

H.1: Descriptive statistics (*SD*, Skew, Kurtosis) and correlation matrix of PBC

	DC1	DC2	AR4	AR6	AR8	AR10	AR12	SE13	SE14	SE15	SE16
DC1	1.00										
DC2	.280**	1.00									
AR4	.515**	.480**	1.00								
AR6	.237**	.478**	.473**	1.00							
AR8	.230**	.292**	.355**	.419**	1.00						
AR10	.238**	.366**	.410**	.476**	.602**	1.00					
AR12	-.042	.296**	.221**	.403**	.218**	.451**	1.00				
SE13	.146*	.498**	.332**	.358**	.188*	.266**	.316**	1.00			
SE14	.133	.489**	.323**	.391**	.185*	.251**	.341**	.857**	1.00		
SE15	.142	.552**	.315**	.428**	.249**	.309**	.334**	.769**	.848**	1.00	
SE16	.157*	.531**	.256**	.328**	.231**	.285**	.299**	.712**	.757**	.791**	1.00
Mean	*3.78*	*5.01*	*3.66*	*4.23*	*4.59*	*4.36*	*5.30*	*5.38*	*5.38*	*5.51*	*5.39*
SD	*2.0*	*1.4*	*1.6*	*1.5*	*1.8*	*1.6*	*1.4*	*1.2*	*1.2*	*1.1*	*1.3*
Skew	*-.02*	*-.55*	*.23*	*-.14*	*-.35*	*-.39*	*-.74*	*-.56*	*-.61*	*-.74*	*-.86*
Kurtosis	*-1.2*	*-.22*	*-.88*	*-.71*	*-.95*	*-.83*	*.21*	*-.21*	*-.03*	*.37*	*.09*

Significant correlations ** $p < .01$; * $p < .05$; *SD* = Standard deviation

H. 2: CFA Parameter Estimates, Standard Error and Critical Ratio of PBC

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Perceived Controllability	DC2	.903	.205	4.410
	AR4	1.449	.255	5.685
	AR6	1.568	.257	6.167
	AR8	1.279	.257	4.967
	AR10	1.471	.256	5.744
	AR12	1.00	-	-
Self-Efficacy	DC2	.389	.099	3.946
	SE13	.982	.065	15.069
	SE14	1.082	.062	16.664
	SE15	.882	.056	15.681
	SE16	1.00	-	-

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix I

Descriptive Statistics and CFA Parameter Estimates for Significant Life Experiences

I.1: Descriptive statistics (*SD,* Skew, Kurtosis) and Correlation matrix of significant life experiences

	Q1S	Q2S	Q3S	Q4S	Q5S	Q6S	Q7S	Q8S	Q9S	Q10S	Q11S	Q12S	Q13S
Q1S	1.00												
Q2S	.251**	1.00											
Q3S	.381**	.300**	1.00										
Q4S	.241**	.341**	.472**	1.00									
Q5S	.156*	.305**	.336**	.263**	1.00								
Q6S	.256**	.452**	.373**	.301**	.585**	1.00							
Q7S	.176*	.387**	.160*	.187*	.355**	.522**	1.00						
Q8S	.454**	.130	.304**	.277**	.262**	.319**	.208**	1.00					
Q9S	.303**	.233**	.206**	.082	.269**	.329**	.461**	.253**	1.00				
Q10S	.132	.159*	.455**	.514**	.314**	.337**	.156*	.350**	.168*	1.00			
Q11S	.257**	.192**	.340**	.273**	.353**	.382**	.159*	.302**	.295**	.408**	1.00		
Q12S	.187*	.205**	.269**	.289**	.360**	.450**	.388**	.255**	.398**	.343**	.380**	1.00	
Q13S	281**	.212**	.323**	.313**	.258**	.333**	.224**	.218**	.235**	.209**	.371**	.447**	1.00
Mean	*4.08*	*5.17*	*3.12*	*2.84*	*4.72*	*4.69*	*5.61*	*2.76*	*4.65*	*1.91*	*3.08*	*5.12*	*4.78*
SD	*1.6*	*1.6*	*1.8*	*2.1*	*2.0*	*1.7*	*1.1*	*1.9*	*1.7*	*1.6*	*1.9*	*1.5*	*1.7*
Skew	*-.25*	*-.88*	*.34*	*.78*	*-.50*	*-.27*	*-.68*	*.72*	*-.50*	*1.8*	*3.6*	*-.55*	*-.75*
Kurtosis	*-.57*	*.28*	*-1.0*	*-.84*	*-.96*	*-.82*	*.10*	*-.77*	*-.56*	*2.2*	*-1.1*	*-.25*	*-.23*

Significant correlations ** $p < .01$; * $p < .05$; *SD* = Standard deviation

I.2: CFA Parameter Estimates, Standard Error and Critical Ratio of Significant Life Experiences

Latent Variable	Item	Unstandardised Factor Loading	Standard Error	Critical Ratio
Outdoor Recreation Experience	Q2S	1.029	.204	5.050
	Q3S	1.094	.177	6.177
	Q5S	1.671	.288	5.811
	Q6S	1.720	.275	6.254
	Q104S	1.00	-	-
EE and Action Experience	Q7S	.851	.149	5.728
	Q8S	.940	.208	4.515
	Q9S	1.108	.205	5.397
	Q11S	1.315	.239	5.998
	Q12S	1.120	.190	5.888
	Q13S	1.00	-	-

Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix J

Results of Parameter Estimates for the Structural Regression Models

J.1: Parameter estimates, standard errors, critical ratios, and item reliability for the hypothesised model

Latent Variable	Parcel Items	Unstandardised Factor Loading	Standardised Factor Loading	Standard Error	Critical Ratio	R^2 (item reliability)
Commitment	PCMT1	1.00	0.826	-[a]	-	0.682
	PCMT2	1.250	0.868	.090	13.891	0.753
	PCMT3	1.194	0.899	.082	14.490	0.809
Intention	PINT1	1.00	0.896	-	-	0.802
	PINT2	.859	0.849	.057	15.031	0.721
	PINT3	.983	0.871	.063	15.628	0.759
Perceived Behavioural Control	PPBC1	1.00	0.926	-	-	0.857
	PPBC2	.889	0.835	.058	15.350	0.697
	PPBC3	.992	0.821	.067	14.903	0.675
Attitude	PATT1	1.00	.910	-	-	0.828
	PATT2	1.250	.988	.061	20.541	0.961
	PATT3	1.094	.868	.061	18.033	0.753
Subjective Norms	PSN1	1.00	0.877	-	-	0.787
	PSN2	.859	0.782	.067	12.807	0.612
	PSN3	.957	0.889	.063	15.234	0.790
Significant Life Experiences	PSLE1	1.00	0.768	-	-	0.590
	PSLE2	1.046	0.793	.103	10.197	0.629
	PSLE3	1.105	0.794	.112	9.895	0.561

[a] Indicates a parameter fixed at 1.0 in the original solution.
Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

J.2: Parameter estimates, standard errors, critical ratios, and item reliability for the final revised model

Latent Variable	Parcel Items	Unstandardised Factor Loading	Standardised Factor Loading	Standard Error	Critical Ratio	R^2 (item reliability)
Commitment	PCMT1	1.00	0.826	-[a]	-	0.683
	PCMT2	1.251	0.869	.090	13.931	0.755
	PCMT3	1.194	0.899	.082	14.515	0.809
Intention	PINT1	1.00	0.897	-	-	0.804
	PINT2	.860	0.852	.057	15.183	0.725
	PINT3	.983	0.873	.062	15.764	0.762
Perceived Behavioural Control	PPBC1	1.00	0.923	-	-	0.825
	PPBC2	.894	0.837	.058	15.419	0.700
	PPBC3	.993	0.820	.067	14.863	0.673
Attitude	PATT1	1.00	0.911	-	-	0.830
	PATT2	1.141	0.979	.051	18.100	0.959
	PATT3	.915	0.869	.047	24.310	0.755
Subjective Norms	PSN1	1.00	0.885	-	-	0.783
	PSN2	.864	0.785	.067	12.869	0.616
	PSN3	.983	0.888	.063	15.321	0.789
Significant Life Experiences	PSLE1	1.00	0.653	-	-	0.426
	PSLE2	.986	0.689	.091	10.600	0.475
	PSLE3	1.012	0.712	.130	7.791	0.507

[a] Indicates a parameter fixed at 1.0 in the original solution.
Critical Ratio is obtained by dividing the estimate of the covariance by its standard error. Values above 1.96 shows that the parameter is significant ($p < .05$).

Appendix K

Interview Schedule

Interview Schedule

Introduction

- The aim of the interview is to understand your motivations and commitment to EE. This is to explore ways that will make the subject interesting for teachers as well as pupils.
- Assurance of confidentiality/anonymity and how the research will be used
- I would like to start by asking you to tell me some of the interesting EE activities you have carried out with your pupils.

Motivations

- What has been the driving force for your interest in EE?
- Are there any life experiences that influenced you most in being committed to environmental education?
- Do you think a similar experience will make your pupils committed to EE?
- Do you realise changes in your motivation toward teaching EE over time? If so what has been your reaction to it?
- What do you think will increase your motivation for teaching EE? (Any perceived problems to these suggestions?)

Constraints

- What are the major issues you grapple with when you decide to teach EE to your pupils?
- Are there other major constraints that affect your teaching of EE?
- How do these issues influence your choice of topic, teaching materials, strategy etc?
- How do you or the authorities react to these constraints/obstacles?
- Most teachers think teaching EE is hard. Why do you think they make this assertion and how can it be made easy?

- What steps can be taken to improve your teaching of EE? (Any perceived drawbacks to these suggestions?)
- How would you describe your pre-teacher preparation to teach EE?

Social analysis

- What would you expect a teacher committed to environmental education to do? OR what criteria will you use to determine a teacher committed to teaching EE

Political analysis

- How do you include and manage all the subjects in the primary curriculum (different priorities of education at the primary level and other duties that teachers need to perform)
- Who has the power to influence how different interests are accommodated
- What do you feel you have control over and what don't you have control over when it comes to teaching EE to your pupils? (Why do you feel you do not have control over whether or not you teach EE to your pupils?)
- Do you think you have enough support/resources from the government/local authority for EE?

Other

- How has the actions and opinions of fellow teachers influenced your teaching of EE to your pupils?
- What is freedom in the curriculum and how or what can be done to make teachers have more freedom in the curriculum?
- How will freedom in the curriculum improve your teaching of EE?

Thank you very much for participating in the study.

Reflexive Comments