

**An Exploration of the State and Status of
Nature Awareness, Appreciation and Education in
the Irish Primary School System**

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Declaration

I declare that this thesis has not been submitted as an exercise for a degree at this or any other institution and it is entirely my own work. I agree to deposit this thesis in the University's open access institutional repository or allow the library to do so on my behalf, subject to Irish Copyright Legislation and Trinity College Library conditions of use and acknowledgement.

Patrick Anthony Madden 16.04.2019

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Summary

This thesis explores the state and status of nature awareness, appreciation and education in the Irish primary school system. The concept of nature in this work is interpreted as plants and animals, rocks and soil, water and weather. These topics straddle the science and geography curricula of the revised curriculum (DES, 1999b;1999c; 1999d; 1999e).

The hypothesis is this: nature awareness, appreciation and education in Irish schools has dwindled since the introduction of the revised curriculum due to many and diverse variables. This waning of its state and status comes at a time when biodiversity is being threatened world-wide and climate change is being closely monitored because of the potential threat it poses to planetary health and economic prosperity.

The Research Questions: The overarching research statement is concerned with exploring the state and status of nature awareness, appreciation and education in the Irish primary school system. Specific exploratory and descriptive research questions under this umbrella statement are:

- What levels of conceptual knowledge of the natural environment do Irish primary teachers and first-year initial teacher-education students (ITE) hold?
- What levels of confidence do Irish primary teachers and first-year ITE students have relating to the natural environment?
- What are primary teachers' experiences of and attitudes towards teaching about the natural environment especially in an outdoor context?
- What is happening in Irish primary schools when children engage with learning about the natural environment?
- How is teaching and learning about the natural environment weighted within the revised curriculum?

- Why is engagement with nature not conducted frequently outdoors in Irish primary schools?

The Theoretical Framework and Key Concepts: A pragmatist philosophy is foundational to the methodology adopted for this research. This philosophy embraces both positivistic and phenomenological epistemologies to attempt to solve the problems posed by the research. The former epistemology is based on an objective ontology and is centred on a pre-structured research design which seeks to capture measurable data; the latter is based on a subjective ontology which seeks meaning from the data. Key concepts relating to the natural environment and nature-based learning were explored: nature and cognition; nature and physical and mental well-being; nature and outdoor education; nature and the affective domain of learning; nature and spiritual/aesthetic development; nature and the development of sensitiveness in children; nature and affordances for creative play; nature and its effect on children with special needs; nature and environmental issues. Also, the concepts of ecopsychology, ecofeminism, deep ecology, biophilia, anthropocentrism and nature-deficit disorder were explored.

Methodology: A mixed methods methodology was utilized throughout this research. Mixed methods research is empirical research that combines quantitative and qualitative data. Qualitative and quantitative data on Irish participants' knowledge of and attitudes to nature education, awareness and appreciation in Ireland were collected and interpreted. Arising out of this framework the following methods were used to capture data: (a) questionnaires were administered online to gather quantitative and qualitative data from 219 primary teachers across a wide spectrum of teaching experience in Ireland and diverse geographical locations to elicit information pertaining to the quality of current teaching about nature, the challenges encountered in this teaching and its status in schools; (b) questionnaires were administered to 253 first-year student teachers to elicit their knowledge of and experience of nature and nature education; (c) semi-structured

interviews were administered to six Heritage in School experts¹ (HE) who promote nature education in schools to elicit an external assessment of the phenomenon under review; (d) 220 whole-school evaluations by inspectors for the school year 2014-2015 were analyzed to ascertain the status of nature awareness, appreciation and education from evaluation of their viewpoints.

Findings:

1. School-grounds in the main lack the variety of habitats necessary for meaningfully engaging children with nature.
2. The nature-knowledge of ITE students relating to identification of species, food-chains, and the concepts of adaptation, conservation, and classification seems to be limited.
3. ITE's contribution to the development of nature awareness, appreciation and education seems to be limited especially relating to its outdoor dimension.
4. Teachers seem to possess limited knowledge in their ability to teach about certain aspects of nature such as vertebrates and invertebrates, and rocks and soil.
5. Lack of time from an overloaded curriculum seems to be a major barrier to teachers' pedagogic engagement with nature outdoors.
6. School gardening seems to be on the increase despite a lack of commitment from stage agencies regarding this aspect of nature-education.
7. The majority of teachers deem that children's knowledge of nature is poor.
8. Nature awareness, appreciation and education seems to have a low status within the revised new curriculum.

¹ The Heritage in School Scheme was initiated as a pilot scheme in 1999. It became a fully-established resource for supporting primary schools in the areas of science, geography, history and Irish culture in 2000. Presently, there are 151 specialists. 109 of these specialise in science and geography.

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Abbreviations

- ADD: Attention Deficit Disorder
- ADHD: Attention Deficit Hyperactivity Disorder
- ANOVA: Analysis of Variance
- ART: Attention Restorative Theory
- ASC: Altered State of Consciousness
- B. ED: Bachelor of Education
- CKT: Content Knowledge of Teachers
- CPD: Continuing Professional Development
- DES: Department of Education and Skills
- DEIS: Delivering Equality of Opportunity
- DfES: Department for Education and Skills
- DOH: Department of Health
- DPS: Discover Primary Science
- DSE: Discover Science and Engineering Programme
- EE: Environmental Education
- EEG: Electroencephalography
- ESD: Education for Sustainable Development
- FETAC: Further Education and Training Awards Council
- GBL: Garden Based Learning
- GIY: Grow It Yourself
- HS: Heritage in Schools
- HSE: Health Service Executive
- INTO: Irish National Teachers Organisation
- IPCC: Irish Peatland Conservation Council

ITE: Initial Teacher Education

IUCN: International Union for Conservation of Nature

IWB: Interactive Whiteboard

IWT: Irish Wildlife Trust

LoTC: Learning Outside the Classroom

MIE: Marino Institute of Education

NCCA: National Council for Curriculum and Assessment

NPWS: National Parks and Wildlife Service

NFER: National Foundation for Educational Research

OECD: The Organisation for Economic Co-operation and Development

Ofsted: The Office for Standards in Education

PCSP: Primary Curriculum Support Programme

PDST: Professional Development Service for Teachers

PCK: Pedagogic Content Knowledge

PPDS: Primary Professional Development Service

PME: Professional Master of Education

RHS: Royal Horticultural Society

SCK: Subject Content Knowledge

SD: Sustainable Development

SEAI: Sustainable Energy Authority of Ireland

SEED: School Earth Education

SESE: Social Environmental and Scientific Education

SFI: Science Foundation Ireland.

SPHE: Social Personal and Health Education

SPSS: Statistical Package for the Social Scientists

STEM: Science Technology Engineering and Maths

SRT: Stress Reduction Theory

UNESCO: United Nations Educational, Scientific and Cultural Organisation

WCED: World Commission for Environment and Development

WHO: World Health Organisation

WSE: Whole School Evaluation

Chapter 1: Introduction

*What would the world be, once bereft/Of wet and of wildness? / Let them be left, /O
let them be left, wildness and wet;/Long live the weeds and the wilderness yet.*

Gerard Manley Hopkins (1881)

1.1 The Topic

This thesis explores the state and status of nature awareness, appreciation and education in the Irish primary system. This topic was chosen because anecdotal evidence, personal observation, media analysis and current research both in Ireland and abroad seems to suggest that children nowadays are increasingly disconnected from nature which may have consequences for their own and others' well-being and that of planet earth.

Pyle (2010), for example, observed from an American perspective that for fifty years 'nature literacy as a fundamental educational objective has been side-lined if not forgotten' (p.155). This view was echoed by Barrows, Mariscal-Murphy and Hernandez (2016) when they concluded from studies in California 'The relevance of natural history is challenged and marginalized today more than ever' (p.1).

In Ireland, the *Wild Child Quantitative Survey* commissioned by the Heritage Council (2010) compared 1000 adults' outdoor activities with their children's outdoor activities. The adults reported that one in three of them had never engaged with making a daisy chain with their children or building a camp/den with them and 40% of them had never engaged with their children in climbing trees. The adults also reported that there was a reduction in their children's play in wild places compared to when they themselves were young. These adults on average believed that they could identify 7.8 out of 9 common birds, insects and flowers but their children could only identify 6.6 out of 9.

Complementing this research in an Irish context, Kilkelly et al (2016) stated: 'Research

shows that the changing nature of children's lives is a major concern and that the child-nature connection is under serious threat' (p.48).

1.2 Answering the Research Questions

To address the research questions outlined on page iv the following activities were initiated: (1) questionnaires were administered online to elicit information from practising primary teachers; (2) nature-knowledge questionnaires based on the sixth-class science and geography syllabi were administered to first year initial teacher-education (ITE) students; (3) Heritage in School experts (HS) were interviewed to ascertain the opinions of outsider practitioners in the primary system; (4) Whole School Evaluations (WSEs)² were evaluated to ascertain the value inspectors from the Department of Education and Skills (DES) place on this topic. The rationale for choosing the research methods were: 1. Practising teachers are in the field daily and should be aware of what is happening; 2. Most of the first-year student teachers went through the primary system when the revised curriculum was being enacted. It would be expected, even though most were out of the system for c.5/6 years that they would retain much of the knowledge about the natural environment that they learned from infants to 6th class; 3. The Heritage in School experts, who on average visited 29 schools each in the academic year 2015-2016 are exceptionally knowledgeable about nature, acquainted with the revised curriculum and experienced at communicating with children. They are invited back repeatedly to schools because of their content knowledge of nature, their pedagogical knowledge, their pedagogical content knowledge and their ability to engage children. Being knowledgeable outsiders, they were in a unique position to observe and offer impartial judgement on what was happening in schools regarding engagement with the natural environment; 4. Whole school evaluations (WSEs) occur

² Whole School Evaluations (WSEs) are carried out in Irish primary schools every five to seven years in order to: "monitor and assess the quality, economy, efficiency and effectiveness of the education system provided in the state by recognised schools and centres of education" (Education Act 1998, section 7 (2) (b)).

regularly throughout the country and the subjects focused on in these evaluations determine to a large extent their status within the primary system.

1.3 Motivation for Study

In 2014, having completed 44 years of continuous teaching as a primary teacher (31 years), lecturer in Social, Environmental and Scientific Education (SESE) in a College of Education (14 years), HS expert on nature education, appreciation and awareness (15 years), and Continuous Professional Development (CPD) facilitator on nature orientated topics (22 years) it seemed to me that not alone were many children, ITE students and primary teachers disconnected ³from nature but also many of them had limited knowledge of plants and animals, rocks and soil and the general natural world around them.

1.4 Aims and Objectives of the Study

However, I needed attestation that my hypothesis was supported, so I embarked on a D.Ed. degree in Trinity College to research my chosen topic. Consequently, the main aims and objectives of my research are:

1. To explore the *state* of nature awareness, appreciation and education in the primary school system in Ireland.⁴
2. To explore the *status* of nature awareness, appreciation and education in the primary school system in Ireland.

The above aims are sub-divided into the following objectives which underpin the research questions outlined on pp iv and v:

- a) To discover the levels of conceptual knowledge of the natural environment (as defined by the nature syllabus in the revised curriculum) of Irish primary teachers and first-year ITE students (DES, 1999b; DES, 1999d).

³ The concepts of 'connection/disconnection with nature' are discussed on pp.10 and 11.

⁴ References to Ireland throughout refer to the Republic of Ireland.

- (b) To discover the levels of confidence Irish primary teachers and first-year ITE students have relating to the natural environment and teaching about the natural environment (teachers).
- (c) To discover primary teachers' experiences of and attitudes towards teaching about the natural environment especially in an outdoor context.
- (d) To discover what is happening in Irish primary schools when children engage with learning about the natural environment.
- (e) To discover how learning about the natural environment is weighted within the revised curriculum (DES, 1999).

1.5 Mapping the Study

The study is divided into seven chapters. Chapter two explores the national and international literature which pertains to the topic of nature awareness, appreciation and education of children. It examines the topic through the following lenses:

- ✓ Cognition and awareness,
- ✓ Connection and disconnection,
- ✓ Physical and mental health,
- ✓ Spiritual and aesthetic appreciation and caring attitudes,
- ✓ Creativity,
- ✓ Place-based and outdoor education,
- ✓ School gardening and the environment.

This chapter also appraises the history of nature awareness, appreciation and education in Ireland since the beginning of the nineteenth century. This dimension of primary education was promoted robustly in the child-centred curriculum of the first two

decades of the century but with the advent of cultural nationalism⁵ after Irish independence in 1922 it waned considerably until the introduction of the new curriculum in 1971 (Curaclam na Bunscoile, Department of Education, 1971).

Chapter three is devoted to the methodology utilised for this study. The methods which were used to capture data on the research question from student teachers, practising teachers, HS experts and WSE reports for the year 2015-2016 are discussed in detail.

Chapter four examines qualitative evidence from experienced Heritage in School experts (HS) who as participant outsiders in the system were in the position of being able to provide evidence of what was happening in schools relating to nature knowledge and education particularly outdoor engagement with the natural environment. Findings from six interviews are analysed and discussed throughout the chapter.

Chapter five presents the findings from the nature-knowledge questionnaire to ITE students. This questionnaire is based mostly on the sixth-class science syllabus and to a certain extent the 6th class geography syllabus (where nature education is embedded). These findings are analysed and discussed throughout the chapter.

Chapter six presents the findings from the questionnaire on nature awareness, appreciation and education in general which was made available online to practising primary teachers from the north, south, east, and west of the country. These findings are analysed and discussed throughout the chapter in a similar way to chapters five and six.

Chapter seven summarises the research and provides recommendations for policy, practice and research. It also outlines the limitations of the research and provides a reflexive account of the research journey.

⁵ The curriculum introduced by the Irish government in 1922 decoupled primary education from the child-centred curriculum of 1900. In this curriculum the teaching and learning of the Irish language and Irish culture assumed a central role (Walsh, 2005).

The dominant thread that weaves through the thesis is that nature awareness, appreciation and meaningful education in this domain of learning is crucial for a child's holistic development and for planetary health in the long term.

Chapter 2: Literature Review

We cannot protect something we do not love, we cannot love what we do not know, and we cannot know what we do not see. Or hear. Or sense.

(Louv, 2011, p.104).

2.1 Introduction

This chapter examines the concept of nature in general and specifically as it applies to the primary school curriculum. It also explores the factors that are associated with its significance for learning and development and its status in the curriculum. Evaluative documents from relevant stakeholders in the primary school system are also scrutinised to elicit their perspectives on this area of learning and pedagogy.

This chapter also provides a brief history of nature education in primary curricula from the 19th century to the present time. An overview such as this provides a foundational framework to assess current perspectives on its role within the curriculum and current awareness amongst teachers and pupils.

Overall, this chapter contributes to a ‘thick description’ (Geertz, 1973) of a phenomenon which is relevant to the curriculum in an age troubled by environmental problems, well-being issues, and general disconnection from the natural world.

Onwuegbuzie and Frels (2016) suggest that no matter what type of paradigm is chosen for research, the conceptualisation process should decide on the goal, the objectives, the rationale and the purpose of the research. The goal of this study is to explore the state of health and the status of nature awareness, appreciation and education in Irish primary schools; the objective is that if the data demonstrate that action needs to be taken to upgrade its state and status this will need to be addressed by the National Council for Curriculum and Assessment (NCCA), the Department of Education and Skills (DES), the Teachers' Council and other relevant policy stakeholders.

The rationale for the study is as follows: having worked for many years as a nature - educator and a Pushkin⁶ facilitator I have observed that children's and ITE students' awareness and appreciation of nature i.e. plants and animals, rocks and soil, weather, seems to be limited and that nature-education lacks depth, scope and outdoor engagement.

Nature awareness in this study is conceptualised as children's experience of nature in their intellectual growth. Bloom's taxonomy of cognition (1956) provides a framework for gaining insight into their cognitive development. This taxonomy begins at the lower levels of learning with factual knowledge of plants, animals, rocks and soil, broad classification of species. In the process of learning about the natural world around them children label, differentiate and classify at a rudimentary level. It progresses to more complex understandings of nature such as comprehension, application, analysis, synthesis and evaluation in which children use their knowledge to understand increasingly complex food-chains and webs, the differences between a variety of habitats, interdependencies, conservation and adaptation of species. The affective domain of learning which is linked to feelings and emotions forms part of this taxonomy.

Unravelling the concept of appreciation, Carlson (1995) stated that there cannot be appreciation without a cognitive element as a prerequisite to an appreciative response. Knowledge of the natural world will lead to an aesthetic appreciation of it. Growth of nature awareness and appreciation in children has implications for their attitudinal development as well. This appreciation besides having an element of aesthetic development has also an element of spiritual development (Chawla, 1988; Carlson, 1995). Nature awareness, appreciation and education has implications for many aspects of a child's development and planetary protection all of which are explored in this chapter.

⁶ The Pushkin Trust was established in Ireland in 1987 by Sacha, the Duchess of Abercorn. The project aims to unite children and adults in the common bond of creativity which transcends all the factors which might otherwise divide them" (Cannon, 2013, p.12). Outdoor engagement with nature is used to trigger creative responses in children in music, art and literature.

Nature education relates to children’s experience of engaging with nature in school. This engagement can be direct, indirect or vicarious as outlined by Kellert (2002).

This chapter also summarises, analyses, evaluates and synthesises literature relating to the reasons why nature awareness, appreciation and education are important. It outlines who is emphasising its importance in education, how it is viewed by the policy-drivers and stakeholders and what caused the present perceived lacuna in education, awareness, and appreciation (Onwuegbuzie and Frels, 2016).

The chapter comprises research literature on empirical research concerning the topic under review. It also comprises theoretical literature embracing the theoretical thinking, politics, issues, ideas, sources and concepts behind the topic (Punch, 2009).

Finally, the literature is examined through the macro lens of nature appreciation, awareness, and education and their importance for children’s cognitive, aesthetic, creative, spiritual, mental, physical, caring and emotional development.

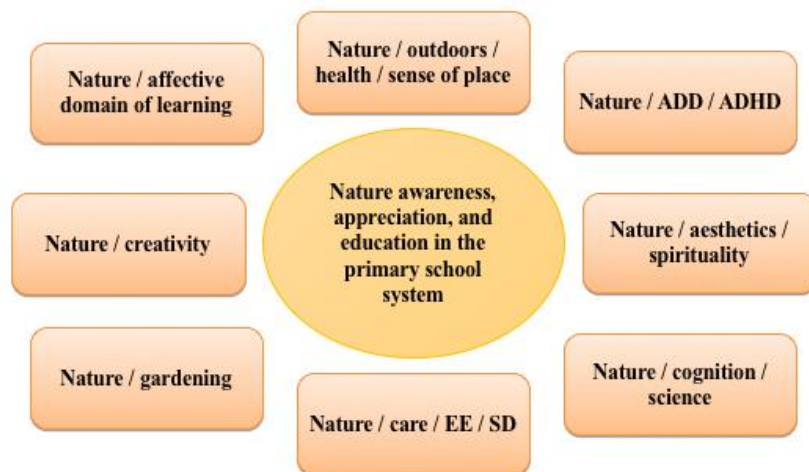


Figure 2.1: A conceptual framework for this study

2.2 Defining Nature

‘Nature’ is a contested construct and is interpreted differently by various authors. These range from the utilitarian/scientific to the aesthetic and mystical and are unpacked in the following pages.

In recent years nature has been sometimes been framed and conceptualised as ‘Natural Capital’ which was summarised by Sullivan ((2017, p.66) as ‘nature and the natural world approached in terms of asset values for human organizations and societies that can be calculated in monetary units using economic and accounting techniques’.

This research did not delve deeply into polarised viewpoints of nature; instead, non-human nature as outlined in the geography and science elements of the revised curriculum was explored (DES, 1999b; 1999c; 1999d; 1999e). The strand units addressed in this study are: Science: Plants and animal life; Science and the environment; Caring for the environment; Environmental awareness. Geography: Environmental awareness; The local natural environment; Rocks and soil; Caring for the environment.

In *Curaclam na Bunscoile* (1971) nature education was referred to as ‘nature study’ and was embedded in the subject area, Social and Environmental Studies which embraced History, Civics, Geography and Elementary Science. In the syllabus for 5th and 6th classes for instance, nature study was outlined under the umbrella of Social and Environmental Studies as: ‘Animal Life’, ‘Plant Life’, ‘Nature Expeditions and Natural Phenomena’, ‘Elementary Science’ and ‘Language Development and Recording’ (p.58). Natural history is another term which is often used to describe the study of nature. For the present century, natural history was defined by Barrows, Mariscal-Murphy & Hernandez (2016) as [a] ‘practice [that] spans a wide range and intensity of activities, from recreational bird watching and botanizing to following structured protocols while collecting data on the presence, abundance, and distribution for any measure of biodiversity’ (p.1).

In this research nature education, appreciation and awareness does take account of factual and scientific knowledge of plants and animals (cognitive development) but it also incorporates an affective dimension which positively influences mental and physical health, (vitalizing effect), aesthetic and spiritual development (nature sensibility), caring and emotional values (nature sensitivity), creativity, outdoor learning, place-based

pedagogy and learning, and environmental education, of which, environmental protection is an aspiration. (Kellert & Wilson, 1993; Sobel, 1996, 2004, 2008; Chawla, 1998; Kahn & Kellert, 2002; Louv, 2005; Saylan & Blumstein, 2007). The philosophic foundations of this affective dimension are ecofeminism, deep ecology, spiritual ecology, and ecopsychology which are discussed later in this chapter (Rozak, 1993; Miles & Shiva, 2014).

The affective dimension of science-teaching was explored by Littlelyke (2008) where he called for more integration of the cognitive and affective dimensions of science-education and suggested that a new approach to science teaching was necessary to dispel stereotypical notions of science and scientists and make the subject more enjoyable and relevant. This integrative process would be necessary, he believed, to promote more excitement and interest in science-learning, a learning which would include ‘a sense of beauty, respect, reverence and awe in approaches to the environment and understanding our place in the universe’ (p.5).

2.2.1 Knowing nature.

Bonnett (2007), the UK philosopher, queried, ‘How can we know nature?’ (p.217). He attempted to answer this question by stating that nature should not be viewed exclusively through the prism of science as it was in the National Curriculum for England (1999). In this curriculum nature is embedded in the ‘Life Processes and Living Things’ area of science and even though spiritual, moral, social and cultural dimensions of science are briefly discussed in the introduction, the syllabus is essentially target driven and prescriptive with all cognitive learning objectives beginning with the words: ‘The pupils should be taught...’. (National Curriculum for England, 1999). Instead of a specifically rationalistic approach to knowing nature, he suggested that what was needed was a kind of knowing in which personal, moral, mystical, and aesthetic dimensions are embedded, where nature is essentially unknowable because it possesses transcendental dimensions.

He called this knowing ‘*knowledge by acquaintance*’ (2007, p.714), emphasis in original) which is similar to becoming acquainted with a person where all the senses are engaged, and it has an affective quality. Citing Henry David Thoreau (1817-1862) as his inspiration for his poetic interpretation of nature he quoted the latter to illustrate his philosophical approach: ‘Open all your pores and bathe in all the tides of Nature, in all her streams and oceans, at all seasons...Grow green with spring, yellow and ripe with autumn...’ (Thoreau, 1849, p.394).

Selby (2017) declaring that knowing nature cannot be pursued in a hasty fashion called for ‘slow learning’ for attuning students to nature. (p.24). This advice suggests regular and systematic engagement with the natural world rather than irregular engagement. (This researcher utilised this approach in a primary school in the eighties and nineties. Children never viewed nature as a discrete subject to be studied; instead they became immersed in it almost on a daily basis through short walks in the nature-friendly grounds, and through gardening literature, language and art).

2.2.2 Environmental education (EE) and nature education.

In this thesis, the two concepts, ‘nature education’ and ‘environmental education’ (EE) are differentiated: nature education is concerned with the study of the natural world in all its complexities; environmental education is issue-related and has a broader remit being mainly concerned with protecting the natural and built environments and dealing with issues that affect both negatively such as climate change, pollution, litter, deforestation, desertification etc.

2.2.3 Sustainable development

One branch of EE is ‘sustainable development’ a term which was coined in 1980 in Zurich by the International Union for Conservation of Nature (IUCN et al, 1980) and international issues such as pollution, climate change, land and sea degradation etc.

Specifically, in the context of this thesis, 'environmental education' embraces the strands, environmental awareness and care (geography and science) in the 1999 revised curriculum for Irish primary schools (DES, 1999b; 1999c; 1999d; 1999e). Some of the themes addressed in this strand are: awareness of the earth's renewable and non-renewable resources, human activities which have positive or negative effects on local and wider environments, local, national or global environmental issues, conservation of the earth's resources, interrelationships between living and non-living aspects of environments, responsible stewardship, and positive aspects of the natural and built environment. These themes suggest that environmental education in the revised curriculum is *issue* orientated and so is markedly different from nature education. On the other hand, nature education in the context of this thesis is specifically orientated to learning about plants and animals and their habitats and inter-relationships in predominantly outdoor settings using all the senses.

Bonnett (2007) argued that EE lost its way due to its distancing itself from nature and concentrating exclusively on sustainable development (SD). He decried the fact that in the UK and other places nature receives little mention in environmental policies. This observation is manifested in the official Irish sustainable development website www.seai.ie in the sustainable energy section where plants and animals are mentioned three times and on both occasions from either an experimental perspective (*Will plants grow towards the light? Do plants need sunlight to grow?*) or an anthropocentric viewpoint when food chains are discussed. In the three chains which are diagrammatically represented the human is at the end twice and in the other one the insects have human features. Relating to the title, 'Teaching Sustainability' one would have expected a broader remit than just teaching about sustainable energy per se. Energy production has a significant impact on biodiversity in ecosystems because of climate change, pollution etc. and therefore the concept of biodiversity should have been explored in detail.

This distancing from nature is also noticeable in the Waldron, Oberman, Ruane, Kavanagh, & Murphy (2011) evaluation of SEAI's education programme, the aims of which are embedded in one of the objectives of this evaluation: 'To what extent does the SEAI education programme achieve its aim to engender energy awareness, education and behavioural change amongst its target audience of primary and secondary teachers and pupils?' (Waldron et al, 2011, p.1). No reference was made of plants and animals or school gardening in the evaluation and the questionnaire to teachers, even though in the literature review of this report, connection to nature in childhood was explored in depth as a precursor for positive environmental behaviour. Nevertheless, encouraging this connection in children is not mentioned in the recommendations of the evaluation. However, this omission could be excused on the grounds that the aims of the SEAI school programme are specifically about engaging the school community with saving energy and that is what the report evaluated. Perhaps then the SEAI should broaden its remit in its educational aims and include engagement with nature to foster in children a love of the world around them first before asking them to save energy. (Sobel, 1996).

The notion of SD is embedded in the oft quoted definition which emanated from the World Commission on Environment and Development [WCED] (1987): 'a development that meets the needs of the present without compromising the ability of future generations to meet their own needs' p.43). Bonnett (2007), however, criticised the anthropocentric approach incorporated in this statement asking, 'what is to be sustained, at what level, and over what time span'? and 'whose needs are to be met'? (p.710).

2.2.4 Environmental education (EE) and children

Bonnett's view was echoed by Selby (2017) who believed that nature was marginalised, commodified and limited to its utilitarian value in mainstream education for sustainable development (ESD) thus limiting its effectiveness. He suggested that learners needed to acquire an emotional, passionate connection with it so that they would be

motivated to be active in preserving the environment. His conclusions about sustainable education resulted from examination of several of the United Nations Educational Scientific and Cultural Organisation (UNESCO) and United Nations General Assembly documents pertaining to sustainable development all of which promote a mainly anthropocentric view of the natural world: (UNESCO, 2014a; UNESCO 2014b; UNESCO 2014c; United Nations General Assembly, 2015).

It would seem then from the above observations that SD education generally needs to have a broader remit and include explicitly in its aims (a) a lessening of anthropocentric foci and a more concentrated approach to preserving nature because of its intrinsic value and (b) engaging children in exploration and understanding of the natural world so that they will be motivated to care for it.

Bonnett's views on EE are echoed by the American environmentalist David Sobel (1996) who wrote on the need to encourage children to love the world before asking them to 'heal its wounds' (p.10).

Hungerford and Volk (1990), analysing research in responsible environmental behaviour observed in their much-quoted paper on the results of this research, that contrary to popular belief, knowledge of the environment and its issues did not lead to environmental awareness and action on behalf of the environment. 'Typically issue awareness alone does not lead to behaviour in the environmental dimension' (p267). Lamenting the fact that EE was issue orientated, usually focusing on a local one of interest, they suggested that there are at least three categories of variables that needed to be addressed. These were entry level variables such as 'environmental sensitivity', ownership variables such as 'in-depth knowledge about issues', and empowerment variables such as 'knowledge and skill in using environmental action strategies' (p.260). Of all these they considered that the 'environmental sensitivity' variable in the research demonstrated the most powerful relationship to environmental behaviour.

Following up on the variable of environmental sensitivity, Chawla (1998; 2006) reviewed the research based on this factor by examining the backgrounds of individuals involved in environmental organisations. She invariably found that the research revealed that exposure to nature in childhood was a significant contributor to their later environmental commitment and activity. Other significant indicators were family members who demonstrated environmental awareness and teachers. Others who explored this phenomenon both in qualitative and quantitative studies were Tanner, (1980); Peterson, (1982); Sivek & Hungerford, (1989/1990); Palmer, (1993); and Bixler, Floyd, & Hammitt, (2002); Palmer & Suggate (2004); Wells & Lekies (2006). However, Chawla added a cautionary note to her conclusion: none of the research was comparative. So, she queried: ‘Do experiences that characterize environmentalists and environmental educators also *distinguish* them from other members of the public’? (p.378, emphasis in original). The research did not consider the fact that there may be many people out there who had positive interactions with nature when they were young but in adulthood this did not manifest itself in environmental concern. Furthermore, all the research concentrated on the external dimensions of the environment such as habitats and effective mediators such as parents; very few looked at the internal dimension such as the *actual child* who is responding to these mediators and habitats or the *type* of play in nature in which the child was involved.

Finally, Pyle (2002) was concerned about ignorance concerning nature (‘nature illiteracy’, p.312) leading to indifference about the environment. He argued too that lack of close contact with and appreciation of our natural surroundings leads to ‘extinction of experience’ (p.312), the opposite of appreciation which leads to concern which in turn leads to conservation. He viewed this phenomenon of disengagement, disaffection, ignorance and apathy as a real threat to the world where nobody is aware of what is becoming extinct and nobody cares. Kahn (2002) expressed similar views about repeated

environmental degradation and repeated acceptance of this by generation after generation. He referred to Pyle's extinction of experience as 'environmental generational amnesia' (p.93).

All of the above research has implications for nature and EE in Irish schools. This research suggests that educators should not be focusing primarily on knowledge of issues such as pollution etc. Instead, they should be focusing on exposing children to the natural environment repeatedly from an early age and encouraging parents and other family members to do likewise.

2.2.5 Importance of children's play in fostering environmental awareness

The importance of children's play in fostering environmental awareness was addressed by Vadala, Bixler & Jones (2008) who examined in detail these play experiences and how children used them. They concentrated their research on 18-35-year olds who were involved in some way with nature pursuits such as natural history, ecology and ethology but were too old to have been involved with the internet as children. Their conclusions replicated that of the other researchers: 'recreational and environmental preferences have their genesis in childhood' (p.14). See Chawla (1996;2004); Tanner, (1980); Peterson, (1982); Sivek & Hungerford, (1989/1990); Palmer, (1993); and Bixler, Floyd, & Hammitt, (2002); Palmer & Suggate (2004); Wells & Lekies (2006), on p.41 for similar conclusions relating to children's exposure to nature and the consequent development in them of pro-environmental behaviour.

In future research on environmental education, Vadala et al (2008) recommended, that because this research demonstrates the importance of parents in providing unstructured play experiences for children, environmental educators should help parents to facilitate these experiences. Furthermore, Vadala et al (2008) voiced concern about the fact that because many parents grew up with the video-game culture of the 1970s onward, they might suffer from generational amnesia, a concept which Kahn (2002) formulated (See

2.9.3) This has brought about a causality whereby parents have little knowledge of nature and therefore may not perceive exposure to it by play or other means as important for their children's development.

Postma and Smeyers (2012) noting that the notion of culpability e.g. trying to instil fear and shame into humans (which includes children) to act in a more sustainable way in order to protect the environment for the present and the future, has failed to generate pro-environmental behaviour, suggested instead a different approach. Citing, Lester & Maudsley, (2006, p.41) who conducted an extensive review of the literature pertaining to children engaged in natural play they concluded that it was precisely this i.e. children's creative play in nature that will generate future caring citizens. They worried that opportunities for play in nature were dwindling in western cultures but were also heartened by the fact that Richard's Louv's seminal book, *Last Child in the Woods* (2005) had generated a desire by parents and educators to re-engage children with nature. They suggested, finally, that education for sustainable development in EE has pushed nature study into the background and that this needs to be integrated into education once more.

Reconnection with nature as a possible trigger towards environmental awareness was also postulated by Saylan and Blumstein (2011) in their book *The Failure of Environmental Education [And How We Can Fix It]*. In this book they argued for the cultivation of an appreciation of nature as a fundamental pre-requisite to effect behavioural change. and they suggested that this 're-natured culture' (Louv, 2011, p.263) could be achieved by changing the curriculum entirely so that students could spend more time engaging with nature outdoors so that their sense of wonder and awe could be stimulated. Concluding their argument, they suggested that if students did not engage with nature outdoors it would be impossible to engender in them a love of nature and without this love stewardship and protection of the environment would be compromised. Connection

therefore leads to protection or as Selby (2017) stated: ‘Passion is the harbinger of activism’ (p.9).

2.2.6 Connectedness to nature.

Several writers, Leopold, (1996); Schultz, (2002); Schultz, Shriver, Tabanico & Khazian, (2004); Mayer & Frantz, (2004); Ernst & Theimer, (2011); Griffiths, (2013) have explored the concept, ‘connectedness to nature’. Mayer & Frantz (2004) summed the concept up as an ‘affective, experiential sense of oneness with the natural world’ (p.504). This close, affectionate, bond with nature differs greatly between individuals. The trait, nonetheless, to a greater or lesser extent affects an individual’s commitment towards environmental care and protection and it is often nurtured in childhood (Carson, 1991; Chawla, 2006).

The intensity of this trait in a person was investigated by Nisbet, Zelenski and Murphy (2009) who developed a new construct which they labelled ‘nature relatedness’ (p.715) and a self-reporting evaluative scale of nature relatedness for measuring a person’s level of holistic connection (cognitive, physical and affective dimensions), with nature.

However, there is divergence of opinion concerning the words ‘connection’ and ‘disconnection’ regarding children’s relationship with nature. Pyle (2002) for instance, argues that people and nature are not different things and that it is nonsensical talking about reconnecting people with nature. In contrast, Braun and Dierke (2017) exploring the construct ‘nature connectedness’ summed up the various interpretations of it ‘as inclusion of nature in self, emotional affinity towards nature, nature relatedness or connectivity with nature’ (p.938).

In this research ‘nature-connection’ is conceptualised as a deep, loving, immersive, emotional and regular relationship with the natural world similar to Bonnett’s notion of ‘knowing by acquaintance’ discussed above on page 12. (Bonnett, 2007, p.714).

2.3 General Trends

In the Western world generally, there is a widespread view that awareness and appreciation of the natural world and connectedness to it is severely diminished at present amongst young people (Orr, 2002; Carmen, 2012; Children & Nature Network, 2012; Heritage Council of Ireland, 2010; House of Commons, 2010; Kilkelly, Lynch, Moore, O'Connell & Field, 2016; Louv, 2005; National Trust, 2013); Palmer, 2015; Pyle, 2010; Saylan and Blumstein, 2011; Monbiot, 2012; Griffiths, 2013).

Louv (2005), for instance, in his seminal book, *Last Child in the Woods*, referred to children's alienation from nature as, 'nature deficit disorder' (p.10) and blamed the pervasiveness of technology for this phenomenon. Blaming society and schools too for not encouraging children to participate in and experience nature he asserted: 'We have industrialized the classroom to the extent that there is no room for nature in the curriculum' (p.136). The National Trust (2012) exploring the consequences of Louv's nature deficit disorder in England found that the condition contributed to increased obesity and stress among children and decreased ability to perform simple physical exercises.

As discussed on page one in an Irish context, the Heritage Council (2010) discovered a similar lessening of children's engagement with nature from data collated from the self-reporting of one thousand parents. Limited knowledge of nature is also reflected in the National Trust (2012) report where it was observed that in a survey they conducted in 2008 only one in three children could identify a magpie and 50% could not distinguish between a bee and a wasp. The National Trust in England while agreeing on the one hand with Louv that the phenomenon, 'nature-deficit disorder' is widespread among children, on the other hand stated that technology and poverty alone should not be blamed solely for the condition. They believed that other factors such as traffic, stranger-danger and over-protective parents also should share responsibility.

2.4 A Typology of Nature Values

The teaching and learning about nature are presently incorporated into the Science and Geography curricula with some incorporation in the English, Irish and Arts' curricula (DES, 1999b; 1999c; 1999d; 1999e). The emphasis on teaching and learning is in the cognitive or scientific domains of nature education with perhaps not enough emphasis on nature's aesthetic, spiritual, emotional and imaginative values. For example, in the 6th class objectives for teaching and learning about plant and animal life the language used could be described as practical with the preponderance of functional verbs such as: 'observe', 'identify', 'examine', 'recognise', 'group', 'compare', 'construct', 'become aware of', 'investigate' and 'understand' (DES, 1999b, p.84). This functional terminology is faithful to the 'scientific approach' which is advocated in the science curriculum: 'A scientific approach is a process of making observations, hypothesising, predicting and carrying out investigations, planning fair tests and analysing the results of tests and investigations' (DES, 1999b, p.2). Nevertheless, the syllabus for all classes in the Plant and Animal strand unit is well-planned, comprehensive and well-sequenced and children would have a broad knowledge of the natural world leaving primary school if this strand unit were taught thoroughly and often especially outdoors.

In contrast to a mostly cognitive approach to teaching and learning about nature, Kellert (2002) offered a broader and more holistic codification of nature for children's development all of which are critically evaluated in this thesis.

Table 2.1

A Typology of Values of Nature

Values	
Aesthetic	Nature's physical attraction and appeal
Dominionistic	Mastery and control of nature
Humanistic	Emotional bonding with nature
Moralistic	Ethical and spiritual relation to nature
Naturalistic	Exploration and discovery of nature
Negativistic	Fear and aversion of nature
Scientific	Knowledge and understanding of nature
Symbolic	Source of language and imagination
Utilitarian	Source of material and physical reward

Note. Kellert, (2002, p.130).

Kellert suggests that these values of nature are developmental in children with the utilitarian, dominionistic and negativistic values developing between three and six years when children's immediate needs are a priority for them. Between six and twelve children's humanistic, symbolic, aesthetic and scientific values develop where they move to a deeper and broader understanding of nature through direct contact with it especially near their homes. At this stage the utilitarian, negativistic and dominionistic values are not as prominent. At this middle childhood period they engage in direct contact with nature exploring it independently of adults, enjoy building dens, develop their caring capacities for other creatures, assimilate knowledge quickly about the natural world through interaction with it and curiosity about it. (Kellert, 2002). Citing Sobel (1993), Kellert recognised that in this period direct contact with nature developed children's personality as they explored nearby nature.

2.5 Nature in the 1971 Curriculum and the 1999 Revised Curriculum

Following on from reports such as *Investment in Education Report* (1965), the OECD report, *Curriculum Improvement and Educational Development* (1966) and the *Plowden Report* (1967), a new child-centred curriculum was introduced in 1971 which included a broad range of subjects. This curriculum's two overarching aims were: 1. To enable the child to live a full life as a child and. 2. To equip him to avail himself of further

education so that he may go on to live a full and useful life as an adult in society (Curaclam na Bunscoile, 1971, p. 12)

Among the new subjects were civics and elementary science, which, along with geography and history came under the umbrella of Social and Environmental Studies. Social studies covered civics and history; environmental studies were concerned with nature study/elementary science and geography. Nature study had a detailed syllabus covering such topics as animal life, plant life, natural phenomena; nature expeditions, keeping diaries, integrating with other subjects and developing nature tables were encouraged (Curaclam na Bunscoile, 1971).

A primary aim of the curriculum will be to stimulate and foster in the child an interest in the world around him and to answer in a natural way many of the questions he may ask about things which confront him in everyday life (p.11).

In 1992, the INTO produced a report summing up the findings of three surveys and one review of the Social and Environmental Studies area of the new Primary Curriculum. In general, this report highlighted the inadequacies found in the teaching of nature study and elementary science (INTO, 1992).

In 1975, for example, 69.5% of the teachers who replied felt that they taught the subject satisfactorily (The INTO Curriculum Survey, 1975).

In the 1986 survey 14% took children outside the classroom on educational walks around the school once a month or more often.

In contrast to the negativity expressed in these two surveys, the Conference of Convent Primary Schools Survey (1975) outlined teachers' positive views on Social and Environmental Studies. An tAonad Curaclaim, An Roinn Oideachais (1983) which was composed of inspectors from the Department of Education also sought to evaluate the success or otherwise of Social and Environmental studies in primary schools. They too found that taking children outside to study the local environment was problematic for 30%

of junior classes and 20% of middle/senior classes. They also questioned the over-reliance on textbooks for teaching and the lack of science teaching. Teachers rated their success in teaching the subjects in this area as follows: 1. History. 2. Geography. 3. Nature Study. 4. Civics. 5. Elementary Science. Quinn (1990) corroborates this evidence after she found that very few teachers went on nature walks. 'There was an all-pervading lack of confidence in taking children out of doors and the teachers admitted that much more out-of-school practical experience was necessary' (p.219).

In 1996 the INTO revisited the 1971 curriculum with a survey on actual practice of 1,000 teachers (540 responded) rather than on their attitudes to curriculum as was done in previous surveys. The following table represents the number of teachers who brought their pupils on nature walks. It should be noted for comparison that in their survey of 1986, data demonstrated that 19% of teachers never went on a nature walk.

Table 2.4

Frequency of Educational Walks in the Environs of the School

Frequency of nature walks	Percentage of teachers
At least once a week	2.6%
At least once a month	8.7%
At least once a term	33.9%
At least once a year	32.6%
Never	20%

Note. INTO, (1996). *Primary School Curriculum: An Evolutionary Process*. Dublin: INTO.

From these low engagement figures on educational walks outside the classroom it is difficult to envisage that meaningful, purposeful, cumulative learning occurred outdoors in nature study. Even though in this survey the INTO stated that teachers in 1996 did not over-rely on textbooks in general, and that only 23% used them in environmental studies, one can only speculate on what other resources were used and indeed what was the quality and quantity of content. Forty-six per cent of teachers used pre-recorded and commercial materials to teach environmental studies which was second only to English (48%). It would

seem then that television and video recordings were significant resources for environmental studies and that this vicarious learning was a substitute for meaningful, practical exploration of the local environment using all the senses. Also, the finding that 66% of respondents used didactic rather than heuristic methods for teaching and learning overall, would suggest that most children were not engaging with the natural world around them using discovery or guided discovery methods.

Through the nineties various reports (Department of Education, 1992, Department of Education and Science, 1995, INTO 1996) reviewed the primary curriculum. The White Paper, *Charting our Education Future*, Department of Education and Science (1995) summing up the consultative process that had been ongoing for several years laid out the stall for a new revised curriculum. Amongst its recommendations for this curriculum were new emphases on assessment, literacy and numeracy, inclusivity, the arts, the Irish language, science, health and well-being, and early years' education. This revised curriculum (which again was innovative and child-centred) was introduced in 1999.

In direct contrast to 1971, it was envisaged that in-service training would be a key strategy towards implementing the 1999 one successfully.

From September 2000 to June 2003, the Primary Curriculum Support Programme (PCSP) provided support for almost 300 schools as part of a developmental project to build capacity for the implementation of the science curriculum. Two one-day in-service seminars were provided for all primary-school teachers in the 2002-2003 school year. Schools were also allowed to close for one day to enable the teachers to engage in whole-school planning for Science (*Science in the Primary School*, 2008).

Twelve cuiditheoiri (curriculum advisors) were also provided to schools to help with implementing the programme which came into effect in September 2003. Nature study was now absorbed in the science curriculum and in the geography curriculum to a much lesser extent. In the former it was embedded under the strands, 'Living Things' and

‘Environmental Awareness and Care’; in the latter, it came under the strands, ‘Natural Environments’ and ‘Environmental Awareness and Care’. (DES,1999a; 1999b; 1999d; 1999e). The inspectorate clearly defined in their report the approach that would henceforth be adopted for the teaching of nature. (*Science in the Primary School*, 2012). At the beginning of their report when they stated that the nature study programme of the 1971 curriculum ‘was absorbed into the science curriculum under the strands, Living Things and Environmental Awareness and Care’ (p.1) and that ‘*the curriculum now requires pupils to adopt a scientific approach to the study of living things*’ (*Science in Primary School*, 2012, p.1, emphasis added). Nonetheless, some elements of the affective domain of learning are mentioned in the introduction to the science curriculum (DES, 1999b) when the promotion of curiosity, care and respect concerning the world around them are discussed in the aims. These values are the opposite of the dominionistic, negativistic and utilitarian ones outlined by Kellert in Table 2.1. This curriculum also promotes a constructivist approach to learning: ‘It involves children in the active construction of their own learning’ (p.3). It emphasises using the locality ‘to provide the starting points for environmental education’ (p.7) so outdoor engagement with nature is encouraged.

In the introduction to the general curriculum (DES, 1999a) children’s spiritual development is discussed. This is developed ‘through the child’s engagement with the aesthetic and affective domains of learning’ (p27). However, in the general objectives and specific aims for science in the introduction the affective dimension of learning is not explicitly mentioned, and neither is outdoor learning. See Section 2.12.7 below for a critique of the affective domain in science in the revised curriculum.

As stated in the previous section nature study was incorporated into the science and geography syllabi under the strands, Living Things, Environmental Awareness, and Natural Environments. (DES, 1999b, DES, 1999d). How then is nature study faring under the combined umbrellas of science and geography? The answer to this question is

attempted by the research which is conducted under the overarching question: what is the state and status of nature awareness, appreciation and education in the primary school system?

Preliminary findings, however, from various reports discussed below suggest that it was not faring well in Irish primary schools. The inspectors in *Science in the Primary School* (2008) commented for example that the majority of principals and teachers assumed that their schools were doing well in the Living Things strand unit whereas evidence from pupils' tasks indicated that it was one of the strands in which pupils' learning was weakest. (Data from pupils' tasks demonstrated that learning in the Strand, Energy and Forces was slightly weaker).

Other disappointing observations from this report concerned the fact that outdoor learning and the use of the immediate environment were not appropriated. The inspectors commented that about one third of pupils did not engage in field-trips. It was obvious too that the pupils were generally not engaged in working in tandem with the seasons which is a fundamental requisite for meaningful nature study. The inspectors reported that only half of school plans referred to seasonal change. (*Science in the Primary School, 2012*). Furthermore, even though many schools were participating in environmental awareness activities through the Green Schools' Project, only 50% had conducted environmental audits of the school grounds and few had bothered to include this important initiative in their plans. Finally, the symbiotic concept of the food chain and habitat had not been grasped by pupils and neither had the fundamental skill of making and using identification keys. (The data in this report is ten years' old and it is quite possible that a higher proportion of schools are now conducting environmental audits).

In another comprehensive report on primary pupils' experience of science which was commissioned by the NCCA, Varley, Murphy and Veale (2008) commented on the lack of outdoor learning opportunities in science provided to children. Summarising their findings,

they commented that even though pupils were enthusiastic about engaging in outdoor learning and having visitors teach them, both occurrences were infrequent. These observations concur with those in the reports of 1986, 1996 and 2008 discussed already.

However, they did add a caveat to the interpretation of the results concerning working outside the classroom, because the research took place between October and February when weather conditions may have had an influence on the data received.

Further to this, the fact that children showed little enthusiasm for learning about insects and mini-beasts could indicate that this learning took place indoors: this researcher can testify from his Heritage in School visits (c.600) that children invariably love mini-beast hunts outdoors and examining species in magnifiers.

Varley et al. (2008) found that children also demonstrated little experience with the strand, Environmental Awareness and Care. This observation too points to a lack of outdoor work though the authors pointed out that children may not have been aware that recycling etc. were science related and they may not therefore have made references to them in the research questions.

2.6 Nature and Science

The teacher guidelines manual of the revised curriculum for science in the Irish primary school state that the strand, living things, ‘absorbs the existing nature study programme’ (DES, 1999c, p. 9). This ‘nature study’ in the previous 1971 curriculum programme (Curaclam na Bunscoile, 1971) embraced the affective domain of teaching and learning somewhat more than in the present curriculum. (‘Affective’ is derived from the Latin word for feelings-*adfectus*). Bloom et al (1956) formulated three domains of learning one of which is the affective domain. The others are the cognitive domain and the psychomotor domain. Of the three domains, the affective one is the most difficult construct to assess because learning outcomes are based on attitudes, values, beliefs, opinions, interests and motivation (Koballa, (2007). In Curaclam na Bunscoile (1971), engagement

with Social and Environmental Studies was expected to ‘cultivate in [the child] ‘a humane attitude to living things’, ‘provide motivation for expressive and creative work’, ‘foster favourable attitudes towards books’. In references to learning about nature there were frequent mentions of the word ‘nature’ and also words that demonstrated an affective and emotional response to it such as ‘unforeseen and exciting happenings (p.15), ‘the discovery of a bird's nest fascinates children’, (p.23) ‘smell flowers’ (p.23), ‘children are fascinated by the moving inhabitants of water’ (p.42), ‘they will be found to talk naturally and with excitement’ (p.49), ‘it [the school garden] fosters an appreciation of beauty and a love of nature’ (p.74). In contrast, the present curriculum (DES, 1999d) takes a more objective, cognitive and functional approach to the study of nature. Examples of cognitive objectives from the third and fourth class (children aged c.9 and 10) science syllabus are: ‘investigate the effects’, ‘sort and group’, ‘use simple keys’ (p. 62). As discussed in Section 2.5 the affective domain of learning gets several mentions in the introduction to the curriculum (DES, 1999a). It also gets some mention in the overall SESE guidelines: ‘it is important that learning activities promote curiosity and enjoyment, so that pupils develop a lasting interest in science’; ‘the curriculum aims to foster positive attitudes to science’ (DES, 1999c, pp 2-3); ‘protect flora and fauna’; ‘identify places that people enjoy’; cultivate...an appreciation of the world according to beliefs and values’ (DES, 1999b, p.5 and pp.90-91); ‘appreciate...beauty and diversity of plants and animals’ (DES, 1999b, p.28). The *Science in the Primary School* (2012) report by the inspectors also alluded to the scientific only value of nature engagement: ‘There was evidence in observation and interview schedules to suggest that many teachers did not fully understand the key differences between ‘nature study’ and implementing a scientific approach to the study of Plant and animal life’ (p.34). (See Kellert, 2002, Table 2.1 above for a broader perspective of nature).

Bonnett (2007) critiquing the science content of the 1999 England national curriculum drew the same conclusion about its content i.e. cognitive objectives are

paramount. He argued that it was based on a very experimental approach in the Francis Bacon (1561-1626) tradition and that '[A] largely analytic / instrumental / invasive rationality dominates' (p.708) 'reflect[ing] a worrying banality, lacking any cognisance of science education as seeking to develop an *appreciation of nature*' (p.708, emphasis in original). This appreciation of nature which was practised by scientists in the past who were known as natural historians would, according to Bonnett, be nowadays classed and belittled by some experimental science enthusiasts as mere 'stamp-collecting' (Bonnett, 2004, p.20).

This 'objectification of nature' (Weber, 2013, p.18) which stems from the rationalistic worldview of The Enlightenment was criticized by Weber in his essay, *Enlivenment: Towards a Fundamental Shift in the concepts of Nature, Culture and Politics*. In this essay, he proposed a new worldview in this era of nature dominance by man (Anthropocene era). He termed his worldview 'enlivenment'. This new approach seeks to explore nature subjectively through channels such as empathy, feelings, and the arts rather than from a dualist perspective of man versus nature.

This subjectivity of nature was also explored by Wohlleben (2015; 2017) when he examined the sociability of trees and how they communicate with each other and how animals display emotional behaviours similar to humans.

In summary, the above authors, Bonnett, Weber and Wohlleben argue for a more subjective approach to the study of nature. To effect this change, learning outcomes for engagement in nature need to have more emphasis on the affective domain of learning so that children's emotions, values and ideas are considered. In the assessment guidelines for science in the new curriculum there is no reference to emotional intelligence and no reference to the fact that there are some aspects of learning that cannot be assessed (DES, 1999b).

2.6.1 The American viewpoint.

The objective worldview of nature as expressed by Bonnett (2007) in the UK was explored by Pyle (2002) from an American perspective. Examining nature study in the school curricula there he asserted that the nature study movement was strong from the mid-nineteenth to the mid-twentieth century. However, he argued that it was replaced by science and mathematics during the second world war and the practice of observation went out of favour. This seems to be a contradictory statement because of course the skill of observation is central to scientific investigation. He probably meant that the naturalist with his/her toolkit of binoculars, hand-lens, notebook etc. closely monitoring all aspects of nature regularly was disappearing. Echoing Bonnett, above, he asserted 'Even the term *naturalist* ...became something of a derogation, implying a soft, non-scientific, and even sentimental approach towards an abstract nature' (p.210).

Louv (2005) too, criticized the functional, outcome-driven approach to nature study in the US when he noted:

Even in the sciences, where nature could play such an important role, the students study nature in a dry, mechanized way. How does the bat sonar work, how does a tree grow, how do soil amenities help crops grow? Kids see nature as a lab experiment. (p.136)

Action verbs in the cognitive domain of learning such as identify, recognise, construct, investigate etc. demonstrate 'the functional outcome-driven approach to nature' predominate in the learning objectives in the strand unit, Plant and animal life, in the science syllabus of the revised curriculum (DES, 1999b).

2.6.2 Science v Scientism.

Answering criticisms relating to his nature-science stance Bonnett (2013) endeavoured to point out, that he was not anti-science when it came to interpreting nature. Conversely, he favoured science for contributing to actively caring for nature. He did,

however, emphasise that he was opposed to *scientism* which is instrumental in its approach and dominated by ‘the metaphysics of mastery’ (p.195). According to him this rationalistic, exploitative, anthropocentric perspective is also reflected in education in general where schools are subjected to ‘the ascendance of pre-specification, modularisation and managerialism’ (p.195) and this had negative implications for the study of the physical world. Instead, he argued we should ‘experience nature as the transcendent other that warrants respect and possesses inherent intrinsic value’ (p.194) and that this normative experiencing of it in a personal, intimate way will bring arts and poetry into relevance. This approach mirrors the symbolic, humanistic and aesthetic values of nature that Kellert described above in Table 2.1.

2.6.3 Nature, and the Science Foundation Ireland (SFI) Discover Programme and STEM.

The Discover Science and Engineering programme (DSE) (now the SFI Discover Programme) was initiated by Forfás, the national policy advisory body for enterprise and science in 2003. In a review by Discover Science and Engineering (2009), *An Evaluation of Discover Science and Engineering*, conducted by an international panel and sponsored by Forfás⁷, the aims of the programme were outlined: ‘to promote an awareness and understanding of the importance of science and engineering in a modern-knowledge-based economy’ (Discover Science and Engineering, 2009, p.7). The emphasis throughout the document is on the physical sciences with no mention of nature, living things or environmental awareness. It could be suggested from this report that the DSE’s *raison d’être* is to promote science in education to service industry, job creation, innovation, enterprise and economic growth. This rationalistic, marketisation approach is complemented by its underlying mathematical bias: ‘...The DPS programme should be

⁷ This board was established in Ireland in 1994 to advise on the government on trade, enterprise, technology, innovation and science. do

revised so that it repeatedly demonstrates the importance of mathematics and measurement' (p.47).

Nonetheless, the Science Foundation Ireland (SFI) Discover Science and Maths Awards do promote outdoor learning in nature to some extent and teachers and students are invited to submit projects under the strands, Living Things and Environmental Awareness and Care. However, the resources on nature in the toolkit section are minimal and omit the most valuable nature education websites such <https://www.opalexplornature.org/learning>, www.naturesweb.ie, www.treecouncil.ie, <https://www.woodlandtrust.org.uk/naturedetectives> and www.biodiversityinschools.com. Four of these are Irish-based. The resources in the toolkit section also direct teachers to www.greenwave.ie which is no longer active for citizen scientists to submit records. The spotter's section on this site is useful for engaging with nature. However, the best method for observing the growth and activities of tadpoles is to have them in an aquarium in the classroom: this is not suggested.

In DES (1999c) it is suggested that 'an equal emphasis... [be placed] ...on the study of living things, forces and energy, materials and environmental awareness' (p.7). However, a physical science/natural science imbalance in the SFI materials for the primary science classroom is reflected in the fact that of 96 activities listed for teaching and learning six are devoted to plant and animal life in which the following topics are investigated: growing tomatoes (a surprising activity considering how difficult it is to grow them from seed and harvesting occurs during the summer holidays), how plants drink, fruit, making a bird feeder, and starch in plants. It could be argued that this amount of resources is a fair distribution considering that there are 12 units in the science curriculum (DES, 1999b). However, a counter-argument would suggest that there is an imbalance and that the physical sciences are privileged over the natural sciences. (Four of the strand units relate to the natural sciences). Contrast this paucity of input on the natural world with the

English Department for Education and Skills (DfES) revised curriculum (2013) in science where there is a strong focus on plants and animals across all classes. Cutting and Kelly (2015) analysing the science content found that over half the content was biology orientated.

The predominance of biology as a science subject in the post-primary sector in Ireland is viewed as problematic by the STEM⁸ Education Review Group (2016) because there is a higher engagement with biology at second level than with the physical sciences. In their report they rightly expressed concern about what they perceived as the low level of knowledge and understanding of the physical sciences amongst pre-service teachers. Nonetheless, the authors of this report promote physics and chemistry as well as engineering and mathematics to provide a technically orientated workforce to sustain economic development in the future rather than promoting them for the development of the student.

In this report but also in other reports and policy-papers, STEM education is prioritised in the Irish educational system: *Action Plan for Education*, (DES 2016a), *Ireland's National Skills Strategy 2025* (DES, 2016b), *Digital Study for Schools 2015-2020* (DES, 2015), *Arts in Education Charter* (DES, 2012), *National Strategy: Learning and Numeracy for Learning and Life* (DES, 2011a), *STEM Education in the Irish School System* (DES, 2016c), *STEM Education Policy Statement 2017-2026* (DES, 2017b). This emphasis in reports on STEM education is not a problem in itself and in the increasingly technological world which students face it should be applauded. A problem arises, however, if other area of learning such as nature, poetry, art, drama and music are not equally prioritised for this changing world.

⁸ STEM: Science, Technology, Engineering and Mathematics. STEM education promotes these subjects in schools as they are viewed as necessary for supporting a knowledge-based economy.

It could be argued for example, from examining these reports, that emphasis on the physical sciences rather than the biological sciences promoted by the DES, DPS and STEM presages poorly for a re-emphasis on nature education in the primary system in the future. ‘The promotion of STEM learning within our education system is a key priority for the Department’ (DES, 2017b, p.7). As outlined in 2.18 this promotion should be viewed as a positive factor in educational policy if it encourages questioning, thinking and observational skills across the curriculum. A problem arises when STEM learning is promoted, especially at primary level, for future economic growth and not whole child development. A stated aim such as this one could be criticized for its narrow focus: ‘We need a national focus on STEM education in our early years settings and schools to ensure we have an engaged society and a highly-skilled workforce in place’ (DES, 2017b, p.5). STEM education focuses on science, technology, maths and engineering and develops creativity and thinking skills in students. It also incorporates the natural sciences such as biology and zoology and engages in activities to address environmental issues. These are positive aspects of STEM. However, educators, among whom should be counted those committed to nature-education and the humanities, who favour a more holistic development of the child could argue that some of its objectives are overly centred on the production of human capital to serve a future economy (McGuire, P., 2008).

2.7 Nature and Well-Being

In this section, literature relating to engaging with nature and its contribution to mental and physical health, particularly children's, is explored. (The topic receives further examination in Section 7.5.1.1). Bird (2007), summed up the three theories associated with nature restorative processes as (a) Biophilia (b) Attention Restoration Theory (ART) and (c) Psycho-physiological Stress Recovery Theory. The genesis of the first theory, biophilia, is often erroneously attributed to Edward O. Wilson who wrote the seminal book, *Biophilia*, in 1984. Gunderson (2014) discussing the theory clearly ascribed it to Erich

Fromm (1900-1980), who first used the expression in 1964, twenty years before. Wilson (1984) described it ‘as the innate tendency to focus on life and lifelike processes’ (p.1). His proposition for mental development was based on the biophilic propensity of humans to affiliate and understand animals and plants and that this affiliation would cause us to grant them greater value and in consequence grant greater value to ourselves. The opposing theory, biophobia, is related to a fear of nature which is ingrained in humans since they were hunters and gatherers and was beneficial for their survival. Increasing distancing of humans from nature due to technological advances resulting in decreasing biophilic tendencies is seen as a contributory factor to degradation of the natural environment (Rogers, 2018).

2.7.1 Attention restoration theory (ART).

This theory was formulated by Stephen and Rachel Kaplan in the 1980s (based on the voluntary/involuntary attention theories of the psychologist and philosopher, William James (1842-1910) and developed from their notion of ‘directed attention’ (Kaplan and Kaplan, 1989, p. 179). Directed attention resulting from mental concentration causes fatigue after a while, but this can be relieved by a process entitled ‘soft fascination’ (Kaplan, 1995, p.172; Kaplan and Kaplan, 1989, p.192). Nature is effective in providing this involuntary attention or soft fascination and restoration is generated by the lowering of fatigue which was initially caused by directed attention. They demonstrated that it is not only fascination in nature that causes restoration in the brain but also being away from routine in a natural setting, being able to explore even a small natural place that is deceptively created to look larger and taking part in activities in nature such as hunting, walking, observing wild animals in such places as zoos, gardening and engaging in survival skills. Kaplan and Kaplan’s attention restoration theory (ART) has implications for nature education in that it would be an antidote to indoor concentrated cognitive

teaching and learning. (This researcher has often witnessed increased attention to learning indoors after short encounters outdoors engaging with nature).

An example of the relevance of ART and the relief of stress is found in the poem 'Dust of Snow' by Robert Frost (1874-1963). A moment of fascination in nature is encountered when a crow shook snow from a hemlock tree on him. This event caused him to have 'a change of mood /and saved some part/ of a day I had rued'. (Lathem, 1969). (The notion of ART is explored further on (2.7) in relation to the work of Faber Taylor and Kuo (2009) and their research into the potential of nature for alleviating ADHD).

2.7.2 Nature and the relief of stress through visual encounters.

In 2.7.1 the Kaplans' exploration of (ART) which benefits cognition is discussed; in contrast their former student Roger Ulrich formulated a theory on the effects of nature on stress reduction which he called stress reduction theory (SRT). This ultimately benefits cognition as with the Kaplans' theory (Williams, 2017).

Ulrich (1984) perceived in his research on patients recovering from cancer that those who were afforded the opportunity to observe trees through a window in the hospital recovered faster than those who only had a view of a brick wall. In a similar study, (natural window-view versus a non-natural view), Benfield, Gretchen, Bell and Donovan (2015) researching 567 first year College students subjected them to working in classrooms with views of nature and views of concrete. They found that the students with the nature views achieved higher grades, were more positive in their evaluation of the course and displayed lower stress levels. However, it had limitations in that the study was not also undertaken in winter when the natural views were less attractive. Furthermore, all the participants were enrolled in one course in one academic discipline and not in diverse courses in diverse disciplines.

The beneficial effects of nature for reducing stress was further researched by Ulrich et al (1991) when they compared the reactions of 120 stressed individuals in both urban

and natural environments using physiological measures like testing pulse and blood pressure and verbal measures such as patients relating how they felt. The convergence of data from both these measures added to the reliability of the test results and the findings demonstrated that the natural settings were more effective than the urban ones in reducing stress.

Similar tests such as the above by Ulrich were conducted by Tyrväinen et al (2014) in Finland when they studied the psychological and physiological effects on 77 workers after short walks in three settings: urban woodland, urban park and urban built-up area. Their tests confirmed that even short exposures to nature had beneficial effects on well-being.

Roe et al (2013) using cortisol as a biomarker found that stress levels were reduced in people living in deprived areas when they were exposed to green spaces. Roe, Aspinall, Mavros & Coyne (2014) investigated the lowering of brain fatigue of people walking in green spaces by using EEG recordings, found positive result of their analysis they advocated more green spaces in urban settings to counteract stress.

Forest Ecotherapy likewise relies on sensory walks in woodland settings for restoring healing. Gleeson (2013), researching this phenomenon stated that this ecotherapy affects in a positive way a person's physical, psychological and social health and contributes such healing effects as reduced stress levels, blood-pressure and heart rates. It also contributes positively to a person's capacity to recover from surgery and engage in restful sleep. In Japan this forest therapy is referred to as *shinrun yoku* or forest bathing where relaxation is attained by opening all the senses to nature in one of the 48 forest therapy trails in the country (Williams, 2017).

This research on the beneficial effects of people's engagement with nature in natural settings, especially woodlands, has relevance for nature education and demonstrates a need for providing opportunities for children to interact with woodland settings either on their

own school grounds or near the school. This researcher has experience of watching children interact in a small woodland setting in the primary school where he once taught. Every day at lunch time children queued up to sit on log seats in the mini-wood to avoid the noisy playground and interact with each other in a peaceful setting. Their interest in sitting in the wood never waned. What else besides conversation did they find there when they opened all their senses to their natural surroundings?

2.7.3 Nature and the relief of stress through auditory encounters.

The research on stress reduction mentioned so far used visual encounters in natural settings as a research variable. In contrast to this methodology, Alvarsson, Wiens, and Nilsson (2010), used auditory stimulation on 40 subjects after a stress induced task to ascertain whether this would have a similar effect. Using physiological measures similar to Ulrich et al they corroborated the results from the nature settings. This research has implications for children's well-being in that bringing them outside to listen to the sounds of nature, perhaps with their eyes closed, could have a beneficial effect.

Finally, Keniger, Gaston, Irvine & Fuller (2013) examining 57 peer-reviewed papers on the effects of human interactions with nature in six settings ranging from indoor ones to outdoor urban and wilderness ones found that it had beneficial effects such as increasing self-esteem, spiritual awareness and general well-being and reducing anger tendencies.

These findings further emphasise the fact that children need to be exposed regularly to natural settings to enhance not alone their cognitive development through nature education in these places but their overall mental, physical, spiritual and aesthetic development as well from contact with greenery. Greening school grounds would facilitate this engagement to some extent. See Section 2.11 for more on the greening of school grounds.

2.7.4 Nature and the relief of stress in children.

Furthermore, looking at research through the psychological benefits' lens Keniger et al. were interested in mental well-being benefits of exposure to nature on children especially that conducted by Maller (2009) in an Australian context. If exposure to nature enhances adults' psychological and physical health and their cognitive functioning would it have the same effect on children? She found a positive impact on children's self-esteem and mental well-being from nature-based curriculum activities. These activities also increased their enjoyment of attending school and gave them a sense of empowerment. However, the qualitative data received was based on school principals', teachers' and parents' perspectives and she concluded that there is a need for more objective investigations to validate her claim that hands-on contact with nature support children's emotional, social and mental health.

In an Irish context, there seems to be little emphasis placed on the benefits of nature on well-being in the Department of Health (2013) report *Healthy Ireland: A framework for inspired health and well-being 2013-2025*. The only reference to nature and well-being in this report is on p. 49: 'Amenities such as forest parks provide opportunities for recreation and our understanding of the environment thus supporting healthier lifestyles while contributing to our well-being'. In the DES/HSE/DOH (2015) *Well-Being in Primary Schools* report there is a mention of 'Plants and Trees' when a description is being made of the physical environment of schools (p.15). However, at no stage are there recommendations for engaging with these plants and trees and in the ten activities that schools could undertake to promote well-being there is no mention of engaging children with nearby nature or further afield. The SESE curriculum receives no mention as a possible support for children's well-being. These could be considered omissions because much research, (as outlined above in Section 2.6.3), highlights the importance of engaging with natural surroundings for enhancing mental, emotional and physical health. On a

positive note, however, pupils' well-being as well as their spiritual and aesthetic development) are mentioned in the *introduction* to the revised curriculum (DES, 1999a) but these attributes are not explored to any great extent in the science and geography curricula (DES, 1999b, 1999c;1999d;1999e).

2.7.5 Limitations to research on stress reduction.

The interactions in the studies conducted by Keniger et al (2013) above, ranged across three typologies from *indirect contact* with nature e.g. looking at nature in a picture such as in the study above, to *incidental contact* e.g. encountering nature on route to work, to *intentional contact* e.g. deliberately diverging from routine such as gardening to engage with nature (emphases added). Nonetheless, they urged caution in interpreting these positive results mainly because the studies were conducted in western societies only, so results may not be universally valid and may indeed be only relevant to western cultures. Also, because the research was conducted by people involved in the social sciences there was no contribution from experts in biological and environmental sciences. Therefore, their valuable perspectives were missing.

These scientists could not provide answers to the unexplored question: which types of 'nature' produce the most positive effects? Could biodiversity richness for example be the most important variable in producing positive psychological responses? They also stated that most of the research was gleaned from self-reporting questionnaires and sampling bias could have had an impact on results. Another limitation to the extensive research examined was the fact that it was generally conducted over short periods of time; consequently, there is a gap that needs to be filled with more longitudinal studies to assess the long-term benefits of interacting with nature. Finally, they concluded that much of the research was conducted without proper control groups so confounding variables could have affected the results.

Nonetheless, taking all these reservations into account in the comprehensive review of Keniger et al (2013) and of others cited above such as the Kaplans, Ulrich, Roe et al and Gleeson who researched the benefits of contact with nature on well-being and cognitive development there is mounting evidence that the provision of nature-education in natural settings will enrich the lives of students.

2.7.6 Concluding remarks on nature and stress-reduction.

Keniger et al (2013) discovered that of the 57 papers examined by them most beneficial effects were in the psychological domain. Papers addressing the physiological benefits from interacting with nature came second in the reviewed studies followed by *papers relating to cognitive and social benefits.*

They interpreted physiological effects as having positive effects on reducing stress, blood-pressure, cortisol levels, headaches, mortality rates, cardiovascular and respiratory diseases and occurrences of illnesses. Psychological effects included increased well-being due to reduction in stress levels and increased levels of concentration.

Bird (2007), in contrast, explored the alleviation of mental stress not through the nature connection lens but through a place-based lens: he attributed a sense of belonging to a place as a contributor to good mental health. The concept of a sense of place is discussed later in this chapter in 2.15.4.

It has to be speculated, therefore, why the Department of Health (2013) report *Healthy Ireland: a framework for inspired health and well-being 2013-2025* and the DES/HSE/DOH (2015) report *Well-Being in Primary Schools* did not advocate the compulsory greening of school grounds both in primary and secondary schools to provide students with indirect, incidental and intentional (nature education outdoors) contact to nearby nature. Is it because the authors did not acknowledge the value of interaction with nature for increasing children's well-being after reading the research? Or is it because they were not aware of this research?

2.8 The Effects of Engagement with Nature on Children with Attention Deficit Disorder (ADD) and Attention Deficit Hyperactivity Disorder (ADHD)

The beneficial effects of exposing children with ADD / ADHD symptoms to nature has been explored in three papers by Faber Taylor, Kuo and Sullivan (2001), Faber Taylor and Kuo (2004), Faber Taylor and Kuo (2009) and Faber Taylor and Kuo (2011) and a paper by van den Berg and van den Berg (2011). In the 2001 paper Faber Taylor et al explained these acronyms as relating to deficits in certain children's diagnosed capacity to focus their attention in general. ADHD has an added dimension however: as well as the inattentiveness associated with ADD, children with this disorder exhibit impulsive and hyperactive tendencies. In the 2011 paper they described children with ADHD performing poorly in school and in social interactions with peers and within their families.

As stated already, their work was based on the Attention Restorative Theory (ART) developed by Kaplan and Kaplan (1989). The latter recognized that voluntary or directed attention can lead to fatigue and that involuntary attention (such as being attracted by something fascinating in the environment such as a beautiful sunset) can produce restfulness which helps the mind to focus again. This phenomenon has also been explored by Cimprich (1992,1993), Hartig, Mang & Evans (1991), Tennessen and Cimprich (1995).

Faber, Taylor et al (2001) in their first qualitative study focused on the question: do activities in green settings outdoors support attentional functioning and consequently cognitive functioning in children with ADD? From the data gleaned from 96 questionnaires from parents of children with ADD in midwestern USA they concluded that these children did indeed improve their attentional capacities and consequently lessened their ADD symptoms after leisure activities in green spaces outside the home thus corroborating Kaplan and Kaplan's theory of attention restoration. Curiously, they found no significant link between reduced symptoms for boys and the availability of green home-spaces; there was evidence of reduced symptoms for girls. (Nonetheless, reduced

attentional symptoms for the non-ADHD population in green-spaces around the home were investigated by Wells (2000) who found that interactions with green settings were effective for increasing cognitive functioning for both genders). In this comprehensive longitudinal study of 2,415 low-income families using a nationally validated test entitled the Attention Deficit Disorder Evaluation Score (ADDES) Wells summed up her findings: 'This exploratory study suggests that the effects of natural elements within the home environment have a profound effect on children's cognitive functioning' (p.790).

Van den Berg and Van den Berg (2011) also found that ADHD children's concentration improved in a wooded setting in comparison to an urban one, but their study was limited by only having 12 children participating. There were limitations to the research conducted by Faber Taylor et al (2001) as well. The children were all severely affected by ADD; their parents were relatively wealthy and living in green areas; the research was survey-based and the results were gleaned from parent reports of a small sample; the study took place in one region in the US; the period in which the study was conducted was short and was in one season; because of the co-relationship nature of the research causality could not be verified for certain. A more experimental approach would be needed to address this.

Some of the limitations relating to this study were addressed by Faber Taylor and Kuo (2004) when they addressed the question: Are green activities better than activities conducted in other settings in reducing the symptoms of ADHD? The sample was much larger, 432 instead of 96. Household income, children's age range, community type, region, and case-severity varied greatly. Their findings indicated that green outdoor activities had a very positive effect on reducing symptoms of ADHD across children from a wide range of family backgrounds and severity of case.

It would seem then from these studies that engaging children from lower-income families and those with ADD and ADHD is beneficial for their cognitive development

(increased attention spans) and lessening the symptoms of the two disorders. Green school grounds would greatly facilitate this engagement.

2.9 Nature, Children and the Outdoors- Positive Consequences of engagement

As discussed further on in the paragraphs on school gardening and design of school grounds (Sections 2.11.1; 2.11.2) the research demonstrates that there is very limited interest from relevant government departments in Ireland on the importance of outdoor learning for children (DES, 2013; DES/HSE/DOH, 2013; DES/HSE/DOH, 2015; DES, 2016; DES, 2016c; Kilkelly et al, 2016; DES, 2017b).

In contrast, the Department for Education and Skills (DfES) and The Office for Standards in Education (Ofsted) in England have actively and robustly encouraged this aspect of teaching and learning in their schools. Ofsted (2004), Ofsted (2008), DfES (2006), O'Donnell, Morris, & Wilson (2006), and Waite (2010, 2013) all concurred on its importance for children's' development. Ofsted (2008) reported from its research that it raised standards significantly and contributed to the social, personal and emotional development of pupils. This finding echoes the many positive findings of the more detailed DfES (2006) report which provided 12 positive outcomes for Learning Outside the Classroom (LoTC). These are demonstrated in Table 2.2 below and many echo Waite (2013) who cited evidence to show that learning outside the classroom contributed to making children more active, healthier, more engaged, more motivated, more capable of managing risk and more skilled.

John Dewey (1859-1952), the education reformer and pragmatist was an advocate of outdoor learning equating it with his progressive theory of education which called for real-life experience in the local environment. 'The teacher should become intimately acquainted with the conditions of the local community, physical, historical, economic, occupational...in order to utilize them as educational resources' (Dewey, 1938, p.40). Dewey's comment relates to place-based education which is explored below in 2.15.4)

In the revised curriculum exploration of the local environment is promoted throughout: ‘the child’s immediate environment provides the context for learning’ (DES, 1999a, p.8); ‘The locality will provide the starting points for environmental education’ (DES, 1999b, p.7)

Table 2.2

The Educational Benefits of Learning Outside the Classroom

Benefits	
Learning	Improve academic achievement
Learning	Provide a bridge to higher order learning
Skills	Develop skills and independence in a widening range of environments
Learning	Make learning more engaging and relevant to young people
Environmental Carers	Develop active citizens and stewards of the environment
Creativity	Nurture creativity
Informal Learning through Play	Provide opportunities for informal learning through play
Behaviour & Attendance	Reduce behaviour problems and improve attendance
Motivation	Stimulate, inspire and improve motivation
Life Skills	Develop the ability to deal with uncertainty
Life Skills	Provide challenge and the opportunity to take acceptable levels of risk
Attitude to Learning	Improve young peoples’ attitudes to learning

Note. Learning Outside the Classroom Manifesto (2006 p.3, Modified)

The beneficial effects on subsequent classroom engagement of students of learning in nature was examined by Kuo, Browning & Penner (2018) and their findings echoed some of those in Table 2.2, especially the effects this outdoor learning in nature had on students’ cognitive development, motivation and directed attention on other curriculum subjects after the outdoor engagement. They argued that their results demonstrated that contrary to general expectation that this outdoor nature would make the students hyper-active in class afterwards, it had the opposite effect and made them more engaged with subsequent indoor learning. This study has implications for student-learning in both primary and secondary schools. If students concentrate better and interrupt less indoors after working outdoors on

nature lessons, a case could be made to provide more nature-based lessons outdoors during the school week to enhance their general cognitive development.

2.9.1 Nature, children and the outdoors: negative consequences of non-engagement.

As discussed below (Sections 2.11 and 2.11.1), there are distinct benefits to children's cognitive, emotional, social, and physical development as they engage in learning on the school grounds. Engagement with nature provides a platform for outdoor learning and will counteract somewhat Louv's 'nature-deficit disorder' (Louv, 2005).? 'Nature Deficit Disorder describes the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses' (p.34).

Lack of engagement with the outdoors often emanates from the children's homes as demonstrated by *The Growing Up in Ireland Study* (2009). This comprehensive nationwide examination of the lives of 8,568 nine-year-old children found that 45% of them had a TV in their bedroom and 35% had a video/DVD player. Two thirds of them usually viewed between one to three hours of TV per day and 10% watched three hours or more. These figures compare favourably with British and US children and demonstrates that children in Ireland are not unique in the amount of time they spend indoors watching TV and subsequently less engaged with the outdoors.

The National Trust (2012) reported from empirical studies that children in Britain watched over 17 hours of television a week: that equals to nearly 2.5 hours a day. (This amount increased by 12% since 2007). In the US, Nielson (2009) reported that children's TV viewing was at an eight-year high with 2-5-year olds spending 4 hours a day viewing and children 6-11 spending 4 hours a day viewing. *The Growing up in Ireland Study* (2009) further revealed that only three-percent of Irish children were involved in Scouts' or Girl Guide activities. Eight-percent were involved in after-school clubs, but it was not

specified if outdoor activities were involved. Seven percent were involved in youth clubs. Again, it was not specified if they were engaged in outdoor activities. Eighty-four percent were involved in organised sports' clubs.

These figures demonstrate that Irish children devoted a substantial amount of their day to watching TV or playing video games in 2009. In this *Growing Up in Ireland Study* (2009) there was no mention of outdoor nature activities such as walking and playing in woods, parks and gardens, gardening, fishing, camping, etc. The finding that only three-percent were involved in Scouts/Guides indicated a low engagement with outdoor nature. Outdoor nature, which is so important for children's development, received no mention in this major and important study. Even when the authors suggested that schools can play their part in encouraging out-of-class activities such as organised sports, drama etc., engagement with nature is not mentioned. In sum, the study regrettably missed an opportunity to ascertain how much and how often Irish children engage with nature outdoors.

Following on from the recommendation from *Growing Up in Ireland Study* (2009) that children should be encouraged to engage with sport, drama etc. outdoors it is interesting to note that in relation to *physical activity* Irish schools scored a D in 2016 in an international study of physical activity for children and youth (The Global Matrix 3.0 on Physical Activity for Children and Youth, 2016). In this study, children's physical activities in 38 countries in six continents were examined under eight criteria: Overall physical activity, participation in organised sport, active play, active transportation, sedentary behaviours, family and peers, school, community and built environment and government strategies and investments. Ireland also scored a D in overall physical activity, and active transportation. Regular outdoor engagement with nature would help to increase children's physical activity and scores in future studies.

In the *Growing Up in Ireland Study* (2011), obesity was examined in nine-year-old children. The above evidence of substantial sedentary lifestyles among them could contribute in no small way to the discovery that 20% of them were overweight and 7% obese. Again, regular outdoor engagement in nature and with nature would help to reduce these percentages.

Physical activity helps to reduce obesity and the engagement of children in nature activities outdoors on a regular basis would facilitate this effect. A survey by the National Trust in England, *Reconnecting Children with Nature* (2012) outlined six barriers to outdoor education in nature. These ranged from health and safety concerns, increased indoor entertainment (echoing the discussion in Section 2.10.1), traffic-danger, a lack of time and space in school settings, diminished access to natural environments to ‘socio-economic and cultural values (p.3). The only one of these barriers that affects engagement with outdoor learning in the school grounds is diminished access to natural environments and this is a barrier that can be overcome by school planning, integration of curricular subjects, provision of resources by the DES, teacher and student-teacher training and holistic school design.

2.10 Nature and School Grounds

Louv (2005) advocated using school grounds with a variety of habitats to promote children’s imagination and creativity. Referring to Nicholson’s (1971) loose parts theory which is based on the idea of a toy with interchangeable parts which can be used in many ways he suggested that a list of ‘loose parts’, (p.87), could include a variety of plants, a wildlife pond, sand, places for sitting in, on, and under, structures that facilitated views and privacy. Many schools do not have grounds with these ‘loose parts’ for children to engage with nearby nature either formally or through unstructured play. Neither is there an urgency to create them in school design (See Section 2.11.2)

In this canon of ‘loose parts’ he could have been more comprehensive by mentioning vegetable beds, compost bins, leaf mould heaps, grow bags etc. which some schools have, and which children use when they are engaged in nature and school gardening outdoors. School gardening is discussed in the next section.

2.10.1 Nature and School gardening.

School gardening remained off the curriculum menu for 37 years until it was reintroduced into the 5th and 6th class syllabus in the new curriculum of 1971. (An Roinn Oideachais, 1971). (The whole content of this curriculum was contained in two teachers' handbooks). It entailed ‘Cultivation and care of flowers and shrubs in school garden. Care of school lawn. Vegetable plot. Fruit trees’ (p.58). Some of the positives listed for having a school garden included ‘[fostering] an appreciation of beauty and a love of nature’ (p.74). It also promoted cooperative learning, integration with measurement in Mathematics, learning about pests and fertilisers, identification of common weeds and experimentation on soil, fostering of pride in the school and its surrounds. No in-service training was provided for teachers and no funding towards the construction of gardens, purchase of seeds and maintenance. As a result, school gardening remained a sporadic activity under the new curriculum.

In 1999, in the revised curriculum there was a marked increase in the number of books required to hold its content-23, instead of two. However, there was a marked decrease in the number of words and space used to describe school gardening activities.

In the science syllabus for first and second class ‘developing a school garden’ was mentioned (DES, 1999d, p.48). In third and fourth classes, the pupils were encouraged to ‘protect flora and fauna, e.g. by creating and maintaining a school garden (p.69). In fifth and sixth classes pupils had to learn about ‘[protecting] flora and fauna, such as creating a wildlife area and planting trees’ (p.91). The *Teacher Guidelines Handbook Science*, (DES, 1999c), offered limited advice on growing in and maintaining a school garden. In infant

classes children could be ‘planting seeds and bulbs’ (p.10). In the section on outdoor learning there was no mention of school gardening. Likewise, in the section on plant processes there was no mention of gardening. The final entry on school gardening appeared as follows: ‘Children should be encouraged to participate in projects to enhance the school and its environs. These might include planning a school garden, creating a wildlife area, planting trees’ (p.131).

Varley et al (2008) in Section 6, Conclusions, Recommendations and Next steps of their report, did not mention the potential of using school gardens for hands-on science enquiry. Summarising the outdoor dimension of science, they observed that outside the classroom pupils were mainly focused on learning about animals with very little plant-learning taking place. The references to plants gave no indication of scientific enquiry, affective or systematic learning because pupils merely stated that they planted bulbs or went outside to pick potatoes.

In the report *Science in the Primary School* (2012) inspectors made no references either to the potential of school gardening for scientific enquiry and holistic learning.

Nonetheless, school gardening began to thrive after the introduction of the revised curriculum in 1999 and this fact seems to be borne out by the following timeline of modern school gardening in the Irish Republic (Unfortunately, no figures are available to outline how many schools are gardening):

- 1985: First school wildlife garden in Ireland was established in Scoil Treasa, Donore Ave., Dublin.
- 1996-1998: Blackrock Education Centre initiated the ‘Gort Project’ under the direction of Marian Rollins. It was sponsored by An Bord Glas. The aim of this project was to establish 150 school gardens around the country and to train teachers how to use them for educational purposes. Two videos were produced for primary

schools on school gardening: (a) *All About Plants with Gerry Daly* and (b) *Down to Earth: Setting up and using school gardens*

- 1996: *Go Wild at School* published. Reprinted 1999 and 2011.
- 2001-2003: The Irish Christian Brothers initiated the *Hope Project*. The aim of this project was to create school gardens in all the Christian Brothers' Primary schools in Ireland.
- 2004: *The School Garden: What to do and when to do it* was published. This was based on the School Gardening module which was initiated in MIE in 2002. This book was reprinted in 2007 and is currently out of print.
- 2008-2009: An Bord Bia created a DVD on school gardening entitled, *Organic Gardening for Primary Schools*. They also published online information sheets on the topic. *The Year-Round Organic School Garden* was published by Kerry Earth Education Project and Irish Seedsavers. Incredible Edibles, an initiative to promote healthy eating and the growing of fruit and vegetables in primary schools was established by Agri Aware.
- 2010 - 2011: Blackrock Education Centre commissioned 60 short videos instructing teachers on all aspects of school gardening. See <http://www.blackrockec.ie/content/environmental>
- 2010: SEED (School Earth Education) was founded. The aim of this organisation is to promote school gardening in all schools on the island of Ireland. See www.schoolearthed.ie
- 2010-2017: SEED, sponsored by An Bord Bia created school gardens at the Bloom Garden Festival.
- 2010-2014: The INTO commissioned 40 articles on nature and school gardening by this researcher.

- 2013: SEED members organised the first school gardening conference in Ireland in MIE. SEED organised additional conferences annually from 2014 to 2019.

All of these initiatives indicate that in the last ten years school gardening is establishing a high profile within the primary school educational landscape. They also indicate tentatively that a higher percentage of children are engaging in practical activities outdoors through gardening.

Cutting and Kelly (2015) in their book *Creative Teaching in Primary Science* saw value in school gardening for teaching science. Advocating the use of a school garden for teaching the subject they suggested: 'A school garden (or a few bags, or pots) is probably one of the greatest single teaching resources in primary science in terms of potential for science teaching' (p.120). Blair (2009) initially investigated this science-gardening connection and found a positive correlation between those who engaged in gardening and high science scores.

Furthermore, Blair (2009) declared: 'Over the last 20 years, school gardening has become a national movement' (p.15). She cited several initiatives in the US which focused on elementary schools. In a comprehensive review of the quantitative and qualitative literature in the US on this topic she found that the quantitative studies demonstrated positive results for science achievement and on food education, nutrition and behaviour. However, these studies were unable to prove that school gardening had positive results on behaviour and attitudes towards the environment so more quantitative studies are needed to explore this dimension of gardening further. On the other hand, the qualitative studies demonstrated a wider array of positive outcomes particularly in the fields of social and environmental behaviour. She also found that enthusiasm for gardening among teachers depended on support and gardening confidence.

However, she found major flaws with the research conducted because of a lack of a body of longitudinal studies to gather more complete pictures, teacher bias, especially in

case study research, lack of rigour in sampling and assigning control and experimental groups and faulty testing instruments. The sample groups were mainly from children in third to sixth grades with hardly any studies undertaken on high school students and younger elementary students. As a way forward, she suggested that as well as addressing the flawed research methodologies already mentioned, researchers in the future should concentrate on qualitative studies of successful school gardens, failed garden experiments and gardens that are creatively managed so that teacher workload is reduced. Finally, she was interested in qualitative longitudinal research that measured the long-term effect of students' positive environmental attitudes brought about by school gardening. In sum, despite the drawbacks encountered in the US studies on school gardening reliable evidence was found to demonstrate that school gardening has positive effects on children's science achievements and their food and nutrition education.

In the UK, similar to the US, there have recently been many initiatives to promote school gardening. These include: *Growing Schools Garden*, *Duchy Originals Organic Gardens for Schools*, *Morrison's 'Let's Grow campaign, Get Your Hands Dirty'*, *Jamie Oliver's Kitchen Garden Project* and the *RHS's Campaign for School Gardening*.

In 2007, the Royal Horticultural Society (RHS) launched *The Campaign for School Gardening* nationally to (a) encourage all schools to get growing, and to acknowledge the right of every child to get involved in gardening, (b) demonstrate the value of gardening in enriching the curriculum, teaching life skills and contributing to children's mental and physical health, (c) convince everyone involved with education in schools of the value of gardening in developing active citizens and carers of the environment and (d) show how gardening can contribute to a sustainable environment. National Foundation for Educational Research (NFER, 2010). Were these objectives achieved?

An NFER, (2010) study evaluated how this school gardening initiative impacted on learning and behaviour in children and on their health and well-being. They approached the

task in two ways: 1. A desk study analysis of data on participating schools (6,235 schools). 2. An in-depth case-study analysis of 10 participating schools which were representative of ‘size, attainment and deprivation indices’ (p.51). They found that involving children in school gardening generated the following positive outcomes: enhancement of literary, numeracy and oracy skills, greater seasonal awareness, greater understanding of how food is produced and healthy food options, an increase in their confidence, resilience and self-esteem levels, development of their physical skills, emotional well-being, sense of responsibility and good behaviour.

However, there were several problems connected with the methodology and conclusions. The research was initiated only a year after the campaign began-surely not enough time to properly evaluate the impact of the *Campaign for School Gardening*. The majority of the schools in the desk-analysis were from affluent areas and areas and had relatively less issues with health and deprivation problems. Longitudinal research would be necessary to properly evaluate the impact of school gardening on all the positive outcomes listed above.

Nonetheless, this research indicates that school gardening is a worthwhile activity to promote with children to achieve a broad spectrum of ‘cognitive, affective, behavioural, physical and social and interpersonal outcomes’ (NFER, 2010, p.6). Passy and Waite (2013) exploring the potential of school gardens in outdoor learning added an emotional element to these learning components in which children gain a sense of achievement from growing vegetables.

In contrast to the US and UK, school gardening initiatives in Ireland are nearly non-existent apart from those initiated by Bord Bia,⁹ SEED (School Earth Education),¹⁰ voluntary individuals, gardeners working for the HS scheme and Grow It Yourself (GIY).¹¹

⁹ Irish Food Board.

¹⁰ SEED: www.schoolearthed.ie A voluntary organisation founded in 2010 which promotes school gardening in Ireland.

¹¹ A not-for-profit organisation founded in 2008 to support people in growing their own fruit and vegetables.

The DES in its wide-ranging *Action Plan for Education 2016-2019* which aims to make Ireland the best educational provider in Europe, contains no references to school gardening. In addition, there are no specific references to nature education, conservation, outdoor education and biodiversity (These are all included in school curricula in Ireland).

The voluntary body, SEED, founded in 2010, aims to promote school gardening in all schools on the island of Ireland. To date it has organised six school garden conferences and established seven model school gardens at the annual Bloom Garden Festival in the Phoenix Park. Literature on the topic is limited to four pedagogic publications: Madden (2011), *Go Wild at School*; Madden (2007), *The School Garden: What to do and when to do it*; Barrett (n.d) *Growing Together School Garden Tips and Healthy Recipes*; Bell, Ní Dhúill and Ní Fhlatharta, (2008) *The Year-Round Organic School Garden*. There is also limited research in Ireland on the effectiveness of school gardens for teaching and learning. (These limitations could be due to the fact that there is very little emphasis on school gardening in the curriculum and in comparison, to the UK, very little mention of it in general school policy).

In Ireland, Swindell (2009) studied the positive effects of using a school garden in a Dublin primary school to include a pupil with special needs in the primary school. Her findings demonstrated improvement in the child's relationships with the teacher and the child's peers; there was also improvement in the child's self-esteem. Kelly (2001) examined the effect of school gardening on pupils with mild general learning disabilities in a disadvantaged area in Dublin. He found that gardening boosted self-confidence in these pupils and, similar to Fitzpatrick (2006), Irwin (2008), and Swindell (2009), their socialisation skills. Freeman (2017) examined school gardening from teachers' perspectives and found that they felt constrained by an overloaded curriculum, lack of knowledge and confidence on school gardening, funding, and a lack of definition of school gardening in the curriculum. Austin (2017) looked at the effects of school gardening on

children's development and found positive results emanating from it in the areas of inclusiveness, community liaison, and children's social, personal and cognitive development, especially those not academically gifted.

Nearly all the above studies involved limited numbers of participants who were designated with learning disorders: the observations were short-term. There is a need therefore, for (a) research on the general population of children in primary schools who are engaged in school gardening (b) larger sampling both in urban and rural areas (c) more longitudinal studies to ascertain the long-term benefits of school gardening.

2.10.2 Recommendations for Improving School Grounds from Research.

With this increasing attention being focused on outdoor learning, Louv (2005), Rickinson et al., (2004), Malone and Tranter (2003) and Rivkin (1997) recommended that there should be an urgency to design new schools with a focus not alone on the indoor spaces but also on outdoor ones as well. Keiz, Evans and Roderer (2015) studied green and non-green schoolyards and found that the former enhanced pupils' physiological and psychological well-being.

In Ireland, Darmody, Smyth and Doherty (2010) in their report on *Designing Primary Schools for the Future* found that the outdoor spaces in schools were not used much for teaching and learning and that there was potential in them for using play as a learning tool and for using school gardens and other habitats for learning as well.

The children interviewed in the Darmody et al report, were very definite in their responses concerning the outdoor spaces in schools. The authors noted that these spaces were central to their thinking on how to improve schools. Of thirteen recommendations relating to these spaces the children suggested that they should have 'Access to green space/gardens within the school grounds' (p.91). The authors did not see this in practice and this must be a source of concern for educators who believe strongly in outdoor nature-based learning.

Chapters 4 and 5 of the report by Darmody et al indicated that, except for physical education and sports, non-classroom spaces were rarely used for teaching and learning. This perception was echoed by pupils in the case-study schools, who indicated that outdoor spaces were generally only used on a very occasional or ‘once-off’ basis (p.84) These observations seem to indicate that in the schools surveyed outdoor engagement with nature did not occur often.

The DES, *Primary School Design Guidelines* (2013) offered limited guidelines for creating school grounds suitable for engaging with nature awareness, appreciation and education. They did suggest that there should be an allowance available for planting trees and shrubs for defining the school boundaries and that the landscaping spaces should be more imaginative for promoting play and learning and should include sundials and weather stations.

Native trees and shrubs could have been specified because these enhance biodiversity to a greater degree than non-native species. Finally, these are only guidelines: there is no onus on architects, builders or school principals to implement them.

These guidelines were updated in 2017 (DES (2017a) to provide recommendations for biodiversity areas only if the schools required them. These could include ‘meadowland, wildlife habitats, gardens and outdoor science areas’ (p.35). It was recommended too that areas of quietness be provided. These recommendations were a welcome improvement on those for 2013. Nonetheless, they are vague and are entirely dependent on the school’s desires.

In contrast to this lack of urgency by the DES concerning the holistic development of school grounds, the corresponding department in England initiated comprehensive and detailed guidelines for school ground development there as far back as 1997 which catered for children’s wellbeing and their integrated outdoor education (Funnell et al.,1997)

Summing up the potential of school grounds for nature-education they stated:

‘School grounds give access to what has been termed the “natural curriculum”.

Plants, animals and soils can only be investigated thoroughly if pupils have direct experience of natural habitats. Changing weather conditions, the rotation of the seasons and the processes of growth and decay can provide a constantly changing context for learning’ (p.15).

2.11 Ecophobia; Ecopsychology; Ecofeminism

Sobel (1996) discussing the possible alienation of children from nature and in consequence environmental education due to teaching them too early about environmental catastrophes coined the term ‘ecophobia’ (p.5) to label this alienation. Explaining the term, he stated: ‘Fear of oil spills, rainforest destruction, whale hunting, acid rain, the ozone hole, and Lyme disease. Fear of just being outside’ (p.5). As an antidote to *ecophobia* he offered *biophilia* ‘the innate tendency to focus on life and lifelike processes’ (Wilson, 1984, p.1) which was discussed in 2.6 above.

Nonetheless, Strife (2012), (whilst agreeing with Sobel that ecophobia was increasing and that children do express feelings of hopelessness and despair about the future of the planet), questioned his theory that this *prevented* them from acting positively towards its preservation. Examining the results of a survey of 1,220 German and Russian youths conducted by Szagun and Pavlov, (1995) Strife found the opposite: these youths who had feelings of hopelessness rejected them by engaging in pro-environmental activities. These youths acting in this fashion, she argued, challenged the view that ecophobia caused disengagement from environmental concerns. In Strife’s in-depth, qualitative, multi-dimensional study relating to this topic of environmental awareness she directed her attention on 50 children from various socioeconomic and ethnic backgrounds in Denver, Colorado because she deemed that there was a lack of research, especially in

the US on children's voices relating to environmental problems and their concerns. She discovered that the majority (82%) had feelings that were apocalyptic in nature.

According to Sobel (1996) the children in Strife's study could be classified as ecophobic which he believed would make them apathetic towards environmental problems in the future. Strife (2012) referred to research in other countries such as Australia which concurred with the ecophobic view and as a result she firstly gave out cautionary advice to teachers, environmental organisations and parents about 'the age-appropriateness of their environmental messaging and environmental curricula' (p.49). Secondly, examining a broad sweep of research in places such as the UK, the US, Australia and Hong Kong she concluded that the main source of their information on environmental problems came from TV which is outside the remit of the educators but not the parents (Strife, 2012). On a positive note, however, she discovered that parents and teachers as information providers of environmental information had an influence on how children understood solutions to environmental problems so perhaps they should be very careful when discussing these problems with them. As with Sobel (2008) she suggested that schools should engage the children in positive, incremental environmental action such as composting, gardening etc. to encourage them to care for the planet rather than focusing too much on environmental difficulties.

Summing up she agreed that even though a selection of scholars (Louv, 2005; Pyle, 1993; Sobel, 1999, 2008) were convinced that ecophobia would affect children's environmental attitudes and concerns in the future, nonetheless, there was not sufficient evidence to prove this. She was also concerned that there was no research into whether ecophobia had a life-long effect on children's behaviour towards the environment.

These observations about ecophobia by Pyle, (1993), Louv (2005), Sobel, (1999; 2008) and Strife (2012) have implications for this research. Children should engage with nature both indoors and outdoors in a positive way so that they gain affection for the

natural world. This positive connection to nature would militate against ecophobic tendencies which seem to have their genesis on an over-concentration on the negative aspects of nature degradation.

This positive connection to nature was explored by Rozak (1993) when he was writing about ecopsychology, which he defined as a more compassionate approach to the earth and to humans in which there would be less dominion, more care, less exploitation, more sympathy, less accumulation, more sharing, less blame and more tolerance. Noddings (2007), echoing the caring convictions of Rozak (1993) wrote extensively about the ethics relating to this phenomenon, arguing for the development of sensitiveness in schools generally as well as towards nature.:

I have argued (...) in suggesting that much of the curriculum should be organised around themes of care: caring for self, caring for intimate others, caring for strangers and global others, caring for plants, animals, and the natural environment, caring for the human-made environment, and caring for ideas (p. 214). See Sections 7.5.1.1 and 7.5.1.3 for more on empathy.

Empathy for the natural world forms one pillar of the conceptual framework for this research (See Figure 2.1). This is explored further in the next section which discusses ecofeminism.

Miles and Shiva (2014) explored the theoretical perspective of ecofeminism¹² which had its origins in the 1970s and 1980s in the peace, feminist and ecology movements which occurred during these decades. Ecofeminism is based on the notion of care for the earth and all living things and is opposed to the man's attempts to obtain dominion over nature and to destruction of natural habitats for capitalistic enterprises. Opposing the patriarchal view that they consider is anti-nature they also oppose technologies such as

¹² The term's first use is attributed to Francois D'Eaubonne in D'Eaubonne, F. (1980) *Feminism and Death* in Marks, E. & de Courtivron (Eds.) *New French Feminism, an Anthology*. Amherst: Amherst University Press.

genetic engineering which interferes with nature's productive capacities and is similar in ways to surrogate motherhood.

This theoretical perspective echoes the worldviews of Rozak (1997) and Noddings (2007) above and leads on to the next section which discusses nature and the affective domain.

2.12 Nature and the Affective Domain

Wilson (1984), summed up childhood influences on the affective domain of nature-learning succinctly when he asserted: 'you start by loving a subject. Birds, probability theory, explosives, stars, differential equations, storm fronts, sign-language, swallowtail butterflies-the odds are the obsession will have begun in childhood' (p. 65).

2.12.1 Nature and aesthetic sensibility; Nature and spiritual values

Van Wieren and Kellert (2013) developed the concepts of aesthetic and spiritual sensibility in nature first outlined by Kellert (2002) in his typology of values of nature experienced by children, specifically, moralistic and aesthetic values. Van Wieren and Kellert (2013) concluded that aesthetic and spiritual values were universal tendencies found in people everywhere.

In their article, they regretted the fact that there was limited research available on the development of children's experience of nature from the spiritual values and aesthetic sensibility perspectives of nature and that environmentalists tended not to give much weight to the importance of the former for human development. They attributed the paucity of research on aesthetic sensibilities and spiritual values to the fact that these experiences are subjective by nature and by implication difficult to analyse. Their own study was very limited in that only 10 children were interviewed, observed and tested and one parent per child was questioned about childhood experiences in nature. The results indicated that all the children (to varying degrees) demonstrated that they perceived aesthetic and spiritual

dimensions in nature. These included senses of *'beauty, pattern and order'* and *'wonder and discovery'* in the aesthetic domain and in the spiritual domain feelings of *'solace and peacefulness'*, *'a sense of commonality and connection,'* a fundamental sense of *'happiness and feeling at one with and at home in nature'*, a feeling that *'nature is more powerful than the individual self'*, and a sense of *'divine presence or mystery in nature'* (Van Wieren & Kellert, 2013, p. 254, emphases in original).

They cautioned, however, that because of the limited nature of this research it could not be generalized. Nevertheless, the study did produce important themes for future research and emphasises again the importance of children engaging with nature both at home and in school to develop their spiritual awareness.

2.12.2 Children and the transcendental experience.

Chawla (2002) exploring the spiritual dimension of the nature poetry of the Romantic poet, William Wordsworth (1870-1850) described how important myth and magic and the archaic experience were in children's relationship with nature. In describing the archaic consciousness, she borrowed from the thinking of the Swiss philosopher Jean Gebser (1907-1973) who wrote about the intimate absorption with the natural world which Wordsworth had and with which children brought up in trust and love have too. Like Kellert, she regretted the fact that research on children's engagement with nature is dominated by that which tries to elicit their knowledge and attitudes about nature. Agreeing, nonetheless, that these are important topics she remarked that they only *'represent a partial perspective of our human experience of nature'*. She referred to this view as *'the mechanistic and instrumentally rational view of nature that dominates modern consciousness'* (p.221). See Littledyke above (Section 2.2) and Bonnett, Pyle and Weber (Section 2.5), for similar non-instrumental worldviews as Chawla's. All believed that some aspects of nature cannot be understood through cognition alone.

Sobel (2008) echoing all of the above stated, ‘One transcendental experience is worth 1000 nature facts’ (p.16). He too, looked to Wordsworth for an example of childhood transcendence when viewing nature. Wordsworth observed:

There was a time when meadow, grove and stream, / The earth, and every common sight, / To me did seem/ Apparellled in celestial light, / The glory and the freshness of a dream/It is not now as it hath been of yore; (Quiller-Couch (1919).

This transcendental perspective on nature is echoed in Louv (2005) when he observed that nature offered the young an opportunity for easily contemplating infinity and eternity. Environmental scientist, John Feehan (2010) in *The Singing Heart of the World* explored this transcendental concept of nature in depth and linked it to the sense of wonder and awe that can provoke a religious response in an individual.

This exploration of the spiritual and transcendental values of nature has implications for nature education. The Pushkin Trust (www.pushkintrust.com) for example which is in operation for 31 years places creativity at the core of child education using nature as the inspiration for children’s engagement with creative writing, visual arts, music, dance and sculpture. Children are encouraged to experience nature through feelings of wonder, awe, reverence and humility as well as through the cognitive process.

2.12.3 Limited research on transcendental experiences.

As outlined already by Van Wieren and Kellert and Chawla in the previous sections, research on the spiritual benefits of contact with nature is limited. Keniger et al. (2013) came to this conclusion after evaluating 57 papers relating to the benefits of interacting with nature. They discovered that only three (5%) of the reviewed papers focused specifically on this outcome. In their examination of the literature they found the following definitions of spiritual well-being common: ‘a sense of connectedness, a sense of purpose, a sense of awe and inspiration and faith in a larger reality’ (p.926). There is a need for

more wide-ranging research on the spiritual benefits of interacting with nature so that these can be validated as legitimate dimensions of nature education.

2.12.4 Philosophy and the affective domain.

Bonnett (2004, 2007) disapproved of the reductionist, instrumental, dispassionate approach to teaching about nature and pleaded instead for a re-focus on an intimate, affective approach that views nature as ‘self-arising’ (p.4); in other words, he wanted us to value nature as a source of wonder with an ‘otherness’ (2007, p.4) which is outside our complete control, has mysterious qualities and is not there for exploitation solely by man.

Wulf (2015) writing about the life of the famous naturalist and explorer, Alexander von Humboldt (1769-1857) observed that even though he had a great fascination with measurements and analysis in nature he was also impelled by a sense of wonder and believed that an emotional response to it was appropriate as well.

Quoting from von Humboldt who stated that, ‘Nature must be experienced through feeling’ (p.36), Wulf proceeded to explore how Humboldt and Johann Wolfgang von Goethe (1749-1842) developed a view of nature that had both subjective and objective dimensions where ‘nature and art, facts and imagination’ (p.38) combined. This view was echoed by the famous environmentalist and conservationist, Rachel Carson (1998), who stated that the acquisition of knowledge which is preceded by an emotional response leaves a lasting impression. She equated facts (knowledge) to the seeds of learning and the emotional response to the fertile soil in which these seeds are sown. Perhaps this emotional response to nature could be triggered in a classroom setting but it would seem that outdoor engagement with it where all the senses are activated would be a more appropriate trigger.

Corresponding somewhat to both views regarding an emotional response to nature was David Sobel's (1996) assertion that positive feelings for nature stimulate an urge to preserve same: ‘What's important is that children have an opportunity to bond with the natural world, to learn to love it, before being asked to heal its wounds’ (p.10). David

Attenborough mirrored these words in 2010 when he stated, 'No one will protect what they don't care about; and no one will care about what they have never experienced' (as cited in Palmer, 2015, p.67.)

In the foreword to Sobel's book, Marion G.H. Gilliam wrote about the reductive, impassive quality of much nature study nowadays. In other words, an emotional response from children is neither fostered or encouraged. In contrast, she suggested that nature literacy should be fostered. This she defined '[as] the ability to read and comprehend, to the extent of one's capacity, all forms of life as a reflection of an intelligible order and an interconnected aesthetic experience of life in its fullness' (p. v).

Sobel (2008) was critical of state curricula in the US in which objectives prioritized facts and concept acquisition in environmental education in the expectation that the assimilation of these would create positive attitudes and behaviour towards the environment. (However, it is not suggested that this approach is prioritised in the revised curriculum in science and geography (DES 1999b;1999d). Instead of the approach he outlined he argued that children should be immersed in the transcendent experience of wild nature and that this experience would have positive consequences on conservation practice. In his argument, he quoted John Burroughs (1919) as support: 'Knowledge without love will not stick. But if love comes first, knowledge is sure to follow'. This quotation mirrors one by Richard Louv which introduces Chapter 2.

2.12.5 Head, heart and hand domains of learning.

Sipos, Battisti and Grimm (2008) exploring the trinity of head, heart and hand domains of learning about sustainability criticized the prevailing emphasis on the cognitive domain (head) in higher education with little recognition given to the affective domain (heart) because of the difficulty of assessing outcomes in this domain. This is understandable if it is a requirement that learning outcomes must be assessed. Perhaps affective outcomes should be mentioned when learning outcomes are being documented in

order to demonstrate how important they are in the learning process. It could be stated that they cannot be assessed.

The harmonious synthesis of head, heart and hands domains of learning can be traced back to the educational ideas of Pestalozzi (1746-1827). The head aspect deals with the formation of concepts and the development of perception; the heart is concerned with the development of the moral person who engenders feelings of love and affection; the hand domain is dedicated to learning practical work (Bruhlmeier, 2015). To incorporate this 'harmonious synthesis' in learning about invertebrates for instance children could learn information about how they are classified, they could care for them in the classroom e.g. woodlice, and they could go on an invertebrate hunt in the school grounds.

The philosopher, Rudolf Steiner (1861-1925) incorporated Pestalozzi's ideas relating to head, heart and hand learning domains into the Waldorf educational system which he founded. In his three-stage cycle of learning the potential of the hand domain dominated the early years of a child's education, the heart the middle years and the head the final years (Angus, 2011). It is a model of education which has merit because it is based on the child's mental, aesthetic, spiritual and physical development.

Singleton, (2015) summed up the model thus: 'The model shows the holistic nature of transformative experience and relates the cognitive domain (head) to critical reflection, the affective domain (heart) to relational knowing and the psychomotor domain (hands) to engagement'. Basing her argument on this model of learning she outlined how transformative learning can be accomplished when engaging students with sustainability issues.

These domains of educational objectives, namely, the cognitive, the affective, and the psychomotor were promulgated by Dr. Benjamin Bloom and other researchers in

1956¹³ in a taxonomy of learning domains. Williams (1995) criticizing formal education in Ireland for emphasizing the cognitive rather than the practical domain of learning pleaded for more status for the latter domain stating that Irish education relies too heavily on linguistic achievement and ignored the traditions of western education, particularly the monastic model, ‘where manual and scholarly activities have been perceived as complementary features of life’ (p.104). His criticism had merit in the mid-nineties when the cognitive domain of learning was paramount in both secondary and primary schools. However, in primary schools nowadays the new curriculum (DES, 1999b, 1999c, 1999d, 1999e) in science and geography (and other subjects) places an emphasis on socio-constructivist learning theories rather than formal learning and also promotes designing and making activities across both curricula. However, Williams seems to be referring to manual activities outdoors such as gardening as well as indoors and as discussed above in Section 2.11.1 there seems to be a lack of constructive policy in this realm of learning in Ireland.

Singleton, (2015) emphasized the importance of place-based education in this process and how engaging with their local place would generate a love for it in children which in turn would enable them to protect it (heart enablement domain). This affective bond was explored initially by Moore and Graefe (1994) who also explored place identity i.e. how a person’s needs are served by a particular place.

David Sobel (2004), an American environmentalist and passionate advocate of place-based, hands-on, cross-curricular learning in the real world as an antidote to homogenized learning stated:

...this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students’ appreciation for the

¹³ Dr. Benjamin Bloom, an educational psychologist concerned with the ubiquitous rote learning in schools created with others a taxonomy of learning in 1956 to promote higher order thinking in learning

natural world, and creates a heightened commitment to serving as active, contributing citizens (p. 7).

Echoing these sentiments, Selby (2017) supplied a list of outdoor nature-based activities which would enable learners to engage in intimate acquaintance with their place to discover its soul and its spirit (*genius loci* and *anima loci*) thus fostering emotional bonds which would lead to pro-environmental behaviour initially in the learners' home-places and subsequently, globally. Stories contribute to discovering the essence of a place and Selby also advocated exploring place through this medium as Laurie Lee did in his book *Cider with Rosie* (1974). 'Place was alive and storied' (Selby, p.15).

Place-based education is especially relevant to learning about the natural world in the primary school through examining local flora and fauna, protecting the local natural environment and pursuing school garden activities. The latter, especially, connects to the local economy, local produce and local people who can become learning mentors. The local becomes a microcosm for the global and makes learning meaningful and interesting. (See 8.7.4 for more on this form of situated learning within a community of learners). This form of learning was first formulated by Lave and Wenger (1991) and has implications for nature-based learning in that it provides an opportunity for teachers who may not feel knowledgeable about plants, animals and gardening to invite outside specialists into a school in order to learn from these 'masters'.

2.12.6 The emotional bond of children with nature and its implications

Research by Chawla (1988, 1998, 2006), Chawla and Cushing (2007) and Tanner (1980), considered that this emotional bond with nature, especially in childhood, had a powerful, positive effect on later environmental behaviour, concern and activism.

The well-known and respected environmental educator, Joseph Cornell (1998), echoed the affective approaches of Chawla (1988, 1998, 2006) and Chawla and Cushing (2007) when he stated, '*[a] sense of joy should permeate the experience*, [emphasis in

original] whether in the form of gaiety or calm attentiveness. Children are naturally drawn to learning if you can keep the spirit of the occasion happy and enthusiastic' (p.15).

Nonetheless, Pyle (2002) was critical of this pervading games and team-work-orientated approach to learning about nature stating that it militated against deep learning. He also criticized environmental education arguing that it had replaced nature study in the curriculum and children were not taught the basics of nature such as the names of organisms and the way they live.

The NFER (2010), in its wide-ranging research on the influence of school gardening on the affective domains which it considered as 'pupil attitudes, values, beliefs and self-perceptions' (p.22), revealed that its impact on the pupils' self-esteem and motivation was most noticeable.

Finally, Kellert (2002), writing at length about the variety of emotions that are experienced by a child in his/her engagement with the natural world, stated that these ranged from wonder and joy to fear and anxiety but nevertheless they all served as strong stimulants and motivators for learning and development.

In sum, placing an emphasis on the affective domain of learning would seem to suggest a most appropriate way forward for nature education because it increases children's love of the natural environment and the place where they initially encounter this environment. This affection leads from the local to the global to create informed citizens who do not wish to see the natural environment degraded.

2.12.7 The affective domain in the 1971 curriculum and the revised curriculum (1999)

The affective dimension of nature is discussed above in Section 2.5. As outlined in that section it seems to receive little emphasis in the literature pertaining to the revised curriculum in science and geography (DES, 1999b; 1999d; 1999e) except in the strand, Environmental Awareness and Care. In contrast, the strand Living Things has no mention

of the affection domain of learning in the objectives. An explanation of this strand states: ‘This strand absorbs the existing *nature study* [emphasis added] programme, which focuses on plant and animal life. It builds an excellent base on which to build and incorporate a scientific approach to the study of living things’ (DES, 1999e, p. 9).

The seemingly functional approach to nature is ameliorated somewhat in one of the aims of science-education which stated, ‘[The aims of science education are]to cultivate an *appreciation* and *respect* [emphasis added] for the diversity of living and non-living things, their interdependence and interactions’ (p.11). Appreciation of diversity and interdependence however, does not manifest an emotional response to nature as something intriguing, fascinating and wonderful *per se*. Neither does it include affective outcomes such as ‘pupil attitudes, values, beliefs and self-perception’ (Passy, Morris and Reed, 2010, p.22)

The approach to the study of nature in the objectives of revised curriculum (DES, 1999b; 1999d) contrasts significantly with that of the literature pertaining to the primary curriculum in 1971 (Curaclam na Bunscoile, 1971). In the social and environmental section of this curriculum there were frequent mentions of the words that demonstrated an affective and emotional response to nature such as ‘unforeseen and exciting happenings (p.15), ‘the discovery of a bird's nest fascinates children’, (p.23) ‘smell flowers’ (p.23), ‘children are fascinated by the moving inhabitants of water’ (p.42), ‘they will be found to talk naturally and with excitement’ (p.49), ‘it [the school garden] fosters an appreciation of beauty and a love of nature’ (p.74).

2.13 Gaps in the Literature

The concept of nature, its status and relevance in current education policies and its beneficial effects are identified in the literature examined in this chapter. Most of this literature emanates from the US, Britain and Australia. The benefits that nature education confers on the holistic development of children and its impact on environmental issues are

explored through literature mainly from these places. In the Irish context reports from government bodies on its state, status and history are scrutinized.

Nonetheless, very little empirical research has been undertaken on nature education in Ireland. The first to engage with the topic in depth was Quinn (1990). Her doctoral thesis, entitled, '*Environmental Education and Awareness in Ireland*' began on a very sombre note: 'The level of concern of Irish people for their environment was, in recent EC studies, found to be the lowest in Europe' (p.iii). Her research mirrored the EC studies. For example, she found that at primary level, 'most of those [teachers] who could remember stated that they had had no environmental education at all and had never gone on nature walks' (p.215). Teachers seldom went on nature excursions themselves with their classes which reflected Varley, Murphy & Veale's (2008) review of the primary science curriculum in which they found that outdoor education was minimal. She also found that teachers had difficulties accessing resources and that their teacher education on environmental education was weak. However, Quinn (1990) sometimes conflates environmental education with nature education and it is difficult at times to decipher whether she is referring to environmental issues or nature per se.

As mentioned above, (2.10.1) some research has been undertaken at diploma and master's levels on the benefits of school gardening in Ireland: Fitzpatrick (2006); Irwin (2008); Swindell (2009); Freeman (2017); Austin (2017). These authors researched the benefits in different settings on different types of children. O'Malley (2014) researching environmental education in Irish primary schools found that children were not disconnected from the natural environment in the traditional view of disconnection but experienced it meaningfully, albeit differently, from that of their parents and environmental educators. Opposing evidence regarding disconnection, however, is evidenced from the writings of researchers outside Ireland such as Louv (2005), Sobel (1996, 2008, 2012), NFER (2012) which are explored in some detail in this chapter.

O'Malley, nonetheless expressed concern about EE because she stated, 'environmental education has been and continues to be intermittent in primary schools in Ireland'. (p.202). In addition, the Heritage Councils' *Wild Child Report* (2012) outlined disconnection of children with nature in an Irish context. This work is the first to explore nature education per se in Ireland and therefore it should contribute to educational research and policy.

2.14 Conclusion

As stated at the beginning of this chapter the literature is examined through the macro lens of nature awareness, appreciation and education and their importance for children's cognitive, aesthetic, creative, spiritual, mental, physical and emotional development.

This development is advanced by outdoor education through school gardening, place-based learning, play, nature walks and exposure to natural settings.

When the affective domain is developed in children these latter activities can lead to environmental awareness and care (Sobel, 1996; Carson 1998). An analysis of the literature pertaining to the history of nature education in the Irish educational system in the next section indicates that this dimension of education has had a chequered trajectory from 1900 to the present with decades of neglect (among other factors) contributing perhaps to its present state. So, is there a case for granting more emphasis and importance to nature awareness, appreciation and education in the Irish primary educational system?

The literature is unequivocal about its importance for children's holistic development. Therefore, is it promoted enough? Science, Technology, Engineering and Maths (STEM) are emphasised in the Irish educational system. Where does engagement with nature fit into this framework? It fits in when students are asked to think for themselves about the natural world. It fits in when they ask questions about this world. It fits in when they see 'the beauty and complexity of nature' (Anderson & Morgan, 2019). The promotion and funding of STEM associated subjects within the Irish educational

system could be perceived as the macrosystem layer of Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1979) which, even though it is the outermost environmental system impinging on a child's development (culture and political system), nevertheless it influences significantly the mesosystem (school environment) in which the child engages after the microsystem which is conceptualised as home and family influences). STEM is promoted within all layers of the educational system in Ireland and because it encourages pupils to question and think for themselves it is beneficial for children's development. Apple (2017) however, analysing Andrew Hacker's *The Math Myth and Other STEM Delusions* (2016) referring to the STEM emphasis across educational policy stated that a 'tense but still effective coalition of multiple forces has been formed that is pushing education in a particular direction' (p.2) and that 'its primary (only?) aim is meeting the economic needs as defined by dominant groups'. If STEM education focuses education in this direction only it will not be effective and would be problematic for children's development. Barnes (2005) had this interpretation of STEM education when he stated in a newspaper article: 'Do we want to educate people to become a viable part of the economy? Or should the priority be to make them a viable part of the human race'? (Barnes, 2005)

The literature constantly re-iterates the fact that initiation and immersion in nature contributes to children's (and adults') positive attitudes towards environmental protection and their overall holistic development. STEM educational objectives will not prevent this happening provided the natural sciences receive the same emphasis as the physical sciences.

2.15 Key Milestones in the History of Nature Education in the Irish Primary

Curriculum

In 1831, a government board representative of the three main churches in Ireland, namely, the Roman Catholic, the Church of Ireland and Presbyterian, was granted £30,000 towards the establishment of a system of national education. Government policy relating to this national system was outlined in a letter to the president of the board by Mr. Stanley, Chief Secretary of Ireland, in which he stated that there should be provision of ‘a system of education from which should be banished even the suspicion of proselytism, and which, admitting children of all religious persuasions, should not interfere with the peculiar tenets of any’ (Beckett, 1966, p.313).

After its establishment in 1832, the National Board of Education proceeded to train teachers, promote literacy and numeracy within a multi-denominational system and provide standardisation throughout all schools (Dowling, 1971).

2.16 Agricultural Education in the New System

In 1838, it extended its brief so that agricultural science could be taught as well. In that year the Board established a model farm in Glasnevin, Dublin where teachers in training at the Marlborough Street Normal School for practical training of teachers in-training on agriculture so that they could teach agricultural science in rural schools (Dowling, 1971).

Later, Model Agricultural Schools were established which combined a good general education with instruction on farming methods. By 1858 there were 42 of these in the country but also a great number of ordinary national schools providing the same type of instruction (Dowling, 1971). An examination of the Commissioners of Education *Agricultural Class-Book* (1868) gives information on the objectives of the course, the intended readers and the contents of the syllabus. The intended readers were to be boarders

in the National Agricultural Schools and pupils in rural national schools where it would be read as a class text-book.

Among the topics discussed were soils and manures, farm implements and machines, crops and livestock. However, by 1883 this policy on agricultural education had to be abandoned because of parsimonious government policies. Only two schools remained open by then (Dowling, 1971).

2.17 Revised Programme for National Schools 1900

As the century ended and the progressive thoughts of educationalists such as Froebel, Pestalozzi and Rousseau were studied, dissatisfaction with a narrow curriculum based on didactic pedagogical methods mounted. A commission of inquiry, entitled the 'Belmore Commission' examining child-centred educational approaches being implemented in Britain, Europe and America concluded that the system of Irish education with its emphasis on the three Rs was outdated and needed reforming (Coolahan, 1981). They recommended that this reform should entail the ending of the controversial payment by results scheme for new subjects, a broader curriculum, more practical subjects, and a re-envisaging of kindergarten education. The result of their deliberations led to the establishment of the radical *Revised Programme for National Schools* which came into existence in September 1900 (Coolahan, 1981; O' Connor, 2010).

2.17.1 Science

Physical sciences were introduced to the main curriculum for the first time in the compulsory Elementary Science syllabus and detailed courses for standards 3rd to 6th were offered. Apart from a study of 'lime, chalk and marble' in 6th standard there was no other mention of the natural sciences in Course 1, Experimental Science, 1900 (Report of Commissioners of National Education, 1900-1901, p.88). Agriculture had been taught in

the old curriculum; this was replaced by a nature study programme for rural schools in 1911 which was entitled 'Rural Science and Horticulture'.

2.17.2 Rural science and school gardening.

After personnel from the Department of Agriculture and Technical Instruction (DATI) gave instruction in rural science and school gardening to teachers in 1912, gardens were established in some schools (Bennett, 2000). This programme was expanded in 1915 after the Commissioners of National Education drew up rules and regulations for an optional Rural Science and Horticulture in the schools' programme. Incentives were provided to promote gardening in schools, such as £5 grants to teachers who taught gardening effectively and prizes of £5 to the teachers of schools with exemplary gardens (Gallagher, 2007). All this activity was prompted by the outbreak of the First World War (1914-1918) when a need developed for increased food production.

2.17.2.1 Syllabus for rural science and horticulture.

This Rural Science and Horticulture course had 60 hourly lessons constructed around practical work and theoretical work in the academic year. Tools were provided. The use of a wide range of tools suggested that the programme was ambitious and that it included the imparting of sophisticated skills such as propagating, pruning and grafting.

2.18 Education in the new Irish Free State

Coolahan (1981) wrote about the 'cultural revolution' (p.39) which focused the attention and energy of the new Irish free state, a revolution which placed the Irish language in a central place in the curriculum.

A conference was convened in January 1921 by the INTO which addressed what they considered the pressing problems of Irish education, namely, an overcrowded curriculum and the low status given to the Irish language in the revised curriculum of 1900.

After the conference the INTO recommended that the overcrowding in the curriculum could be solved by eliminating from the curriculum elementary science, nature study, drawing, hygiene, and needlework in the lower classes as obligatory subjects. Optional subjects in future would be drawing, advanced algebra, advanced geometry and mensuration, French, Latin, bookkeeping, cookery, manual instruction, domestic science, *nature study* [emphasis added] (from 3rd class to 6th only), *elementary science* [emphasis added] (where laboratory facilities with equipment were available), *rural science and school gardening* [emphasis added] (in schools with gardens and proper equipment) (Gallagher, 2007).

2.18.1 Nature study in the new educational system 1922

Nature study could be taught informally through the Elementary Science programme in infants; from 3rd onwards plants, life cycles of insects, weather and river study were on the menu (Gallagher, 2007). The Rural Science and School Gardening course was of three-year duration and was ambitious in its content and structure: Year 1 focused on plant life and on the care and maintenance of garden tools and on soils; Year 2 on gardening skills and plant diseases; Year 3 on weather, the garden's surroundings and revision (Gallagher, 2007).

2.18.2 Further recommendations

The INTO further recommended that the status of Irish could be raised by making it an obligatory subject for an hour a day in all national schools and by making it the mode of instruction in infants. English as a subject would not be taught in infant classes and subjects such as history and geography, drill and singing would be taught through Irish in the senior classes. Content of songs and history were to be Irish in nature. The recommendations of this report which were accepted by the Irish Free State government came into force in April 1922 (Coolahan, 1981).

2.18.3 Cultural nationalism

Cultural nationalism which entailed promoting Irish up and down and across the school system was the central educational objective of the new administration. The heuristic and child-centred curriculum of 1900 with its broad range of subjects and its kindergarten policies was abandoned. Walsh (2005) summing up its general ethos stated that its ideological stance was based on cultural revival. Of interest to this research is the fact that nature study lost its status by being confined to the realm of optional subjects.

2.19 Rural Science/Nature Study in the Curriculum, 1925-1934

However, because of the difficulties encountered in teaching the programme, a second conference took place in 1925. The INTO advised that compulsory subjects be reduced to three: Irish, English and mathematics. This advice was not taken and some modifications were allowed. Instruction could be through English in the infant classes until 10.30 and exceptions from teaching all ordinary subjects through Irish were to be given to teachers who were not competent enough to do so. Some schools, depending on size, were compelled to teach rural science (Coolahan, 1981).

Coolahan's reference to rural science, however, does not provide much information of what went on in schools and makes no mention of nature study.

It can be concluded from reports such as *Reports of the Department of Education* (1925-26-27), however, that even though rural science and its alternative, nature study, were obligatory subjects in schools from 1926 onwards only nominal attention was being given to them by about a third of national schools and that this attention was haphazard, lacking depth and scope. To address this situation the inspectors had to attend a Rural Science course which was delivered through the medium of Irish. (Report of Department of Education, p.50).

By the school year 1933-34 rural science was being taught in 679 schools with plots attached and nature study was taught in 2,544 schools (Report of Department of Education,

1933-34). Amalgamating both these figures demonstrates that 55.7% of national schools (includes convent and monastery schools) were participating in rural science and nature studies. This compares to a figure of 33% in 1926-27.

2.20 Rural Science/ Nature Study in the Curriculum, 1934-1948

With the advent to power of the nationalistic Fianna Fáil government of Eamon de Valera in 1932, it was inevitable that there would be a renewed interest in cultural nationalism and promoting the revival of Irish through the national school system. The new Minister for Education, Tomás Ó Deirrig, believed that this should happen and in the *Revised programme of primary instruction* (which he proposed implementing in 1934) teaching in the infant classes would again be conducted through the medium of Irish throughout the day and rural science was no longer obligatory (Coolahan, 1981). ‘The policy devised in 1934 was to remain, with slight alteration, the policy for Irish national education up to 1971’ (Coolahan, p.43).

The opening paragraph of the Department of Education (1934) *Revised Programme of Primary Instruction* summed up the robust approach to the teaching of Irish. The Secretary of the Department, Seosamh Ó Néill outlined how rural science (or nature study) was no longer compulsory and neither was mathematics in many schools. The English curriculum was reduced and made optional in standard one. He suggested that these changes would ‘secure more rapid progress and more effective work in the teaching of Irish and in the development of teaching through Irish’ (p.3)

The relegation of nature study and rural science to the lower status of optional subjects meant that these subjects were dropped by many schools. Their relegation to low status in an agricultural country was even more surprising when one considers this statement from the Report of 1933-34: ‘In this agricultural country, where the teaching in the past has been to rely almost entirely on the bookish aspect of education, the national, economic, and educational value of rural science is very great’ (p.25).

The report of the Department of Education 1947-48 demonstrated the narrow, Irish language-orientated nature of the primary curriculum. There was no mention of rural science or nature study in this report; only Irish and arithmetic were reviewed. (Rural science and nature study disappeared from reports after 1941-42, which suggests that they were not considered important any longer).

Table 2.3

Abridged Reports from The Department of Education 1936-1948 Demonstrating the Lack of Status of Rural Science / Nature Study

School Year	No. of Schools	No. doing Rural Science/ Nature Study	% of schools doing Rural Science/ Nature Study
1936-37	5,685	350	6%
1937-38	5,653	350	6%
1938-39	5,127	No data	No data
1939-40	5,114	No data	No data
1940-41	5,575	350	6%
1941-42	5,553	No data	No data
1942-43	5,570	No data	No data
1943-44	5,590	No data	No data
1944-45	5,537	No data	No data
1945-46	5,514	No Data	No Data
1946-47	5,509	No Data	No Data
1947-48	5,485	No Data	No Data

Note. Report of the Department of Education for the School Year 1947-48 (Abridged)

2.21 Rural Science/ Nature Study in the Curriculum, 1948-1954-Optional

In the general election of 1948, De Valera's Fianna Fáil led government was defeated. This led to the advent to power of an inter-party government in 1948. General Richard Mulcahy (1886-1971) became Minister for Education and he proceeded immediately to make changes in the infant curriculum. He advocated a return to more child-centred, activity learning but all subjects would continue to be taught through Irish. English, however, could be taught for half an hour each day 'at the discretion of the manager' (O' Connor, 2010). To support the new programme a hand-book by An Roinn Oideachais, *An Naí-Scoil: The Infant School, Notes for Teachers* (1951) became available

in 1951. Furthermore, the *Notes* suggested that nature study was not to be regarded as a subject: its purpose was to provide activities which would stimulate informal conversations and observation while promoting curiosity, experimentation and discovery learning (O'Connor, 2010).

In addition to the above changes in the infant curriculum, Mulcahy established a Council of Education in 1950 to assess the workings of primary schools. This Council remained in deliberation for four years and in their report issued in 1954 they criticised the narrow curriculum and suggested that it be broadened by the addition of more subjects, namely, physical training, nature study, drawing and music in senior classes (Ó Catháin, 1954)

2.22 Obligatory Nature Study, 1954-1971

Following on the report, nature study was reintroduced as an obligatory subject in 1954. Optional subjects would no longer be on the curriculum. The 11 obligatory subjects were as follows: religious instruction, Irish, English, arithmetic, history, music, physical training, nature study, geography, drawing, needlework (for girls). Detailed syllabuses were drawn up for standards III to VI. The content of these covered plants and animals, local natural features, weather, water, air and food.

A practical component was included in which the children engaged in nature walks, sowing of flowers in window pots, collecting specimens and keeping nature tables (Report of the Council of Education, 1954).

Quinn (1990) researching 234 teachers' knowledge of the subject found that mostly this was very limited. '[T]heir environmental education was negligible, being excluded due to rigid syllabuses and examination pressures' (p.259). (These 1990 teachers were pupils in the forties, fifties and sixties). Of six difficulties listed for not teaching the subject in their schools, lack of knowledge was given as the most limiting factor. This was due to the inadequacy of the teaching in the primary school and in the training colleges. 'They felt

their training was very limited, was sketchy, unstructured and totally inadequate' (Quinn, 1990, p.216).

2.23 Winds of Change in the 60s

The winds of change began blowing across the Irish educational system in the 60s with the improvement in the economy, the perceived inadequacy of the rigid, curriculum-centred curriculum, new understandings of child development and parental interest in education and its capacity to improve social mobility (Walsh, 2005). The Department of Education's *Investment in Education Report* (1965), was a catalyst for change too as it highlighted social and gender inequalities in the Irish educational system and the need for a well-educated workforce which would contribute to economic development. '*Investment* [emphasis in original] illustrated the traditional shortcomings of the educational system- from curriculum limitations to ineffective use of resources to severe disparities in participation linked to class and religion' (Walsh, McCoy, Seery & Conway, 2014, p. 119). These disparities were highlighted in this report.

Nevertheless, Loxley, Seery & Walsh (1995) argued that the report exerted a dominance on educational policy geared towards the development of the economy: '...the primary force behind the initiative was the conviction that education was crucial in developing human capital and that investment in this form of human capital would see Ireland emerge as a new, modern economy' (p.177).

Other influences on change according to the INTO (1996) were the *Plowden Report*, the abolishing of the Primary Certificate exam and OECD Report, *Curriculum Improvement and Education Development*, 1966.

2.24 History and significance of school gardening

School gardening has had a long and erratic history and down through the ages and has had an imprimatur from such eminent educators as Comenius (1592-1670), Jean-

Jacques Rousseau (1712-1778), Heinrich Pestalozzi (1746-1827), Friedrich Froebel (1782-1852), Rudolf Steiner (1861-1925), Maria Montessori (1870-1952) and John Dewey (1859-1952).

2.24.1 School gardening in Ireland.

In Ireland, school gardening has had a particularly chequered history from its introduction to schools in 1914 by the Department of Agriculture and Technical Instruction to promote the growing of fruit and vegetables to support the war-effort. This initiative, however, was short-lived because in 1922 when the new Free State Government adopted a strident agenda to promote the Irish language it was consigned with primary science and nature study to the limbo of an optional subject.

School gardening made a brief emergence in again in 1926 when rural science was introduced as an obligatory subject in certain categories of schools. However, its death knell was sounded in 1934 when the enthusiastically nationalistic government of

Eamon De Valera made rural science and nature study optional to make room for the aggressive teaching of Irish (Matthews, D'Estelle Roe and O' Doherty, 1992).

2.24.2 Summary of school gardening.

School gardening was gaining popularity in the early years of the 20th century until cultural nationalistic policies within the primary system steadily removed it from the curriculum until it was re-introduced in 1971. From then until the introduction of the new revised curriculum (DES, 1999a) it gained little traction in schools. Since 2000 it has been gaining popularity in schools but as Subramaniam (2002) observed, comparatively very little research has been undertaken on its beneficial effects on children's learning and the literature regarding this learning domain is mainly focused on practical matters relating to gardening initiatives and management of gardens.

2.25 Overall Summary

As can be seen from this historical vignette, nature education has a chequered history in Irish education due mainly to political interference. Even in the years from 1971 to 1999 in which it was most positively and robustly promoted it was in general inadequately taught by teachers who had limited knowledge themselves because of their own lack of engagement with this domain of learning in their own primary school years and deficient preparation for teaching nature in teacher-education colleges. Furthermore, even when it was taught there was little engagement with it in its proper educational setting i.e. outdoors.

Table 2.5

Summary of Nature Study / Horticulture in Irish Education from 1831 to Present Day

Year(s)	Status on Curriculum	Notes
1838-1883	Agricultural Science	Agricultural Class book
1900-1922	Elementary Science	Mostly physical science. Obligatory
1911-1922	Rural Science & Horticulture	Optional
1922-1926	Nature Study 3 rd -6 th Elementary Science	Optional Optional where lab facilities and equipment available
	Rural Science /Gardening	Optional in schools with gardens and equipment
1926-1934	Rural Science/ Gardening Nature Study	Compulsory for certain sizes of schools Compulsory - alternative to Rural Science
1934-1948	Rural Science & Nature Study	Optional
1948-1954	Nature Study	Obligatory as informal subject in infants
1954-1971	Nature Study	Obligatory-Not in Primary Certificate
1971-1999	Nature Study & Elementary Science	Compulsory
1999-to present	Plant & Animal Life Rocks & Soil Environmental Awareness, Science and the Environment, Caring for the Environment, The Local Natural Environment	Compulsory Compulsory Compulsory

Note. Reports of the Department of Education.

Relatively recent reports on its status and its impact within the revised primary curriculum indicate that it is in a subservient position and generally being inadequately taught (Varley, Murphy and Veale, 2008; Science in the Primary School, 2012).

With climate change and its possible calamitous consequences on the planet very much on people's minds nowadays, there is a case for enabling nature education to have a much more robust presence not only in the Irish curriculum but also around the world. In the Irish education landscape, particularly in science teaching, nothing less than a paradigm shift is necessary to move from a position where the physical sciences are given precedence to a position where both the physical and biological sciences are assigned equal status. In this new, reimagined landscape a more holistic view of science would prevail throughout the educational system.

This reimagined landscape would include school gardening, the benefits of which are outlined later in this thesis. It would also include pupils engaging with nature in a holistic process outside of the science syllabus to enable them to read the open book of nature, integrate with other subjects and develop their overall well-being and life-skills.

Chapter 3: Research Design, Methodology and Methods

Personal acquaintance with local flora and fauna-once an essential knowledge and later at least commonplace in most cultures-has become scanty to absent. (Pyle, 2010, p. 155).

3.1 Introduction

This chapter focuses on the research questions, the philosophical foundations underpinning the research, the mixed-method methodology deemed most appropriate for conducting this research and the methods employed to generate data-collection. The chapter concludes with an examination of the populations relevant to the quantitative and qualitative approaches, the selection of samples, the pilot study and ethical considerations.

3.2 The Research Questions

Blaikie (2010) discussing research questions suggested three headings for them: what, why and how. What questions are explanatory; why questions explore causes and reasons for characteristics in phenomena; how questions are concerned with change. He suggested that what, why and how questions embrace, description, understanding, explanation, prediction, change, evaluation and assessment. Therefore, using this model, the questions for this research were addressed.

3.2.1 What question.

This is the overarching research question: What is the state and status of nature awareness, appreciation and education in the Irish primary school system? Information, gathered by questionnaires, interviews and DES whole school evaluation (WSE) documents was sought to answer the following research questions:

- What levels of conceptual knowledge of the natural environment do Irish primary teachers and first-year initial teacher-education students (ITE) hold?

- What levels of confidence do Irish primary teachers and first-year ITE students have relating to the natural environment?
- What are primary teachers' experiences of and attitudes towards teaching about the natural environment especially in an outdoor context?
- What is happening in Irish primary schools when children engage with learning about the natural environment?
- How is teaching and learning about the natural environment weighted in the Irish primary system?
- Why is engagement with nature not conducted frequently outdoors in Irish primary schools?

Specifically the last question sought information on the following aspects of children's engagement with the natural environment: Is the pedagogical/learning approach embracing such considerations as fostering sensitivity and caring traits in children through contact with nature; is it enhancing their cognitive, spiritual, aesthetic, mental, social and physical development through nature engagement; is it approached through vicarious learning in indoor situations and/or direct learning outdoors; does it consider children's acquisition of gardening and identification skills; does it develop positive attitudes towards sustainable development and conservation?

3.2.2 Why question.

A reason question asks: Why is engagement with nature not conducted frequently outdoors in primary schools? The literature review provides some of the answers to this question and more was gleaned from the questionnaires and interviews on the current situation. The history of nature education in Irish primary schools and reports INTO, 1983; INTO, 1992; INTO, 1993; Quinn, 1990; (*Science in the Primary School*, 2012; Varley et

al, 2008) provide the background underpinning the lack of outdoor education in nature and about nature within the present and previous curricula.

3.2.3 How question

The ‘how’ question asked, how is teaching and learning about the natural environment weighted within the revised curriculum? Data was gathered from practising teachers in open-ended questions to determine the status appropriated to engagement with nature in the primary school. Data was also gathered from whole school evaluations (WSE) by inspectors to ascertain the status they assigned to nature engagement in the hierarchy of subjects they examined.

3.2.4 Focusing the research questions.

De Vaus (2014) explored the three types of variables involved in research which helped to focus my research questions. The independent variable in my study is nature awareness, appreciation and education in the Irish primary school. The dependent variable is the state of nature awareness, appreciation and education in the system and the status it holds presently; the intervening variable is how it has been and is being taught in schools.

Table 3.1

The Three Types of Variable Relevant to this Research

Variable	Type
Independent Variable	Nature awareness, appreciation and education in the Irish primary school system
Intervening Variable	Nature education
Dependent Variable	The state and status of nature awareness, appreciation and education in the Irish primary system.

Note. Adapted from de Vaus (2014)

Fundamentally, information was sought on the current state and status of nature awareness, appreciation and education in the Irish primary school system. The research was both descriptive and explanatory. Five characteristics of descriptive research were considered when framing the research questions (de Vaus, 2014). These were the time-

frame of the research, the geographical location pertaining to the research, the sub-groups within the research, the particular feature of the research and the ideas generated by the research.

3.3 de Vaus's Five Characteristics of Descriptive and Explanatory research

1. Time-frame: The time frame encompassed nature education in the Republic of Ireland from 1999 to the present. This is under-pinned by background information which examines nature education from 1831 to the present.
2. Geographical location: The geographical locations were Irish primary schools, Colleges of Education and places convenient to HS specialists. Schools in Donegal, Galway, Waterford, Kildare and the administrative counties of Fingal, South Dublin, Dunlaoire/Rathdown and Dublin City were targeted in the teacher-questionnaires to provide data from a wide and varied range of rural and urban locations.
3. Subgroup patterns: Nature education, awareness and appreciation throughout the primary school system was examined in large schools, medium-sized schools, small schools and DEIS schools.¹⁴ Also perspectives from pre-revised revised curriculum teachers (DES,1999a) and post-revised curriculum teachers were examined. Questionnaire on nature-knowledge were administered to first-year ITE students. Six HS specialists were interviewed. 220 WSE evaluations of inspectors of primary schools were examined. These sub-groups provided data from a broad and varied spectrum of student teachers, teachers and inspectors.

¹⁴ DEIS: Delivering Equality of Opportunity in Schools. An initiative of the DES to combat educational disadvantage and help children who are at risk. It was launched in 2005. In the year 2016/17 825 primary schools and 185 secondary schools were in the scheme. Of the primary schools 328 were urban/town; 312 were rural.

4. Aspect: A particular feature of the research was its focus was on all aspects of the state and status of nature education, awareness and appreciation in the Irish primary system, especially the outdoor dimension.
5. Abstraction: It was partially an abstract study and concerned with ideas relating to the state and status of nature awareness, appreciation and education in the Irish primary system especially in the affective domain of learning such as well-being, the qualities of care and affection, spirituality and aesthetic appreciation.

Carmen (2012); Heritage Council of Ireland (2010); House of Commons (2010); Kilkelly, Lynch, Moore, O'Connell & Field (2016); Louv (2005); National Trust (2012); Palmer (2015); Pyle (2010); Saylan and Blumstein (2011), suggested that in many places, including Ireland, children are disconnected from nature. Several causes were cited including increased urbanisation, the prevalence of technology, the over-use of car transport, fear of the outdoors and diminished knowledge. The latter cause, especially in an Irish context, is of particular interest to this research.

3.4 Philosophical Underpinnings

The ontological, epistemological, stances adopted in this research have a bearing on the methodology on which it is grounded. These are explored in the following sections.

3.4.1 Ontology.

An ontological stance is how the researcher views the world and this has implications for the theoretical background of research and methodologies employed. Ontological assumptions deal with 'the nature of reality and the nature of things' (Cohen, Manion & Morrison, 2011, p.3). This research endeavours to maintain a balance between the two fundamental ontological positions, realism and non-realism and therefore was objectivist and subjectivist in its approach. Realism in an ontological context views reality as

objective, singular and measurable by cause and effect; a non-realist or relativist position views reality as constructed by persons (Cohen et al, 2011).

Bailey (1994) writing about realism and relativism as ontologies behind positivism and constructivism respectively stated that realism is connected to an epistemology which favours objectivism, reality and quantitative methods. The teacher and ITE questionnaires and WSE reports in this research adopt a mainly realist approach to gather facts on the phenomenon under review.

Relativism's epistemology is interactive and subjective and favours qualitative and interpretive methods of research. The interviews conducted with HS specialists adopted a generally relativist approach as did the open-ended questions to practising teachers. Arthur, Waring, Coe & Hedges (2012), referred to the above extreme views as positivism and interpretivism respectively.

3.4.2 Epistemology.

Epistemology is concerned with the nature of knowledge and the relationships that exist between the researcher and the researched (Punch, 2009). The researcher's focus is the acquisition of knowledge. What constitutes this knowledge? What is true and legitimate? Positivism is an epistemological position in which “positivists believe that the knower and the known are independent” (Tashakorri & Teddie, 1998, p.7). This position had relevance to the factual data collected in the fieldwork mainly through the questionnaires which were administered to teachers and students and content analysis instruments. In this positivist form of research objective knowledge is out there and can be measured (Merriam, 1998). The research approach for gaining knowledge here is through a deductive process. The ontological positions of constructivism and subjectivism had relevance to the interview instrument where the epistemological position for the research was an interpretivist one. The research approach to gaining knowledge here was mainly inductive.

Bryman (2012) in contrasting the two epistemological positions of positivism and interpretivism concluded that the difference between the two approaches was one of emphasis: positivism is concerned with explaining human nature; interpretivism is concerned with understanding it. From the theoretical perspective of positivism in this research objectivist answers were sought from student and teacher participants to questions such as: [**Students**] Is this the leaf of (a) silver birch? (b) oak (c) elm? (d) willow? (e) don't know. [**Teachers**] How often on average do you take children outside to study nature? Once a week; once a fortnight; once a month; once a year; never. Which of these resources do you use when teaching about nature? Textbook; video; nature objects (buds, leaves etc.); interactive whiteboard; other (please specify). From an interpretivist viewpoint subjective answers were sought to questions such as: [**Students**] Which of these descriptors describe how you feel about your knowledge of nature (plant and animal life)? (a) very confident (b) confident (c) neutral (d) unconfident (e)? [**Teachers**] How effective in your opinion is nature education in your school? (a) very effective (b) effective (c) neither effective nor ineffective (d) ineffective (e) very ineffective. What features (if any) of your school grounds are suitable for nature study?

As these questions demonstrate, no research is purely objective or indeed subjective in its approach. There is a grey area between these polarities where they intermingle, and this is explored by (Scriven, 1972; Barone, 2000; Patton 2002). The latter summed up the modern approach: 'As this is written we are still searching for language and terminology to transcend the old and outdated divisions of objective versus subjective' (p.576). Bryman (2012) explored this grey area below in 4.5.1 when he was contrasting quantitative and qualitative approaches in research. (p.9)

Ontology, epistemology and methodology (the latter influenced by the former two and influencing in turn the methods chosen for the research) provide the framework in which research is carried out. Arthur et al., (2012), outlined four related assumptions in a framework for research which are represented in a very basic way in this diagram which is nonetheless useful in mapping the research journey which was undertaken in this study.

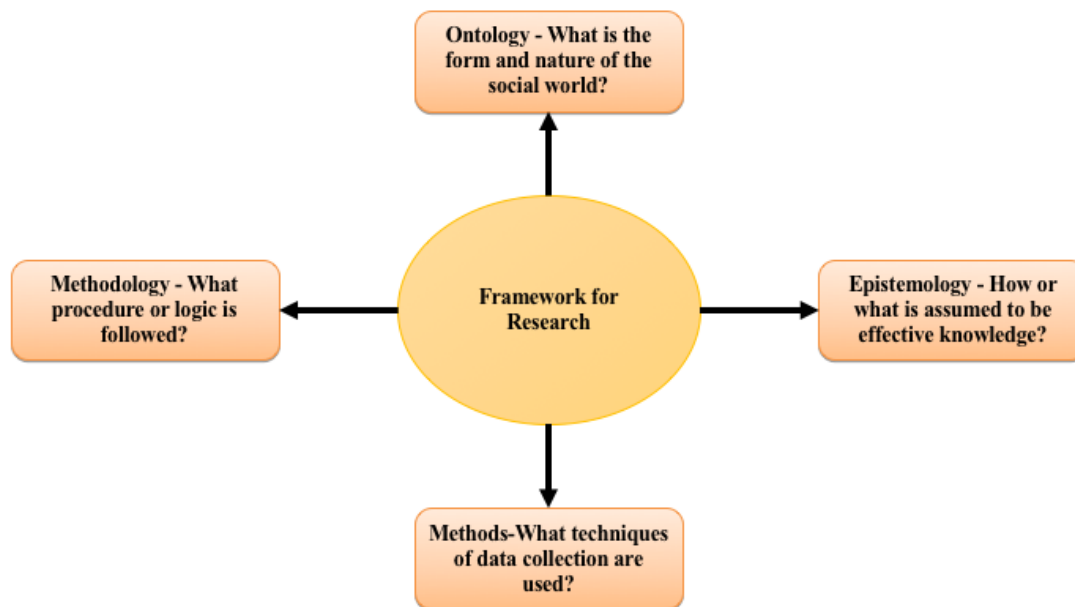


Figure 3.1: The relationship between ontology, epistemology, methodology and methods (adapted from Arthur et al. 2012).

3.4.3 Nature awareness, appreciation and education on the ontological and epistemological bedrocks.

Using the lenses of ontology and epistemology it is necessary to examine what is meant by ‘nature’ in this study. Specifically, it is non-human nature in the context of the revised new curriculum (DES, 1999b; DES, 1999d). The strand units of interest are: Plants and Animals; Caring for My Locality; Environmental Awareness; The Local Natural Environment; Rocks and Soil; Weather, Climate and Atmosphere.

Awareness of nature in this study takes account of factual and scientific knowledge of plants and animals (cognitive development) through constant outdoor immersion in the

natural world and practical work in the school garden. As discussed in 2.1, Carlson (1995) stated that there cannot be appreciation without a cognitive element as a prerequisite to an appreciative response. Nature appreciation in this study is grounded on awareness and is intertwined in the following aspects of human development: mental and physical health, aesthetic and spiritual sensibility, creativity, sensitiveness to living things and a caring attitude towards the natural environment.

The hypothesis is this: primary school pupils, teachers and potential primary teachers have limited knowledge of nature as outlined in the revised curriculum (DES, 1999b; DES, 1999d). This hypothesis is based on this researcher's long experience of working as a primary teacher, lecturer in Social, Environmental and Scientific Education (SESE), Heritage in School expert (HS) and CPD facilitator.

3.4.4 Logic.

Logic has a bearing on the research framework in that it deals with causality and linking pieces of research in a causal process. The logical development of this piece of research adopted this following trajectory based on the overarching research question: What is the state and status of nature awareness, appreciation and education in the primary school system in Ireland? Stage 1: A questionnaire to ascertain novice student teachers' knowledge of and attitude to nature. Stage 2: Semi-structured interviews with HS experts who specialise in nature education. Stage 3: Online questionnaire with open and closed questions for teachers in primary schools to ascertain their perceptions relating to nature-pedagogy and learning in and about nature in the primary school system. Stage 4: Analysis of a full academic year of school inspectors' whole school evaluation reports to determine the status which the DES assigns to nature education in the primary system.

3.5 Theoretical Perspectives

This section explores the theoretical perspectives of positivism and interpretivism, feminism and pragmatism and outlines how these are relevant to this research.

3.5.1 Paradigms.

Assumptions regarding methodological theory are described generally as paradigms. Denzin and Lincoln, (1994); Guba, (1990); Bryman, (1988), referred to paradigms as clusters of beliefs which guide the researcher on what in the world should be studied, how it should be studied and how results should be construed. Usher (1996a) referred to paradigms as maps rather than as guides which decided on issues or problems to be addressed and the methods to be employed in addressing these issues.

In the 1980s there was a distinct polarisation of views regarding the traditional positivist or scientific paradigm and the interpretative or participants' perspectives paradigm. This led to the so-called paradigm wars (Gage, 1989). Researchers clung to either quantitative research methodology which is mainly based on a positivist paradigm or qualitative methodology which is mainly based on an interpretivist paradigm.

Bryman (2012) suggested that incompatibility between the quantitative and qualitative approaches was not considered to be a reality anymore. Sometimes, a seemingly quantitative approach has qualitative dimensions; qualitative approaches likewise can contain quantitative elements. In dealing with mixed methods research, Bryman further explored the quasi distinction between the two approaches and asserted that it was not as rigid and separate as was generally perceived. Even though quantitative research focuses on behaviour and quantification and qualitative research on meanings and words this is not necessarily true in all circumstances. In the mainly quantitative questionnaire, which teachers could access online, some questions sought meanings. Example: 'What word comes to your mind when you think of nature?' Other questions in the mainly qualitative interviews to HS specialists such as 'Are children in primary schools being brought outside

very frequently, frequently, sometimes, seldom, never?’ are focused on behaviour and have a quantitative slant.

3.5.2 Mixed Methods and pragmatism.

Mixed methods research gained respectability after the entrenched paradigm wars and is often referred to as a pragmatist paradigm. Gorard (2010) favoured mixed methods but refused to call it a paradigm. He viewed mixed methods as the correct way to approach research because of the variety of tools that the researcher could use.

Creswell (2009), outlined postpositivism, constructivism, advocacy/participatory and pragmatism as the four paradigms behind research which were later expanded by Gray (2014) whose paradigms are discussed later. Both include pragmatism as a worldview.

This study began with research questions that needed answers and methods were chosen for answering them. Punch (2009) referred to this method of planning as the pragmatic approach. This approach with its emphasis on action, verification of truth, inquiry and experience is attributed to C.S. Peirce (1839-1914), William James (1842-1910), and John Dewey (1859-1952). Denscombe (2010) outlined the following core ideas of this philosophy in mixed methods research:

1. Knowledge is based on practical outcomes and ‘what works’.
2. Research should test what works through empirical inquiry.
3. There is no single, best ‘scientific’ method that can lead the way to indisputable knowledge.
4. Knowledge is provisional. What we see as truth today may not be truth in the future.
5. Traditional dualisms in the field of philosophy and science are regarded as not helpful. (pp 148,149).

3.5.3 Mixed Methods as a discrete paradigm.

Denscombe further stated that modern mixed methods proponents such as Tashakkori and Teddie (1998) and Johnson and Onwuegbuzie (2004) viewed this methodology as a paradigm in itself and that it was replacing the old paradigms of positivism and interpretivism. This contrasted with Gorard's view which was explored earlier in 4.8.2 and demonstrates that there is some debate on what exactly constitutes a paradigm.

3.5.4 Mixed Methods and designs.

Creswell and Plano Clark (2007) drew up a classification of mixed methods research under four headings: triangulation design, embedded design, explanatory design and exploratory design. This research utilises triangulation design which merges data to acquire a fuller picture (convergence). Methodical triangulation was used 'to obtain different but complementary data on the same topic' (Morse, 1991). When the research problem is explored by quantitative methods initially, Morse (1991) referred to this type of research as '*sequential triangulation*' (p.120 emphasis in original) represented by the notation, QUAN→qual. This research was driven mainly by a deductive process from quantitative methods e.g. student and teacher questionnaires and results complemented from induction of qualitative methods i.e. interviews with HS specialists.

In sum, this research was a mixed-model type within the mixed methods paradigm using within-stage mixed-model design in which questionnaires and interviews included both closed and open-ended questions (Johnson & Onwuegbuzie, 2004).

3.6 Other Theoretical Perspectives

Gray (2014) listed positivism, interpretivism (symbolic interactionism, phenomenology, realism, hermeneutics, naturalistic inquiry), critical theory, feminism, postmodernism, and pragmatism as the main theoretical perspectives in educational

research. These are based on Crotty's (1998) and Lincoln and Guba's (1994) analysis of the same perspectives. Of these theoretical perspectives, positivism and interpretivism (especially the phenomenological aspect), feminism and pragmatism had relevance to this study.

3.6.1 Positivism.

Scientific investigation and the search for facts based on an objectivist epistemology constitute the positivist paradigm. This research has a significant amount of positivist/post positive input in that there is an attempt made to deduce how much student teachers know about nature (as outlined above in 4.5.4) using closed questionnaires. This research also endeavours to deduce from the teacher questionnaires and the inspectors' reports information about the current state and status of nature awareness, appreciation and education in the primary school.

Creswell (2009) has abandoned the term positivism altogether preferring to use the word postpositivism when describing scientific methods arguing that it is impossible to be positive about knowledge claims where human behaviour and actions are being analysed. Popper (1968) was first to introduce this term to counter the certitudes and foundationalism attributed to positivism. Popper's worldview is referred to as critical rationalism and introduces an interpretive element to positivist thinking. Even though, he still favoured an objective approach to research, results of experiments and the theories based on them would always be conjectural because in the future they could be proven to be false. 'Popper is not interested in the context of *discovery* of scientific hypotheses but only in the context of justification of hypotheses and laws' (Flick, 2015, p.21, emphasis in original).

3.6.2 Interpretivism.

This research was also significantly influenced by the interpretivist perspective which is based on a constructivist ontology. Interpretation of some questionnaires

administered to teachers elicited their knowledge of and attitudes to nature using open-ended questions; some inductive analysis was also to interpret inspectors' weighting of the nature dimension in schools and to interpret interviews given to expert practitioners in the field such as HS specialists.

3.6.2.1 Phenomenological research.

Phenomenology is a philosophy that is the bedrock of qualitative research. Patton (1990) stated that in phenomenological research the core essence of a phenomenon such as loneliness is sought by bracketing, analysing and comparing the experiences of different people.

This theoretical perspective or paradigm is a descriptive process based on studying the meaning and insights individuals give to a phenomenon from their own experiences. The interviewee is the main actor in the drama. Consequently, in-depth, inductive interviews where the world experienced by the participants is explored, is an ideal tool for research in this area. The world of nature in primary schools experienced by HS specialists explored in six interviews.

'Bracketing', (mentioned in the first paragraph above), where the researcher adopts an outsider's, unbiased stance is an important aspect of this approach. Denscombe (2010) stated that 'researchers need to approach things without predispositions based on events in the past, without suppositions drawn from existing theories about the phenomenon being studied and without using their everyday common-sense assumptions' (p.99). Echoing this aspect of phenomenological analysis, Patton (1990) observed that the researcher 'brackets out the world and presuppositions to identify the data in pure form, uncontaminated by extraneous intrusions' (p.485). Further to this he noted that once the data are collected it is horizontalized i.e. all of it is given the same weight and then broken into meaningful clusters and analysed carefully. As noted below in the reflexivity paragraph, this researcher, being a long-established HS expert, needed to bracket predispositions

concerning nature awareness, appreciation and education in primary schools, in order not to prejudice the data instrument.

Phenomenological research within the interpretivist paradigm involves putting one's own prejudices and preconceptions aside and concentrating on the views, opinions, attitudes and personal constructions of subjects. Use was made of the phenomenological research tradition when interviewing the HS specialists to gain insight into their collective experiences relating to nature awareness, appreciation and education in primary schools.

3.6.2.2 Heuristic inquiry.

Finally, in phenomenological analysis there is a heuristic inquiry process. Here the researcher looks deeply into himself/herself, his/her tacit knowledge and his/her perspectives (rather than those of the participants) on the phenomenon he is investigating. (The word 'heuristics' is derived from the Greek word *heuriskein* which means to find out or discover).

Gray (2014) summed up heuristic inquiry by explaining that in this form of research the researcher tries to illuminate a problem or a question and come up with answers. Moustakas (1990) outlined several stages in the process which begins with initial engagement.

In this research, this initial engagement is questioning the state and status of nature awareness, appreciation and education in the primary system. The second phase is immersion or complete absorption with the experience; the third is incubation which is a period when gradual understanding of the experience grows within the researcher and it becomes more meaningful. This is followed by illumination when insights gain more clarity and explication when the whole experience is reflected upon and analysed. The final stage is creative synthesis in which all elements of the experience are coalesced.

In the procedural journey undertaken in this research concerning the state and status of nature awareness, appreciation and education in the primary school system the

completion of this chapter passes the signposts of initial engagement, immersion and incubation.

3.7 Methodologies

Creswell (2009, p.11) referred to methodologies as ‘strategies of inquiry’. He listed them as either quantitative (using experimental and non-experimental designs such as surveys), qualitative (using narrative research, phenomenology, ethnographies, grounded theory and case studies) or mixed methods (using sequential, concurrent or transformative approaches).

Van Manen (1990) referred to methodology as the philosophical framework that underpinned research assumptions. Crotty (1998, p.3) stated that [methodology] ‘is the strategy, plan of action, process, or design, lying behind the choice or use of particular methods and linking the choice and use of methods to the desired outcomes.’ Choice of methodologies therefore follow logically from research paradigms to methods or tools, ‘the sweeter layers of research’ (Loxley, 2014).

3.8 Mixed-methods as a methodology

Originally known as multiple methods research there is still some debate as to whether mixed methods research is a methodology or a method. Creswell et al (2003) defined mixed methods research as ‘the collection of analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of data at one or more stages in the research’ (p.212). Yin (2006) disagreed with this analysis, however, and argued that mixed methods could be a mixture of quantitative methods as a package or indeed a combination of qualitative methods. The mixed methods research in this study is based on Creswell’s model rather than this one offered by Yin: the data from document analysis, interviews and questionnaires are integrated in a single study.

3.8.1 Pragmatism in mixed methods methodology.

Denscombe (2010) analysing the pragmatist position which is adopted in the mixed methods approach stated that it was problem-driven and that it was chiefly concerned with answers to problems. This strategy is very relevant to this research as an answer to this question is being sought: 'What is the state and status of nature awareness, appreciation and education in the primary school system? He also explored the other two characteristics of mixed methods research namely the quantitative and qualitative approaches in a single project and the link between them. The latter link equates to triangulation which contributes to accuracy in research where the strengths of one method may compensate for the weakness in another. Finally, he highlighted the possibility of non-corroboration in results from utilising different methods, stating that contradictory evidence may lead to an unsatisfactory conclusion to the research process, but this could also demonstrate defects and limitations in the methods used.

3.8.2 Four main designs revisited.

As discussed in 4.5.4, Creswell and Plano Clark (2007) outlined four main designs of mixed-methods research: triangulation, embedded, explanatory, and exploratory designs. The first one is of particular interest to this study because it uses quantitative and qualitative data collected concurrently (always attractive when time is limited) for comparison and analysis to arrive at a comprehensive interpretation. Exploratory design is also of particular relevance because in this research close-ended/open-ended questionnaires are used to gauge participants' knowledge of and attitude to nature in a primary school context and interviews to provide deeper understanding of the results from the quantitative data. This is depicted in the literature as QUAN + QUAL. This complementary process is referred to by Creswell (2007) as 'connecting the two datasets by having one build on the other' (p.7). Creswell (2009), advised using concurrent triangulation strategy for researchers who have a limited time-frame and this strategy is favoured in this study. In

this strategy, quantitative and qualitative data are collected simultaneously and compared. Usually, equal importance is given to each method but sometimes one may take priority over the other after the data has been collected. Discrepancies can sometimes be found when this analysis is completed, and this can be problematic for the researcher whose theory may have to be revisited.

3.8.3 Four characteristics of mixed methods research.

Tashakkori, and Teddlie (2010) outlining characteristics of mixed-methods research mentioned four that are very relevant in this research. These are methodological eclecticism (choosing best tools for answering questions), mixed designs, balance in the methodological spectrum i.e. avoiding polarisation into quantitative and qualitative camps and a focus on the research question for determining the methods. The research question is answered using survey and interview methods and analysing whole school evaluation documents produced by inspectors in the DES.

Mixed methods research then could be summed up as empirical research that combines quantitative and qualitative data. Creswell (2006) defined mixed methods research ‘[as] a methodology [which] involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of quantitative and qualitative approaches in many phases in the research process’ (p.5). This study combines data from closed, knowledge seeking questionnaires to student teachers and closed and open-ended questionnaires to primary teachers with interview data from specialists in the field and analysis of inspectors’ documents to answer the question: What is the state and status of nature awareness, appreciation and education in the Irish primary school system?

3.9 Case Study

Yin (2009) discussed the importance of *questions* when deciding on a research method. He considered that ‘How’ and ‘why’ questions-explanatory questions- are very

relevant for case study choice. 'What' questions are more relevant to an analytic survey, but they are also used in a case study to explore a phenomenon. (The what, why and how questions for my research as discussed in 4.2 above, relate positively to Yin's definition of case-study questions (Yin, 2009).

He specified that the 'case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context... "[and] relies on multiple sources of evidence, with data needing to converge in a triangulation fashion' (Yin, 2009, p.18). The phenomenon ('unity of analysis' (Yin, 2009, p.29) which are researched is the state and status of nature awareness, appreciation and education in the primary school system. A mixed methods approach is utilised to converge data and bring about convergence of data through the triangulation process.

Stake (2000) defined a case study as 'both a process of inquiry about the case and the product of that inquiry' (p.436). He identified the intrinsic type where a clearer understanding of a particular case is sought. The case study in this research within the mixed methods approach is the intrinsic type, where a clear understanding of the state and status of nature awareness, appreciation and education in the primary school system is sought. Stake added that 'boundedness and behaviour patterns are useful concepts for specifying the case' (Stake (2000, p.436). The case study in this research has two boundaries: the primary school system and the state and status of nature awareness, appreciation and education within that system.

The behaviour patterns pertaining to this phenomenon are examined from teachers', student teachers', heritage specialists', and inspectors' perspectives. Stake (2000) further added that even though the case was singular it also had subsections. Attitudes, perspectives and knowledge from teachers, students, inspectors and heritage specialists constitute subsections within the case study. Yin (2009) described this type of case study as a single embedded one composed of multiple units of analysis.

De Vaus (2014) contrasting the survey method and the case study method stated that a function of the survey analysis method was to describe the characteristics of a set of cases whereas the case study seeks to understand fully the ‘wholeness’ of a particular case” (p.5). As stated above, the particular case in my research is the state and status of nature awareness, appreciation and education in the primary school.

3.9.1 Validation by triangulation.

Moisander and Valtonen (2006) summed up this method of obtaining credibility and validity succinctly when they suggested: ‘Triangulation usually refers to combining multiple theories, methods, observers and empirical materials to produce a more accurate, comprehensive and objective representation of the object of study’ (p.24). This aspect of triangulation has been discussed in 4.8.2.

Yin (2009) and Stake (2000) also explored the concept of triangulation for validation of data. Extolling the virtues of the data collected in case studies the former stated that one of the great positives of this methodology was that it created an opportunity to use a multitude of evidence sources. He compared this harvesting of rich data in the case study approach to the paucity of data harvested in other methods. Another advantage he offered was that the uses of multiple sources contained ‘the development of *converging lines of inquiry* (emphasis in original), a process of triangulation and corroboration’ (pp.115-116). Stake, (2000) also emphasised the importance of this process of triangulation of evidence and suggested that the use of multiple perceptions clarified meaning.

Nonetheless, several authors (Hammersley and Atkinson, 1995; Denzin and Lincoln, 2000), warned that triangulation of methods did not necessarily guarantee validity and truth of findings. The latter stated: ‘[Triangulation]...is best understood as a strategy that adds rigor, breadth, complexity, richness and depth to any inquiry’ (p.5).

This research utilises multiple sources such as two types of questionnaires, interviews and analysis of secondary data to see if the evidence is confirmatory triangulation or non-confirmatory triangulation.

In summary, in this research a case study was undertaken, which was informed by the principles of naturalistic inquiry in which data were generated via mixed methods (analysis, interviews, questionnaires). Figure 4.2 provides a concise summary of the research questions, the conceptual framework, the goals of the study, the methods employed to collect data and the validity of this data.



Figure 3.2: Research Design Map (adapted from Maxwell, 2005).

3.10 Methods of Data Collection Which Were Employed in this Research.

To attempt to answer the question-What is the state and status of nature awareness, appreciation and education in the primary school system? -firstly, quantitative and qualitative data collection instruments were administered to study participants which included teachers, student-teachers and Heritage in School experts (HS); secondly, secondary data from whole-school evaluations (WSE) of primary schools for the academic year, 2014-2015, were analysed to ascertain the emphasis primary school inspectors from the DES place on this area of teaching and learning in the primary school.

3.10.1 Questionnaires to Practising Teachers and Student Teachers.

These were mostly utilised to gather quantitative evidence about student teachers' knowledge of nature and primary teachers' experiences of learning about nature in their own school days and engaging with it in their present schools. (The students were questioned on the knowledge of nature that 6th class pupils would be expected to know). Interviews were mostly utilised to gather qualitative data from HS experts about their experiences of teaching nature as outsiders in the primary schools that invited them in as guest teachers.

3.10.1.1 Indicators.

De Vaus (2014) urged the researcher to clarify the concept first and then to develop indicators for tapping the concept. He further added that these indicators should be based on five underlying types of question content which he listed as 'behaviour, beliefs, knowledge, attitudes and attributes' (p.94).

Behaviour questions relate to how people behave in their working lives and the teacher-questionnaire elicited information from teachers on how they taught this aspect of education in their own schools at present. Sample question: do you ever teach nature outdoors? Belief questions examined whether teachers believed some aspect of nature

education were true or false e.g. how effective in your opinion is nature education in your school? Knowledge questions focused on their knowledge of nature e.g. how confident do you feel about teaching the following aspects of nature? Attitude questions sought to establish what the respondents 'think is desirable' (p.94) e.g. have you any general comments to make about nature education or nature in general in your school? Attribute questions sought to find out about respondents' age, education (especially nature education) etc. and were included first to ease respondents gently into the questionnaire e.g. in initial teacher education how often did you study nature?

3.10.1.2 Design of questionnaire and information required from respondents.

The questionnaire which was made available to the teachers was divided into four parts (see Appendix L). In part one they were asked to give details on the school they were teaching in when the questionnaire was administered. In part two information was sought on their experience of learning about nature as primary school pupils. In part three information was sought on their experience of learning about nature in ITE. In part four questions were asked about their experiences of teaching nature. Numerical rating scales such as the (a) Likert scale (b) scores (d) ranking (e) checklists (f) binary choice formats and (g) multiple choice formats were utilised in questions such as: (a) How often do you take children outside to study nature? Once a week, once a month, once a term, once a year, never (Multiple choice). (b) Do you keep a nature table in your class? Yes, No (Binary choice). Please rank in order of importance what you consider to be the biggest challenges to your involvement in school gardening, with one indicating the most important and six the least important. Lack of knowledge of gardening; lack of time; lack of confidence in bringing children outside; safety issues; lack of suitable school garden; weather (Ranking scale). How would you rate your ITE as a foundation for the teaching of children about nature? Excellent, very good, good, fair, poor (Likert scale) Although quantitative evidence was the dominant type collected from the questionnaires there was

some qualitative evidence gathered from them too. An example of an open-ended question in the questionnaire where meaning was sought (an action usually attributable to qualitative research) was an attitude question such as: What word comes to your mind when you think of nature?

3.10.1.3 Pretesting to ensure reliability of data collection instrument.

De Vaus (2014) advised that, where possible, the pretesting should be carried out with people resembling those who would undertake the answering of the final questionnaire. This advice was taken on board in the piloting of the questionnaire instrument for primary teachers. In September 2016, 11 practising primary teachers with an interest in nature were asked to complete the questionnaire; eight lecturers in a College of Education were asked to do likewise (all but one had been primary teachers; five of them had completed doctorates and were accustomed to research).

Two of the lecturers and two of the practising teachers did not respond but the rest of those invited to participate provided very useful feedback resulting in the questionnaire being amended considerably. Three suggested that ‘weather’ should be included as one of the potential factors for not bringing children outside to study nature or engage in school gardening; two suggested that responses to the question, ‘When you attended primary school did you go outside to study nature?’ Should be more precise. For example, they suggested that the possible answers ‘very frequently’, ‘frequently’, ‘sometimes’, ‘seldom’ should be quantified and so these options were changed to ‘once a week’, ‘once a fortnight’, ‘once a month’ and ‘seldom’ respectively. One suggested that the word ‘obstacles’ in the request, ‘Please rank in order of importance what you consider to be the biggest obstacles to school gardening?’ would read better if it were changed to ‘challenges’. Two requested that ‘Community schools be included in the options relating to where teachers taught. Two suggested that the question, ‘How would you rate children’s

knowledge of nature’? wasn’t clear and that it should either be changed to children in their own school or children in general. The latter suggestion was taken on board.

Four of the practising teachers found very little to criticize and gave feedback such as follows: ‘I have read through the questionnaire and found it very comprehensive and straightforward’; ‘the questions are pretty thorough and take a lot into account’; ‘in my opinion, the questions are very comprehensive and easy to respond to’; this is a wonderful questionnaire and one which is very easy to follow’. Interestingly, one of the practising teachers could only provide feedback on minor mistakes in question construction and none on question content relating to her College of Education. She stated that she could not contribute because ‘they had only one day in college for science and geography, so we didn’t get out and about studying nature at all really’.

It was suggested, too, that some brief summaries of research be included before a few questions to make respondents feel less inadequate about their own contribution to nature education in their own school. This was done for three of the questions.

3.10.1.4 Sampling.

The questionnaires which took c. 10-15 minutes to complete were administered to practising primary teachers online using the SEED website, www.schoolearthed.ie, utilizing a probability sampling procedure and a stratified random sampling strategy. Gray (2014) suggested that an advantage of this strategy was that ‘it increases the likelihood of key groups being in the sample while still ensuring an element of random selection’ (p.210). These key groups within the overall population of primary teachers were: 1. Teachers in large schools (>200), teachers in medium-sized schools (>100<200), teachers in small schools (<100), teachers in DEIS schools and teachers in urban and rural schools. In order to cater for broad geographical coverage teachers in Donegal, Galway, Waterford, Kildare, and the four Dublin administration authorities of Fingal, Dublin City Council, South Dublin and Dunlaoire/Rathdown were targeted with the questionnaire.

Using the sampling frame on the DES website, www.education.ie, the number of schools in each key group were counted and then 1/10 of each group was placed on the SEED website and contacted by email in November 2016. For example, Donegal had 27 large schools, 38 medium schools, 110 small schools and 9 DEIS schools. Dividing each number by 10 and rounding to the nearest whole number, the following ratios were found: Large: 3; Medium: 4; Small: 11; DEIS: 1. Next, the sampling frame (the complete list of mainstream primary teachers) was consulted to select every k th element (“Total Enrolment in Mainstream National Schools for 2016/2017,” 2017.) The following table provides a breakdown of the total number schools and teachers involved (k th element in parentheses).

Table 3.2

Number of Schools and Teachers Targeted for Completion of Online Questionnaire

Large schools (>200)	Medium schools: (100<200)	Small schools: (<100)	DEIS schools	Civil administrative area	Number of teachers
51(5)	53(5)	126(13)	52(5)	Galway	72
63(7)	20(2)	18(2)	10(1)	Kildare	50
31(3)	22(2)	21(2)	10(1)	Waterford	32
27(3)	38(4)	110(11)	88(9)	Donegal	61
111(11)	57(6)	21(2)	102(10)	Dublin City Council	135
43(4)	16(2)	3(1)	12(1)	Dunlaoire/Rathdown	34
77(8)	8(1)	7(1)	15(2)	Fingal	59
82(8)	6(1)	10(1)	31(3)	South Dublin	67
Total:					
485(48)	220 (23)	316(33)	320(32)	09	510

In total, 510 teachers in 137 schools in nine civil administrative areas were targeted to answer qualitative and quantitative questions online. Out of a population of 20,000 teachers, adopting a margin of error of 5%, an estimated response rate of 70% and a confidence level of 95%, a sample of 377 teachers was required. The number to invite to achieve these levels was 539 (‘Calculate response sample size’, 2016).

3.10.1.5 Timeframe.

School principals were contacted by email on the 20th November 2016. The email contained the following information: this researcher’s name and credentials, the title of the

research, the potential benefits of the research for children and parents, assurance of confidentiality and anonymity, the voluntary nature of the request made, the time it would take to complete the questionnaire (10-15 minutes), the deadline of the 30th November and the URL where the questionnaire could be accessed. A participation consent form was attached to the email (See Appendix B).

Reminders were sent to non-respondents on the 8th December with follow-up phone calls. Both informed participating schools that the deadline had been extended to January 20th, 2017 because December was a busy time in schools. When schools returned from the Christmas holidays on the 11th January further reminder emails were sent to schools which had still not responded. On the 22nd January, a final email was sent to schools stating that the deadline had been extended to Valentine's Day, the 14th February.

3.10.2 Questionnaires to Student Teachers.

In September 2016 and February 2017, face-to-face questionnaires were administered (after ethical approval from TCD and two Colleges of Education was granted-see Appendix A) to first year B.Ed. and PME students before they embarked on studying the following strand units of the new revised curriculum: Plants and Animals; Caring for My Locality; Environmental Awareness; The Local Natural Environment; Rocks and Soil; Weather, Climate and Atmosphere. Before completing the questionnaire, each student was required to read a participation consent form and sign it. A copy of this was given to each after the questionnaire was completed. (See Appendix B for a copy of the form).

3.10.2.1 Validity of student-questionnaire.

The questionnaire's main objective was to assess the students' knowledge of nature. The content of the knowledge section was based solely on the learning objectives of the Science and Geography syllabi of the revised curriculum (DES, 1999b, 1999d) for sixth

class particularly relating to the Science Strand, Living Things and the Strand units, Plant and Animal life and the Geography Strand, Natural Environments and the Strand Unit, Rocks and Soil. It was divided into three sections: Section one: Biographical details; Section two: Students' experience of learning about nature; Section three: Their knowledge of nature. Multiple choice questions were mostly utilised in the questionnaire with some ranking scale, binary choice and Likert scale questions.

3.10.2.2 Structure of the knowledge section: identification of plant / animal life.

The science curriculum objectives for sixth class are: 'The child should be enabled to observe, identify and examine the animals and plants that live in local habitats and environments' (DES, 1999b, p.84).

Is this naming important? Personal observation of children from visits to c. 500 primary schools since 1999 through the HS scheme has demonstrated to this researcher that children in general can no longer identify common species such as the ash, hawthorn, thrush, chaffinch, primrose, fern, woodlouse, millipede, and the small tortoiseshell, peacock and cabbage white butterflies. Pyle (2010, p.155) echoed this observation when he wrote: 'Personal acquaintance with local flora and fauna-once an essential knowledge and later at least common in most cultures-has become scanty to absent' and he argued that this lack of knowledge will have environmental consequences in the future. 'How can a culture confront imperilled ecosystems when a large majority of the members have no functional knowledge of the system's working parts' (p.155). The questionnaire essentially sought to elicit if the students had 'personal acquaintance with flora and fauna' and a 'functional knowledge' of how nature works. (Pyle, 2010, p.155). The basis of this 'functional knowledge' starts with identification of common species. A summary of the questions relating to identification skills is given in Table 3.3.

Table 3.3

Summary of Questionnaire to ITE students on Identification of Species

Common Species	What the Students were Required to Do
Common trees	Students were asked to identify the leaves of the oak and rowan tree, and the bud of the ash from four-choice lists.
Common wild flowers	Students were asked to identify the dandelion and the primrose from four-choice lists.
Common birds	Students were asked to identify the jackdaw and the chaffinch from four-choice lists.
Common butterflies	Students were asked to identify the small tortoiseshell from 4 choices.
Common fruits	Students were asked to identify a rose hip, ash keys and a beech nut.
Common vegetables	Students were asked to identify a root vegetable from four choices.
Common mammals	Students were asked to identify a pygmy shrew from a list of four.

3.10.2.3 Interdependence between plants and animals.

These are the interdependence objectives of the science curriculum: ‘The child should be enabled to identify the interrelationships and interdependence between plants and animals in local and other habitats’. (DES, 1999b, p.84)). Table 3.4 sums up the questions that were asked regarding interrelationships and interdependence between plants and animals in local habitats.

Table 3.4

Summary of Questionnaire to ITE Students on Interdependence

What students were required to do
1. Students had to construct 3 food-chains. In two chains, the first three parts were given. In one, the seven parts were jumbled.
2. Students had to explain why wasps are useful to gardeners.
3. Students had to choose from a list of four butterflies the one which used nettles as larval food-plants.

3.10.2.4 Adaptation.

These are the adaptation objectives of the science curriculum: ‘The child should be enabled to observe and explore some ways in which plant and animal behaviour is influenced by, or adapted to, environmental conditions’ (DES, 1999d, p.84)). (This

indicator was taken from *Science in the Primary School* (2012, p.34); they were also queried about hibernation and migration.

Table 3.5

Summary of Questionnaire to ITE Students on Adaptation, Hibernation and Migration

Domains	What Students were Required to Do
Adaptation	Students had to choose two ways the camel, whale, duck, eagle, Polar bear and bat were adapted to their environments ^a
Hibernation	Students had to choose from a list of four Irish mammals one of which hibernated
Migration	Students had to choose from a list of three birds one of which migrated to Ireland annually

Note. This indicator was taken from *Science in the Primary School* (2012, p.34)

3.10.2.5 Classification.

These are the classification objectives of the science curriculum: ‘The child should be enabled to group and compare living things into sets according to their similarities and differences’ (DES, 1999b, p.84). Classification: Students were asked to classify vegetables, vertebrates, and some invertebrates into families.

Table 3.6

Summary of Questionnaire to ITE Students on Classification of Species

Domains	What Students were Required to Do
Classifying vegetables	Students had to choose which was a root vegetable from a list of four
Classifying vertebrates	Students had to name the five main invertebrate classes
Classifying invertebrates	Students had to classify four invertebrates as crustaceans
Classifying mammals	Students had to choose a mammal from a list of four animals

3.10.2.6 Characteristics of major groups of living things.

These are the characteristics’ objectives of the science curriculum: ‘The child should be enabled to become familiar with the characteristics of some major groups of living things’ (DES, 1999b, p.84).

Table 3.7

Summary of Questionnaire to ITE Students on the Characteristics of Major Groups of Living Things

Characteristics of Living Things	What Students were Required to Do
Characteristics of animals	Students had to decide whether it was true or false that a common fly, a worm, a spider and a boy are animals.
Characteristics of carnivores and herbivores	Students had to decide on whether a millipede was a carnivore or an herbivore.
Characteristics of arachnids	Students had to explain why a spider is not an insect.
Characteristics of amphibians and reptiles	Students had to name two characteristics that distinguished reptiles from amphibians.

3.10.2.7 Habitats.

These are the objectives of the science curriculum: ‘The child should be enabled to observe, identify and examine the animals and plants that live in local habitats and environments’. (DES ,1999b, p.84).

Table 3.8

Summary of Questionnaire to ITE Students on Habitats

Habitat	What Students were Required to Do
Habitat of woodlice	Students had to identify the habitat of woodlice
Meadow habitat	Students had to explain why a meadow is a suitable habitat for brown butterflies, amphibians and finches

3.10.2.8 Strand: Natural environments; Strand unit: rocks and soil.

These are the objectives of the geography curriculum: ‘The child should be enabled to collect and identify some common rocks in the locality; learn about the characteristics of some common rock types and where they may be found in Ireland and in other parts of the world; be familiar with some ways of changing and/or improving soil structure; compare soil samples from different parts of the locality’ (DES, 1999d p.80).

Table 3.9

Summary of Questionnaire to ITE Students on Rocks and Soil

Matter	What Students were Required to Do.
Rocks	Students had to choose from a list of four rocks the most common one in Ireland.
Soil	Students had to name any three components of soil and give two reasons why earthworms are beneficial to it.

3.11 Sampling

The following table illustrates the numbers of B.Ed. and PME students enrolled in colleges of Education in the academic year 2015/16. These figures which were supplied by the DES enabled this researcher to determine the confidence level relating to the sample and the margin of error.

Table 3.10

List of Entrants to B.Ed. and PME ITE in the Year 2015/16

Type of Student	Colleges of Education
B.Ed. Students	1016: DCU: (St. Patrick's College, Church of Ireland College of Education); Maynooth University (Froebel College); Mary Immaculate College; Trinity College (Marino Institute of Education)
PME Students	819: DCU: (St. Patrick's College); Mary Immaculate College; Trinity College (Marino Institute of Education); Maynooth University (Froebel College); Hibernia College.

Purposive sampling was carried out on the students in two of the colleges. 60 PME students and 110 B.ED. students were chosen from one college and 35 PME students and 66 B.ED. students from another (total cohorts in each). Out of a population of 1.016 B.Ed. students, utilizing 176 respondents and adopting a confidence level of 95%, a margin of error of 6.72% was achieved. Out of a population of 819 PME students, utilizing 95 respondents and adopting a confidence level of 95%, a margin of error of 9.46 was achieved. ('Calculate response sample size', 2016)

3.11.1 Pre-testing.

Pre-testing of the questionnaire was carried out in June 2016. Fourteen lecturers in a College of Education submitted suggestions for improvements. Forty-two changes were made after their comments. The main changes are outlined below.

Table 3.11

Main Changes Made to Student-Questionnaire After Pre-Testing

Changes Made to Questionnaire	
1.	Students were given an option at the end to opt out of having their answers used for research
2.	A box was inserted at the beginning outlining briefly the purpose of the research and the structure of the questionnaire
3.	A “don’t know” option was added to eleven multiple-choice type questions such as this one: Is this leaf from (a) silver birch? (b) oak? (c) elm? (d) willow? This was done in order to discourage students from guessing the answer.
4.	In order to provide a more complete profile of the student’s exposure to nature education he/she was asked to state which of these subjects he/she studied up to Leaving Cert. level: Chemistry, Physics, Biology, Agricultural Science, Geography, None of these.
5.	One question asked: Name the five classes of vertebrates (animals with backbones) on earth? The next question asked: What is the difference between a vertebrate animal and an invertebrate animal? The latter question was omitted as a result of a lecturer’s observation
6.	Which one of these two aspects of nature (a) plants and (b) animals are you more knowledgeable about? A third option added was: Circle (c) if you feel you are equally knowledgeable about both.

3.12 Interviews with Heritage in School Experts

The Heritage in Schools scheme is a Government sponsored scheme to introduce people who are experts in particular aspects of Irish heritage to primary school children. It was established in 1999 and presently there are 152 experts covering the cultural and environmental heritage requirements of primary schools in every county in the Republic. Of these, 109 have an interest in nature education.

Primary school principals or Green School and science co-ordinators can invite any of these experts into their schools for one day or five days to educate, engage and inspire children with their expertise. This expertise could relate to birds, butterflies, biodiversity,

gardening, bats, bogs, water etc. According to the Education Officer of the scheme in which has its headquarters in Church Lane, Kilkenny, some are very popular and busy; others not. Table 3.12 illustrates that year on year the popularity of the scheme with schools has increased significantly since 2013 especially five-day visits to the one school by experts.

Table 3.12

Number of Schools Visited by HS Experts 2013-2014

	Year			
	2013	2014	2015	2016
No. of School Visits	1,331	2,001	1,922	1,984
No. of children who participated	77,165	96,644	91,184	83,747 ^a
No. of schools who availed of scheme	606	865	736	802
No. of DEIS schools who availed of the scheme	260	393	216	221
No. of children from DEIS schools who participated in a HS Visit	23,716	30,043	30,144	30,770
No. of schools who availed of more than 1 visit	226	352	327	368
No. of 5 Series bookings ^b	116	145	147	197

Note. Information supplied by Maria Walsh, Education Officer with the Heritage Council

^a While the number of children participating in the scheme in 2016 is slighter less than the total figure for 2015, this reflects the increased number of schools availing of more than 1 visit in the calendar year.

^b No. of 5-series bookings.

Having first sought permission to interview experts for this research from the Heritage Council who administer the scheme information was then sought from the Council regarding those who visited schools most often. The Council supplied this researcher with a list of the eleven busiest specialists who visit schools at least 45 times a year. These experts covered 77% the counties in the Republic. These are the counties: Galway, Cavan, Donegal, Leitrim, Sligo, Dublin, Wicklow, Meath, Carlow, Kilkenny, Kildare, Louth, Westmeath, Wexford, Laois, Offaly, Longford, Galway, Clare, Limerick.

After permission was granted by the Heritage Council, this researcher interviewed six of these regarding their experiences of teaching nature to children both indoors and

outdoors. Before doing this however, the interview was piloted with two practising HS specialists.

3.12.1 Rationale for choosing the interview instrument with Heritage in School Experts.

Six of the most active experts were chosen and these represented schools in all four provinces. They were therefore, in the unique position of offering an outsider's interpretation of the reality of nature engagement in the primary schools they visit. The interviews recorded their opinions on the state and status of nature awareness, appreciation and education amongst primary school children and their teachers. This selection method is called purposive sampling: the participants were selected because they were deemed to be information-rich. Open-ended and closed dichotomous, multiple-choice, rank-order and rating questions were created in the interview guide to elicit fact and opinion-based information from participants. In the main, the objective of the interviews was 'to gain insights into things such as people's opinions, feelings, emotions and experiences' Denscombe (2010, p.172). This in-depth approach echoes the 'posture of indwelling' (Maykut & Morehouse, 1994, p.25). Maykut & Morehouse explained what they meant by this phrase as 'being at one with the person under investigation, walking a mile in the other person's shoes, or understanding the person's point of view from an emphatic rather than a sympathetic position' (p.25).

3.12.2 Interviewer effect.

This researcher should declare that he is a Heritage in School expert himself and was one of the first recruited into the scheme in 1999. Having visited nearly 500 primary schools under the scheme since its inception this researcher has been able to assess the quality and quantity of nature education in primary schools. This view needs to be corroborated from evidence from other experts so that a broader, richer and more valid

evaluation can be made of its state and status within the primary school system. This researcher's experience with, and insight into the world of heritage experts, possibly facilitated being accepted readily by the interviewees and enhanced the interviewer/interviewee relationship. Contrariwise, Denscombe, (2010), writing about the 'interviewer effect' (p.179) advised researchers to be mindful of factors which affect the interviewer/interviewee relationship such as age gap, social status, educational qualifications. Being a heritage expert also enabled this researcher to formulate questions that they could answer. However, this researcher was also conscious of the necessity of being neutral with personal thoughts and views and to bracket these in order that leading questions could be avoided.

3.12.3 Interview approaches.

In interviews where the epistemological view of the interviewer is positivist and where quantitative data are required, a structured approach using standardized questions is chosen. In contrast to this, in interviews where the interviewer has adopted a predominantly phenomenological position and where quantitative and qualitative data are sought, non-standardized questions are administered. At the farthest end of the looser, less-structured interview approach are non-directive interviews, informal conversational interviews and problem-centred interviews. (Gray, 2014). Using an interview guide, semi-structured interviews were utilized in which mostly qualitative data were gathered from interviewees who were prompted, and their answers probed for additional information. Arksey and Knight (1999) referred to such an interview guide as 'a framework for the main body of a semi-structured interview and is based on the key questions that the study is addressing' (p.97).

3.12.4 Interview skills.

Denscombe (2010) delved deeply into the skills required by an interviewer to conduct a fruitful interview. Among them he listed being attentive, being sensitive to an informants' feelings, being able to cope with silences, being skilled with prompts, probes and checks and being neutral in making judgements. Drever (1995), (in contrast to quite a few writers) clarified the difference of meaning between prompts and probes. 'Prompts are directed towards what they know but have not yet mentioned' (p.23). 'Probes are directed to what they have already said, asking them to clarify and explain but not as a rule asking them to justify or defend their position' (pp. 23, 24). King and Horrocks (2010) outlined elaboration, clarification and completion probes. Clarification seeks explanation from the respondent re words, phrases, accounts. Elaboration probes seek more detail; completion probes require the respondent to complete a story or explanation that was deemed somewhat truncated. There were twenty-eight probes in the interview guide. (See Appendix C for examples in the interview guide).

3.12.5 Types of interview questions.

Mears (2013) asserted that interview questions in the main relate to the what and the why of the lived experience of the respondents. He also referred to the questions which do not relate to the content matter of the interview. These are concerned with who has the information which is required and how many interviews would be necessary to gain that information; also, how will the data be analysed. Patton (2002) identified six categories of questions that can be asked of participants. He then proceeded to suggest that any kind of question could be subsumed within these. This advice was useful as a framework for the interview guide. The following table outlines these with examples of questions relevant to each.

Table 3.13

Examples of Questions Within Patton's (2002) Framework

Focus of Question	Example of Question
Experience and Behaviour Questions	What activities do you do mostly with children when you visit schools
Opinion and Values Questions	What in your opinion is the most effective way to engage children with nature education?
Feeling Questions	How do you think nature education impacts on environmental awareness and care?
Knowledge Questions	What do you perceive as the benefits of children being connected to nature?
Sensory Questions	Not relevant.
Background/Demographic Questions	What influenced you to have an interest in nature?

Note. Patton (2002, modified)

These are qualitative type questions and administering these types to the HS experts was the main focus of the interview schedule.

Patton (2002); Arksey and Knight (1999), also asked interviewers to be careful about the wording used in questions. For example, Patton advised caution when using the word 'why' in a question because it could lead to minimal response and infinite regression where asking about one cause can lead to asking about another which eventually leads to a long chain in which nothing substantial is elicited from respondents. Wording questions that lead the respondent to the answer the interviewer wants to hear were to be avoided at all costs. A question such as 'We've been hearing a lot of really positive comments about this program. So, what's your assessment?' (p.367) is problematic too according to Patton because it leads to response bias: the respondent has *a priori* knowledge about what the interviewer believes. Arksey and Knight (1999) advised about using appropriate vocabulary that is not confusing for respondents, precise language (avoiding phrases such as average, regularly etc.) and against using ambiguous language, double-barrelled, personal or sensitive and assumptive questions. The questions in the interview schedule were carefully worded to avoid all of the issues related to poor questioning which have been discussed.

3.12.6 Participant reactivity.

Tashakorri and Teddie (1998) asserted that one of the difficulties relating to data collection was participants' awareness that they were being studied (participant reactivity). Because participants react to this awareness in different ways this reactivity affects the reliability of the data and the integrity of the findings. They offered a spectrum of participant responses from the good participant who wants to row in with the researcher's beliefs in order to please to the negativistic participant who is wary of the researcher and his objectives and tries to thwart the interview process by answering contrary to what he considers the researcher expects. The overarching research question, -what is the state and status of nature awareness, appreciation and education in the primary school system? - could trigger participant reactivity because implicit in the question is an assumption that nature awareness in the primary schools is not in a healthy state. A participant might want to agree with the hypothesis because of a perceived inferiority in the power food-chain. To avoid participant reactivity in the questions to the interviewees, this researcher's beliefs regarding the state and status of nature awareness in the Irish primary system were not divulged at any stage of the interview process.

3.12.7 Power relations in research interviews.

Kvale (2006) explored power dynamics in research interviews and outlined the danger of breaching good ethical practices by exploiting the interviewee's trust to acquire information and extract confidential material when the participant is off-guard. He also addressed the common misconception that an interview is a dialogue. A dialogue he maintained 'is a joint endeavour where egalitarian partners, through conversation, search for true understanding and power' (p.483). According to him an interview cannot be construed thus because of the unequal hierarchical power relationship between the interviewer and interviewee. Teasing out this uneven power relationship further he outlined how the interviewer rules the interview, how it is a one-way dialogue, how it's an

instrumental dialogue (it serves the interviewer's agenda), and most ominously, 'the interview may be a manipulative dialogue' (p.484), echoing what was written on line 3 in 3.12.7 above. At no stage in the interview process did this researcher acquire information from the interviewee when he/she was off-guard and in all interviews this researcher portrayed himself as an equal to the participants, being a HS expert himself.

3.12.8 Interview topics.

Rubin and Rubin (1995) provided a suitable metaphor for structuring an interview into topics. This is 'the tree-and-branch model' where the trunk is the central topic and the branches the central questions. In this model questions are planned so that each branch is explored with an equal amount of depth to cover the subject under review. In this research, the trunk is nature awareness, appreciation and education in the primary school system; the branches are the item pool or topics on which questions are based. After brainstorming the topic in depth, the following topics were chosen: Heritage in schools' scheme, teachers' engagement with nature, pupils' engagement with nature, Green School initiative, school grounds.

3.12.9 Sensitizing concepts.

Blumer (1954) was particularly concerned with the necessity of clear, unambiguous, conceptual development to connect theory to empirical evidence. He considered that concepts were the gateway to empirical science. These, to be effective, must be clearly identified and must avoid vagueness in their development. Distinguishing between definitive and sensitizing concepts, he stated that the former was prescriptive in nature but that the latter suggested directions for looking. Elaborating on this statement he suggested that empirical research that is guided by pre-defined concepts is bound to have limitations because pre-defined concepts do not fit every circumstance. In contrast, sensitizing concepts allowed the empirical evidence to effect a change in them when contradictory

findings manifested themselves. In other words, they guide the research but do not dominate it. This perspective is echoed by Denzin (1978) when he wrote: ‘The observer moves from sensitizing concepts to the immediate world of social experience and permits that world to shape and modify his conceptual framework’ (p.9).

The sensitizing concepts in this work were modified and reshaped through the inductive process of the interviews. This researcher being the analyst, was watching for ‘incidents, interactions, and conversations that illuminate these sensitizing concepts in a particular programme’ (Patton, 1990, p.279). Nonetheless, because this research contains quantitative and qualitative evaluations there were definitive concepts which led the more objectivist elements of the research e.g. closed questions in the questionnaires. For example, a respondent’s knowledge of what happened in his/her own school when children engaged with nature was elicited by asking questions about this. What kind of outdoor education do you see happening most in schools? Outdoor trails? School gardening? Nature walks? Visits to natural areas outside school? Nature games? Other?

3.12.10 Trustworthiness.

Bryman (2012) outlined credibility, transferability, dependability and confirmability as criteria for trustworthiness in quantitative and qualitative research. The first one entails submitting the findings of, for instance, an interview to the respondent to confirm that they are authentic records of what was said. This member validation, respondent validation or member check technique is not infallible, however, because a respondent may not want to be critical of the interviewer or, contrariwise, may deliberately want to censure the findings. Nonetheless, transcripts were emailed to the interviewees in the interviews for validation and all responded either with comments or none at all.

In the second criterion, namely, transferability, he advised that thick description (Ryle 1949; Geertz 1973) should be encouraged in accounts of findings so that the work has transferability possibilities. This ensures that not alone is this material described in

detail, but it is interpreted and analysed as well so that it can be used by other researchers. To ensure thick description this researcher utilised probes and prompts regularly throughout interview process.

The third criterion is dependability. Here an audit trail of records was established by relating to all phases of the research from formulating the question, pre-testing, selecting participants, keeping interview transcripts, analysing data, and making decisions relating to this data.

The fourth criterion deals with confirmability where objectivity is required so that the researcher's personal values do not skew the research itself and the findings emanating from them. This research uses multiple sources to verify whether the evidence is confirmatory triangulation or non-confirmatory triangulation.

3.12.11 Pre-testing.

Two practising HS experts agreed to pre-test the interview questions. After the pre-testing, some major changes were made in the interview guide, especially in the probes. For example, the original probe, what activities do you do with them when you visit a school had a secondary probe: What do you do with them on a wet day? One probe was modified because it was deemed to be a leading question. So, the probe, do you think it's being taught too much from textbooks? was changed to: What about textbooks, videos, TV, websites? The question: What do you perceive as the benefits of children being connected to nature? needed elaboration so it was qualified by, 'By this I mean, deeply knowledgeable about and attracted to nature'. 'Spiritual and aesthetic awareness' was explained by: 'What I mean here is fostering a sense of awe and wonder and developing their sense of beauty'.

3.13 Secondary Data: Analysis of Reports

220 Inspectors' reports on WSE over one academic year, 2015-2016, were examined to ascertain the value and weight given to nature awareness, appreciation and education by inspectors' working for the DES (2016d).

3.14 Reflexivity

The terms 'reflectivity' and 'reflexivity' need explanation first. Chiseri-Strater (1996) differentiated clearly the conceptual difference between them when she wrote, 'to be reflective does not demand an "other"', while 'to be reflexive demands both an other (sic) and some self-conscious awareness of the process of self-scrutiny' (p.130).

The Latin phrase, *primum non nocere* means not doing wrong to participants. These words define the essence of reflexivity. However, they are not all-embracing. Pillow (2003) referring to four reflexive strategies discussed at length the subjectivity of the researcher and how to transcend it, power relationships, representing the subject's narrative faithfully and gathering the truth.

Rennie (2009) defined reflexivity very succinctly in terms of 'self-awareness – and a 'gauge of personal agency within that self-awareness' (p.598).

Nonetheless, in the field of research there is disagreement as to what constitutes 'reflexivity'. Gewirtz and Cribb (2006) for example differed substantially from Hammersley's (2008) interpretation of the concept especially about knowledge production and use. The former believed that the purpose of research was not alone to generate new knowledge but also to affect change in society using this knowledge and this is bounded by ethical issues. It is heavily value-orientated according to them. Hammersley, on the other hand, while accepting that values are important in research warned of the dangers of recommending policy changes because of findings. In his view this could lead to bias in research findings. Hammersley's views are straightforward regarding the research process

defining it as knowledge-seeking rather than with an agenda for influencing policy-making. ‘

The values, biases, assumptions, values of this researcher regarding the question and concept(s) of the research invariably affected the questions asked in both questionnaires and interviews. Ironically, this researcher, having a life-long passion for nature, brings problems to the research process. Preconceived assumptions may have hardened and consolidated to such an extent over time that answers can be deciphered even before the questions are given. Leading questions i.e. putting words into participants' mouths in interviews and questionnaires could be especially problematic because of a long-time immersion in the phenomenon being investigated. Kirby and McKenna (1989) referred to these biases and assumptions mentioned above as ‘conceptual baggage’ (p.32) and stated that the researcher must bring them out in the open so that the research process itself can become a focus of inquiry to ensure that it is credible and lacks bias.

This researcher has laid out his stall fully and openly at the beginning of the research to bring transparency to all his research methods.

3.15 Conclusion

In this chapter, the theoretical framework behind the intended research is examined to answer the overarching question: What is the state and status of nature awareness, appreciation and education in the primary school system? This has involved close examination of research philosophies, paradigms, methodologies, methods of collecting data and reflexivity. In sum, this research is based on objectivist and constructivist epistemologies, on positivistic and interpretivist theoretical perspectives and on a mixed methods methodology utilizing questionnaires, interviews and document analysis to capture data.

Chapter 4: Findings, Analysis and Discussion from Interviews with Heritage in School Experts

...types of research methods usually selected by naturalistic inquirers involve those most closely associated with a human component (Gray, 2014, p.24).

4.1 Introduction

In the qualitative research section in Chapter 3 the rationale for choosing HS experts is discussed and the interview process is explored in detail. Utilizing Rubin and Rubin's (1995) tree and branch model, and Patton's (2002) typology of types of question, seven topics were chosen for the interview guide based on a priori knowledge of the phenomenon, nature awareness, appreciation and education in the Irish primary school system. The six branches of Rubin and Rubin's (1995) trunk are: The Heritage in School Scheme; the most effective ways to engage children with nature; teachers' knowledge of nature; children's knowledge of nature; benefits of being connected to nature; outdoor learning; environmental awareness and care. These topics were chosen to provide breadth and depth to answer the overarching research question: What is the state and status of nature awareness, appreciation in the Irish primary school system?

Chapters 5 and 6 seek to answer the same question using a more quantitative approach. The insights gained from this mixed methods research paradigm defined by Johnson and Onwuegbuzie (2004) as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study' (p.17).

Table 4.1

Chosen Interview Topics Administered to HS Experts

Topics:
• The Heritage in School Scheme
• The most effective ways to engage children with nature
• Teachers' knowledge of nature
• Children's knowledge of nature
• Benefits of being connected to nature
• Outdoor learning
• Environmental awareness and care

This chapter focuses on the findings of six semi-structured interviews with a purposive sample of HS experts which took place between December 2016 and June 2017 in various locations throughout the country. In purposive sampling 'researchers hand-pick the cases to be included in the sample based on their judgement of their typicality or possession of the particular characteristics being sought' (Cohen, Manion, & Morrison, 2011, p.156). These are information-rich cases according to Patton (2002).

Gray (2014) pointed out that the researcher needed to be aware of some disadvantages associated with this type of sampling such as the danger that the researcher could be biased in selecting participants or unintentionally omit some important characteristic in selecting a sample. To avoid this bias the participants were selected using these two criteria: (a) They were chosen to represent a broad spectrum of counties; (b) They were among the busiest specialists from a panel of 111 who teach about nature according to the Heritage Council of Ireland which administers the scheme.

Interviews were conducted from December 2016 to June 2017 in six locations around the country. (These locations are not made public to protect respondent' identities). All interviews were recorded on a Sony IC recorder ICD-PX312 with the permission of the participants. They were also recorded concurrently on the recording app of a Samsung Galaxy mobile phone. Transcripts were made as soon as possible after the recordings in order that a backlog of recordings would not accumulate and whilst the data captured were

fresh in the interviewer's mind. When the transcripts were completed they were emailed to participants for their approval before they were analysed. (A promise concerning this was made in the participation information document which all participants signed after the completion of the interviews. See Appendix B). All were happy with the transcripts and deemed them accurate apart from a few minor errors. One specialist, Harry, also wanted to see a copy of the analysis made on his recording because he was anxious that a few comments he submitted in his interview could be misinterpreted.

4.2 Themes, Categories and Sub-Categories Which Emerged from the Data Provided by Heritage in School Experts

After complete approval was given by all participants the data were sorted into themes, categories and sub-categories. (Reading about research methodologies and methods this researcher had become aware that themes and categories are often conflated and interchanged). A reading of Morse (2008), however, clarified these misconceptions when she stated that 'a category is a collection of similar data sorted into the same place (p.727) and 'a theme, on the other hand, is a meaningful "essence" that runs through the data' (p.727).

Manual coding was undertaken in June 2017 to extract 'chunks of speech...out of the transcript' (Arksey and Knight, 1999, p.163) and these were pasted under categories and sub-categories for each of the six interviewees onto six separate A4 sheets. These categories and sub-categories were then examined to elicit themes in the data.

The five themes which emerged from this thorough immersion in the data were as follows: The Heritage in School Scheme; Nature awareness, appreciation and teachers; Nature awareness, appreciation and education and children; The Green School Initiative; School Grounds.

Table 4.2

Theme 1: The Heritage in School Scheme

Category 1 and subcategories	Category 2 and subcategories	Category 3 and subcategories	Category 4 and subcategories	Category 5 and subcategories
Involvement (a) Experience (b) Geographical span	Work with children (a) Indoors (b) Outdoors (c) Most effective way to engage them (d) Enjoyment of work (e) Reaction of children	Influences on Heritage Specialist's interest in nature (a) School (b) General	Meaning of Nature for Heritage Expert	Influences on the Heritage Expert's devotion to nature (a) Relatives (b) Primary school (c) Secondary school

Table 4.3

Theme 2: Nature Awareness, Appreciation and Education of Teachers

Category 1 and subcategories	Category 2 and subcategories	Category 3 and subcategories	Category 4 and subcategories	Category 5 and subcategories
Knowledge of nature (a) Quality (b) Aspects of nature -most knowledge (c) Aspects of nature - least knowledge	Teaching nature indoors (a) Textbook (b) Multimedia	Teaching nature outdoors (a) Walks (b) Outings (c) Games (d) Frequency (e) Barriers	Younger teachers/ older teachers and nature	Curriculum (a) Integration (b) Overload

Table 4.4

Theme 3: Nature Awareness, Appreciation & Education and Children

Category 1 and subcategories	Category 2 and subcategories	Category 3 and subcategories	Category 4 and subcategories	Category 5 and subcategories
Knowledge of nature (a) Quality (b) Aspects of nature most knowledgeable about (c) Aspects of nature least knowledgeable about (d) Native/non-native species (e) Rural / Urban children (f) Very knowledgeable school or class	Process of learning about nature (a) Identification of plants & animals (b) Most effective way to enable learning (c) Fear factor (d) Children's perspectives on nature (e) Games' approach	Benefits of being engaged with nature (a) Physical (b) Mental (c) Spiritual & Aesthetic (d) Environmental awareness and care	Climate change (Ecophobia)	Technology & nature

Table 4.5

Theme 4: The Green School Initiative

Category 1	Category 2
Effects on children of their involvement in it	Improvements

Table 4.6

Theme 5: School Grounds

Category 1	Category 2
Design of (a) Biodiverse habitats (b) Improvements	Gardens

The contents of the sheets were then cut and pasted onto A4 coding sheets for each interviewee under the five themes cited above.

As stated in Chapter 4 and above, one of the criteria for choosing the Heritage specialists for this research was geographical spread. Those chosen visited 77% of the 26 counties in 2015-16 which represented a broad sweep of the country.

Table 4.7

List of HS Experts Chosen for Interviews (Names are Pseudonyms)

Interviewee	Counties covered	Schooling & Experience	Influenced by:
Ian	Four counties	In scheme since 2014. Visited 49 primary schools in 2016/17. (Full quota).	His father and scouts. No nature in primary.
Molly	Two counties	Attended primary school 1978-1988. In scheme since 2009. Visited 45 primary schools in the 2016/2017. Also visited 26 under other schemes.	Childhood trips to the beach; a teacher in 5 th and 6 th class who brought the class to the Botanic and Killiney Hill.
Niamh	Thirteen counties	Attended primary school 1954-1962. In scheme since 1999. Visited 20 primary schools in the academic year 2016-2017.	Growing up in the country. 'Go out and play and don't come in unless you're bleeding'. No nature in Primary.
Jack	Three counties	Attended primary school in the fifties. In scheme since 2002. Visited 25 primary schools in 2016-17.	Growing up on a small farm. No nature in Primary.
Robert	Three counties	Attended primary school 1952-1958. In scheme since 1999. Visited 33 primary schools in 2016/17.	Had inherent interest. Influenced by primary teacher who talked about birds and secondary teacher.
Harry	Two counties	Attended primary school 1963-1969. In scheme since 2002. Visited 110 primary schools in 2016/17. (Full quota).	'My mother took me to feed the ducks'. '... father showed me my first oystercatcher'.

Chunks of relevant data from each category and sub-category were then extracted from the coding sheets pertaining to these six respondents and pasted onto A3 sheets so that commonalities and differences could be perceived at a glance. This technique, though painstaking, ensured that a rich and varied tapestry of data emerged from all the sheets and no information was overlooked.

4.3 Heritage Experts Working with Children

The experts were put at ease at the beginning of the interviews by asking them questions about themselves and their experiences of teaching nature in primary schools.

Table 4.7 demonstrates that the experts chosen for this research cover a wide geographical span and visit a lot of schools.¹⁵ The ones who attended primary school before the new curriculum was introduced in 1971 received no nature education and this concurs with the evidence from Chapter 2, Part 2, which explores the history of nature education in Irish primary schools. From 1954 to 1971 it was obligatory to teach about nature, but it was not inspected, and it was not on the primary certificate exam and so had a low status. Ian who attended primary school from 1971 onwards, when it was obligatory and inspected, could not remember any input on it at this level. Molly was lucky to encounter a teacher in 5th and 6th at least who was passionate about the subject and she attributed some of her own passion to this teacher.

4.3.1 Reaction of children.

Generally, the experts were delighted with the positive reactions of children to nature and they spoke about their fascination and excitement with it, their love for it, their sense of wonder. *‘They love going out to find spiders...they love going out to do things’*-Niamh. *‘When you see this aha! or the eyes...the moment where that firing or triggering. You know you’ve affected either their way of looking at the world or thinking’*-Molly.

However, Jack and Molly came up against situations where children were fearful of nature and going into the woods. Fear of nature was not in the original interview guide, so it became a supplementary indicator and was added on to the original schedule. Jack recounted:

‘There’s fear of going out...they think in terms of danger all the time’.

On the two occasions he witnessed fear in children wasps were involved. By spending time observing them the children’s fears reduced.

Molly’s experience was similar:

¹⁵ The counties they covered were: Cavan, Donegal, Leitrim, Wicklow, Sligo, Dublin, Wicklow, Carlow, Kilkenny, Kildare, Louth, Meath, Limerick, Westmeath, Wexford, Laois, Longford, Offaly, Galway, Clare-20 in total.

'They have negative emotions associated with it [the environment] ...an anxiousness going out...a fear...not all...but I'd say 60% going out afraid to some degree'

She attributed this fear to lack of exposure to nature and a scary forest character called 'Slenderman' who is found on You Tube. Jack blamed teachers' phobias e.g. fear of wasps for this phenomenon and he maintained that these transferred easily to children. Molly suggested that an antidote to this fear was exposure to the outdoors. Jack added to Molly's antidote for this fear. Like her, he stated that exposure alleviated the fear, but he also added that education was important. He recounted two occasions when they encountered wasps on nature walks and the children were fearful but on these occasions the teachers were not. Gradually, he brought them closer to the wasps explaining all the time what they were doing and eventually the children became less fearful.

'And some of them got down on their knees and got in very close to where the wasps were coming in'.

Only two of the experts referred to fear in children regarding certain aspects of nature.

4.3.2 Enjoyment of working with children and teachers.

All the experts enjoyed working with the children and teachers in the schools.

Jack mostly enjoyed raising the enthusiasm of the children about the outdoors especially about creepy-crawlies and turning over stones but found it took time to get them interested so that they could engage effectively with the activity. Three others enjoyed

'interaction with the children, 'working with children and nature' and 'showing people things that they'd never seen before'.

Harry hoped that all the new learning about and enjoyment of nature would make the younger generation morph into a more caring society regarding the natural environment than that of previous generations.

Molly found it difficult to answer the probe regarding what she enjoyed most about nature because she enjoyed it so much. There was nothing particularly in nature that she liked doing. The whole HS engaged her totally in an ongoing enjoyment of her work with children.

4.3.3 Activities with children.

The experts liked to work in the school grounds or nearby nature to the school such as a park on hands-on activities and getting the children to notice things using all their senses.

Niamh believed that it was a waste of effort taking the children out in buses when they didn't know what was near at hand on the school grounds. She had encountered a class who had no clue regarding the identity of a tree that was outside the classroom window and it was obvious that this class had never really seen the tree before. Niamh had come across in this instance an example of plant-blindness a term which was first used by Wandersee and Schussler (1999). They described the phenomenon as 'the inability to see or notice the plants in one's environment' (p.820) and they discovered from research that it was prevalent among children in their studies. They believed that this would have negative consequences for the study of biology but does this observation apply in Niamh's case? There is not enough evidence, but it does seem that the class had limited contact with nearby nature.

Robert used art indoors as a mediator to focus the children's interest on nature. Harry, too, used art to stimulate their interest but also song, poetry, maths, geography. These are examples where HS experts integrated nature with other subjects.

Molly only worked indoors when the weather got too cold, but she advocated nonetheless that one should

'get them outdoors...get them outdoors and let them feel the cold...let them feel the rain within reason'.

All of the experts agreed in the interviews that outdoor engagement with nature was the best approach and like Molly would be reluctant to let the weather interfere with going outdoors provided the children were suitably clothed.

Harry found the microscope invaluable for generating interest and advocated discovery learning.

'If I tell them something, they will forget it. If I show them something they might remember. If I let them find it themselves, they may remember it for life'.

4.3.4 Improvements to scheme.

The experts were happy with the scheme but there were some criticisms and concerns. Robert proposed that the scheme should be expanded to incorporate Northern Ireland because Ireland is a topographical entity.

Ian and Harry advised that there should be more days allocated so that specialists could make a better living out of the scheme. They both believed that a maximum of 45 days was too limited for generating a viable wage. Harry was especially critical of the fact that schools had to raise the specialists' fee through getting the children to bring in subscriptions. This should come from the Department of Education. He also believed that the principal's support was crucial. For example, if a principal had an interest in sport or music the discretionary funds would be allocated to these pursuits.

Jack was the only one who complained that it was a pity that so many schools did not use the scheme. He was the only one who thought that teachers didn't prepare children enough for the specialist's visit. Sometimes he found that going on field trips the children might be

'tied up with elephants and gorillas and stuff like that. You have to get that out of their heads a little bit'.

Jack meant by this statement that if teachers had not focused the children on the particular activity or place to be visited children would have very vague notions of what they would encounter on their outdoor trip.

4.3.5 Meaning of nature for heritage experts.

A word cloud was created to give an indication of the words the HS experts used when responding to this question: Nature can mean many things. What does it mean for you? As can be deciphered from Figure 5.1 the words ‘world’, ‘living’, ‘environment’ and ‘trees’ were mentioned most often in contexts such as ‘living world’, ‘the great other world of the non-human and the human connection with it’, ‘the whole world in which we live’, ‘outdoor environment’, ‘living environment’, ‘trees and wild plants and their use’, ‘it’s wildlife, it’s trees, it’s climate, the whole world in which we live’.

Their interpretations of nature correspond with the nature that is embedded in the strand units *Plants and Animals* and *Environmental Awareness and Caring for the Environment* and *Rocks and Soil* of the revised curriculum (DES, 1999b;1999d). They also added on an attribute of nature-engagement-well-being.



Figure 4.1: Meaning of nature for Heritage Experts: a word-cloud created from words supplied by Heritage in School Experts when asked ‘What does nature mean for you?’ (Template created on <http://www.wordclouds.com/>).

4.4 Nature Awareness, Appreciation and Education Relating to Teachers

Teachers agreed with what the heritage experts planned and only on one occasion was there evidence of conflict between the expert and the class teacher. Jack had proposed that the class would go outside to look for invertebrates under stones and he was surprised when the teacher queried the fact that he hadn't provided a box of gloves for the children to wear during this activity. This had never happened before. However, he was not surprised by what he considered her over-obsession with health and safety because he stated,

'some teachers have a very clear-cut way...they want everything to run very clean and very organised and no mud and no dirty fingers'.

Should Jack have been surprised? It would have been interesting to find out exactly what were her fears. Perhaps there had been evidence of rat-activity on the school grounds. This was an isolated incident and no other expert referred to a fear of dirt.

Concerning parental/child fear of nature in general, Louv (2005) devoted a whole chapter of his book to a wide spectrum of fears and blamed them for separating 'a developing child from the full, *essential* benefits of nature' (p.123, emphasis in original).

Palmer (2015) in her book *Toxic Childhood* was very critical too of an over-protective approach when dealing with children and cited evidence for an increase in allergies due to ultra-hygienic practices. 'Wrapping children in cotton wool carries a very high risk of suffocation' she stated (p.57). Interestingly, teachers did not consider safety issues in the top three barriers for not bringing children outdoors to study nature (Figure 6.6). Safety issues also ranked least for not engaging with school gardening (Figure 6.7).

4.4.1 HS experts' perceptions of teachers' knowledge of and commitment to teaching nature.

Jack, Robert and Molly quantified their responses to the question regarding their perceptions of teachers' knowledge by stating that it was *'fair, 'fair to weak' and 'fair to good.'* These perceptions were their opinions and were based on many years' experience of observing teachers and from discourses with them. Harry, and to some extent, Jack, went into more detail and quantified their knowledge in discrete areas of nature as this table demonstrates:

Table 4.8

Harry's Evaluation of Teachers' Knowledge of Vertebrates / Invertebrates and Rocks / Soil

Phenomena	Evaluation
Birds: Fair	Molluscs: Fair
Mammals: Good	Plants: Good
Insects: Fair	Life Cycles: Good
Crustaceans: Fair	Habitats: Good
Food Chains: Good	Classification: Very Good
Plant Science: Excellent	Rocks & Soil: Good

Again, this is Harry's view from observing and talking to teachers. Jack in contrast to Harry, believed that their knowledge of birds was best, but knowledge of rocks and soil was very low and life cycles, food-chains and habitats. He was of the opinion that their lack of knowledge of the names of plants and creatures plus an overloaded curriculum prevented them from taking children outdoors.

Ian was of the view that teachers had a lack of knowledge on all aspects of nature except the life-cycle of the frog and the butterfly.

Nonetheless he said that they would know the *"basic birds like most people will'*. (This latter observation is collaborated in Section 6.5.1.1 where teachers expressed their highest confidence levels for teaching about mammals, birds, gardening, flowers and trees so it seems that teachers are comfortable teaching about birds).

He did add a note of optimism to his pessimistic analysis of their knowledge when he stated that the younger teachers were great at accessing information and taking on new

challenges like surveys. All in all, he was of the opinion that teachers knew the *'bare minimum to get them through the curriculum'*.

Harry commented that they *'were excellent at doing the theory from books'* but that they were completely lost when it came to do practical work with children, especially outside. He surmised that the majority of them taught from books. They had no confidence in identifying common species and putting theory into practice, so specialists were very important as a resource for counteracting this. He blamed the Colleges of Education for teachers' lack of knowledge and was critical of the book orientated methods used in these places for teaching nature to students. (In Section 6.5.1.2, the majority of teachers believed that the ITE they received in nature was in the variable, poor to fair). Harry's observation regarding nature-education in Colleges of Education is reinforced by the teachers' self-reporting that they regarded their ITE education as poor to fair.

Niamh's responses concurred with Harry's regarding outdoor exploration of nature.

'Now, they're not terribly comfortable and happy and full of knowledge about being out of doors. They're happy in the class with their lessons prepared'.

Niamh here is referring to the relative unpredictability of outdoor engagement with nature in comparison to engaging with it indoors.

She believed that their strongest knowledge base was mammals and that they knew less about plants. She was concerned, however, that in all the classes she went into the children were sure squirrels hibernated. (Interestingly, 19% of the student teachers ($n=253$) questioned on their knowledge of nature thought this was a fact too). She blamed this misinformation on the fact that the teachers themselves were taught this as a fact. Her observations relating to an overloaded curriculum tallied with Jack's above and she was of the opinion that

'they don't have time to teach about wildlife when they spend the whole day doing this' [teaching other subjects]. (In Section 6.6.2.2, 82% of teachers ranked lack of time as

number one for not going outside to engage with nature so perhaps the curriculum in general needs to be more integrated and streamlined).

She offered integration of nature into all subjects as a possible solution to bringing more nature into this overloaded curriculum.

Robert's views tallied somewhat with Jack's regarding birds and rocks and soil and Harry's regarding food chains and plant science. Knowledge of crustaceans, insects, molluscs, classification and habitats was poor. In contrast to Niamh, he felt that teachers, especially female ones, had knowledge of plants. (In Section 6.5.1.2, teachers' lowest confidence levels were expressed relating to teaching about shrubs, fish, amphibians, reptiles, invertebrates, hedgerow, pond, bogland and rocks and soil so perhaps these topics should receive more emphasis in ITE and continuous professional development (CPD).

4.4.2 Teachers with the most knowledge of nature.

Four of the experts surmised that older teachers were more knowledgeable about nature. (They didn't specify what they meant by 'older'). Harry conjectured that there was no difference. Niamh, in contrast, was of the opinion that,

'the younger teachers in particular will know what they've been taught so they have lessons laid out and stuff that they know' and that *"there was certainly more go in them"*.

She was often appalled at the fact that schools that had been built a long time ago were only now getting the hedgerows and gardens because the younger teachers were seeing the educational advantages of these. This observation would seem to suggest that younger teachers are receiving input on the benefits of greening school grounds in their primary or secondary schooling or in ITE.

4.5 Nature Awareness, Appreciation, Education and Children

The presentation, analysis and discussion pertaining to this theme mirrors that done in Section 4.4.1 and Section 4.5.2 in the areas of knowledge, outdoor education, urban v rural children. Their reactions to the experts' visits and the activities they did are explored in Sections 4.3.1 and 4.3.3.

4.5.1 Children's knowledge of nature in general.

The experts differed here as they did with their views on younger and older teachers' knowledge.

Ian again was the most critical stating that it was generally very poor and almost non-existent. They were especially poor on invertebrates and soils. Often, they would know about crocodiles and kangaroos but wouldn't know about badgers and foxes. Her observation seems to indicate that they are learning about nature from TV, which in itself is to be commended. She seems to be critical of the fact, however, that they more about global nature rather than the local.

Molly was nearly equally despondent about their knowledge especially the simple things in the ecosystem such as the function of pollinators, common trees, birds and animals, food-chains. She added that they knew a lot about non-Irish nature such as wolves and werewolves, poison ivy and the Venus flytrap and she wondered where they got all their information on these. She would prefer if they as much about local nature. They were, however, knowledgeable about mini-beasts.

Jack's response concurred with Ian's and Molly's regarding children's knowledge in that he felt that in general it was '*weak*'. According to they were very '*weak*' on habitats and food-chains but good on birds and mammals. (In Tables 5.6 and 5.7 it can be seen that ITE students' knowledge of food-chains was also limited).

Harry again went into detail on what he perceived as their knowledge content of nature after reaching 6th class. (In Section 6.8.1 the majority of teachers surmised that

children's knowledge of nature was poor to fair. Less than half indicated that it was good to very good. (These observations were not empirically tested but they were based on the opinions of experts in their fields).

Table 4.9

Harry's Opinion of a Typical 6th Class's Nature-Knowledge

The Areas in which Children are Weak.
• They cannot name a mallard which is the most common, widespread duck
• They do not see many wild animals
• They cannot identify the different species of butterfly
• They know what a food cycle is, but they wouldn't be able to identify one within the school grounds
• They are aware of plant science because it can be done from a book
• They wouldn't know what classification is or what a crustacean or mollusc is
• They would not be able to identify rocks; some are aware of soil types
• Mammals - Good / Life-cycles - Good / Plant Science - Good / Birds - Fair / Insects - Fair / Plants - Fair / Soil - Fair / Molluscs - Weak / Classification - Weak / Rocks – Weak

Harry's views which are outlined in this table seem to suggest that he thinks they have limited practical knowledge of certain aspects of nature such as the ability to recognise rocks, butterflies and the commonest duck and recognise a food chain on the school grounds.

He always started his classes by determining their awareness of nature first and according to him this was always at a low level.

In contrast to the views of the four above, Robert believed that the knowledge of primary school children was good to very good and Niamh believed that they knew about wildlife and that were knowledgeable about food-chains and plant-science, but they were poor at identification.

'You go into a school and the baby infants know daisies, dandelions and buttercups.

You go into 6th class and they know daisies, dandelions and buttercup'.

This observation seems to suggest that children are not engaging with identification of common plants. Like Ian and Molly, she noticed that they often knew more about non-

native species than native species and for instance, if the topic of hibernation arose in conversation they always said that bears hibernate. Like Robert she noticed extremes with children and this depended on interest. Some who watched such programmes as the Discovery Channel could go into detail such as telling you the number of hairs on a dinosaur's or rhinoceros's tail. This could be interpreted as a positive finding. Robert came across

'incredible little nerds who knew everything about everything'.

This would indicate that there are certain children who have a special interest in nature and pursue this interest themselves or with close relatives.

4.5.2 Knowledge of nature of rural and urban children.

Niamh speculated that urban children knew more about nature than rural children. She attributed this to the fact that country children were ferried everywhere in cars and seldom get a chance to walk in nature. In contrast she was of the opinion that urban children, particularly suburban ones, had parks to walk in and often walked to school during which they observed nature such as leaves falling.

Harry agreed with Niamh regarding urban and rural children's knowledge. He too, suggested that country children were ferried everywhere by car and did not get the same opportunities to gain access to wildlife as urban children who had their parks. Lack of parental knowledge was a factor in both rural and children's knowledge base. He conjectured that in Irish society in general awareness levels were low. [In Section 4.3 the limited emphasis on nature in primary education from the foundation of the state to 1971 is postulated as a possible cause of this lack of awareness].

Ian noticed no difference between urban and rural children's knowledge of nature.

'Oftentimes they [rural children] won't know any more than the kid that's buried in a housing estate'.

Three respondents, however, did state that rural children were better informed about nature.

Molly believed that

'they're far more connected in the country and the children from Eastern European countries are the most connected'.

This observation would seem to suggest that children of migrants from Eastern European countries know about nature because their parents/relations are meaningfully engaging them with it in Ireland or that they learned about nature in their home-countries from either their teachers or their parents.

Jack and Robert reasoned that rural children had more connections to farming and this was a factor in their greater knowledge.

Therefore, experts were divided on rural and urban children's knowledge of nature with one believing there was no difference between them, and the others equally divided on their opinions.

4.5.3 Nature walks as leverage for children's appreciation, awareness and education about nature.

Nature walks are beneficial in enabling children to become aware of nature and to appreciate it in its reality (Waite, 2010). Varley, Murphy & Veale (2008) in their review of the primary science curriculum summarised outdoor engagement of pupils with science as limited. This finding was corroborated by the inspectors' report on science in the same year (*Science in the Primary School*, 2012). From interview data they concluded that about one third of pupils did not engage with science in an outdoor context. Responses from the interviews with the HS experts demonstrate that little has changed since 2008 when data for the above report were gathered.

Niamh conjectured that children were not brought out *'frequently'*. She attributed this fact to a concern by the teachers with disciplinary problems as classes were generally

large. However, she speculated that if they were brought out more they would become accustomed to the experience and discipline would be less of a problem.

Ian, too, believed that they seldom went out. He often asked teachers did they go out and they would reply in the negative adding a rejoinder that this aspect of the curriculum was left to outsiders like Heritage experts. He cited health and safety concerns from the teachers and a lack of local knowledge as key reasons for not venturing out (In Section 6.6.2.2 only 15% teachers cite safety concerns as the number one barrier for not going outside).

Jack, too, concluded that there was not much engagement with the outdoors and he put this down to lack of knowledge by the teachers and curriculum constraints.

Robert noticed as well that teachers were not enthusiastic about going outside and he attributed this to fear of litigation as Ian did. He conjectured that some parents objected to this type of learning and perhaps their attitudes seeped into the school.

Molly's response regarding outdoor engagement was in accord with all of the above. She conjectured that the children seldom went out due to pressure on teachers by an over-scheduled curriculum and that because of this pressure there was no enjoyment in bringing them out (This view is corroborated by teachers in Section 6.6.2.2 when teachers cited an overcrowded curriculum as number one barrier for not going outside).

Finally, Harry concluded the children went outside rarely except on school tours and very little learning occurred on them. Like Jack, he felt that teachers' lack of confidence in identification of species was a causal factor (See Section 6.6.2.2 where teachers themselves reported that this factor was third in a hierarchy for not bringing children outdoors).

4.5.4 Naming and identification of species.

Participants' views on the importance of being able to identify common plants and animals is explored in this section.

Bebbington (2005) conducting research on 812 A-level students found that they had poor ability to name common wild plants. '86% of A-level biology students could only name three or fewer common wild flowers whilst 41% could only name one or less'. She believed that this lack of knowledge would have negative consequences for their environmental care and good citizenship in the future.

Like Bebbington, Pyle (2010) advocated learning names of species: 'plants and animals...they all have names and faces. Making an effort to know some of them is simply good manners among neighbours' (p.156). Randler (2008), citing research from four sources also concluded that 'basic knowledge about animal or plant species, their identification and life history has been targeted as a fundamental aspect for learning and understanding in biodiversity' (p.224). Therefore, it would seem from research that identification of plants and animals is an important skill.

Ian maintained that it was more important to get children outside and involved in nature activities than to be obsessed with identifying species. He stated:

'We're starting at such a poor level that if you can get kids comfortable to dig in a pile of leaves or under a bunch of stones...[it's] a victory'.

He believed that naming of creatures etc. would follow automatically over time with further exposure to the habitat.

Robert did not consider that identification was important either. It was more important to know *about* the species. He referred to old farmers he knew who didn't know the names of species but could tell you lots about them. Four of the specialists believed naming and identification of species was important.

Molly believed that leaders facilitating outdoor education were not familiar with the names of plants and animals, so they resort to games with the children.

'I think people freeze when they go outdoors, and they go: "I don't know the name of that tree so there's no point in me talking about it. So, they tend to focus on games'.

Molly was not anti-games, however, and she stated

'I do definitely see the benefits of them being given time to allow them to immerse themselves in nature so the enjoyment of games I think is fantastic'.

Niamh suggested that children should be taught about, and learn the names of two common flowers, one tree, one mammal, one bird and one invertebrate every year in primary school so that by the time they reached 6th class they would have a broad repertoire. Her suggestion regarding naming agrees with those outlined by Bebbington (2005), Randal (2008), Pyle (2010) and Mohnke, Erguvan & Schluter (2016). Presently, she was of the opinion

'they're not good at naming...they don't pay enough attention to stuff...and if you show them a yellow flower it's always a daffodil...if you show them a blue flower it's always a bluebell'. If I brought them out and they knew 16 flowers I would drop dead of shock...and they're just local things around the school'.

Jack, too, deemed that naming and identification of species was important and that teachers should start with the local names and develop from that base.

Harry commented, that if the children don't know what something is how could they be expected to care for it. Also, he believed that to compound matters a lot of teachers cannot name and identify either.

'They can't go outside and identify trees, birds, butterflies, insects...you name it...it's everything they can't identify'.

Perhaps if Niamh's naming and identification scheme were in place, Harry would not have asked this question:

'When children leave 6th class how many of them can identify the difference between a blackbird and a crow'.

4.5.5 The most effective ways to engage children with nature.

Jack maintained that the most effective way to engage children was to get them outside as often as possible. He surmised that there were curriculum constraints on teachers and that a lot of them did not go out because of lack of knowledge of species. Jack believed that they did not need to know a lot; getting children out to look should be the main objective. He gave an example of a lesson outside where he got the children to look at the grass and discover all the shades of green even in a small patch. He advised teachers not to wait for a free hour to bring the children out but to take five minutes here and there to connect with the outdoors to observe the clouds or weather signs or other natural phenomena. He also believed that encounters with plants should be approached from a story-telling perspective. Children would remember the names if the story behind the plant were relayed to them. For example, the story of how the dandelion got its name: it is derived from ‘dent de lion’, the tooth of the lion because of the shape of its leaves.

‘But once you build the names of say a dozen plants or trees or whatever in that sort of way, the rest in a way will follow because you have built up the interest’.

His view coincides with Randler (2008) concerning the naming of species. He carried out research on the best aids for teachers to use in assisting species identification and observed: ‘Interestingly, names that evoked an association were retained better than names with a reference to its appearance’ (p.225).

Niamh made the same comments as Jack regarding the children outside.

‘They love going out to find spiders...they love going out to do things...so, I’d say the most effective way to teach the kids is to bring them out and show them stuff in the garden...get them to grow something themselves’.

Molly’s approach was different to the above two. She believed that the voice of the children was important. We must find out what nature means to them.

‘Rather than saying, “What’s the name of this? What’s the name of that? You know...imagine you’re walking in the park ...what do you see in your mind’s eye? Get them fully engaged in it’.

Ian’s viewpoint concerning the most effective way to engage children with nature was different from those of Jack, Niamh and Molly. He maintained that immersion in nature often was the most effective way to engage children and that the more stabs they got at it the better they would be.

Harry’s approach was similar to the constructivist inquiry one advocated by Molly but there should be an affective dimension to it too.

‘My philosophy is that you must let the children find out for themselves, in the place that it lives, and allow them to ask questions about it’.

He believed that a whole school biodiversity plan which would include outdoor activities like gardening and exploring the school grounds for living things would be useful.

Finally, Robert’s advice concerning the most effective way to engage children with nature was completely different from the others in that it adopted a more philosophical stance. He suggested that nature should not be confined to the SESE¹⁶ curriculum area because here the cultural aspect of it is ignored.

‘One learns so much about the natural world through science, but it is preoccupied with the how of things whereas I would suggest that the why of things is even more important and that why doesn’t come from science’.

Instead, he advocated a more philosophical approach instead to engagement with the natural world. We should muse more on it and ask questions such as:

‘Why are we here? How do we fit into the scheme of things? How do we relate to nature’?

¹⁶ SESE = Social, Environmental and Scientific Education

Robert believed that linking nature with dance, music, folklore etc. would provide a more holistic approach to the subject rather than having it compartmentalised totally into science.

The experts varied in their opinions regarding the most effective way to engage children with nature. There was general consensus that engaging children with nature outdoors was an effective approach. Two experts a constructivist inquiry approach to learning about nature and one believed it should be integrated across curriculum areas.

4.5.6 The benefits to children's physical and mental health of being connected to nature.

The literature review chapter details the research of Ulrich (1984), Kaplan and Kaplan (1989), Kenniger, Gaston, Irvine and Fuller (2013) and Benfield, Gretchen, Bell and Donovan (2015) on the beneficial physical and mental effects of nature exposure on students, patients and children.

Their findings corresponded with the views of all six respondents. Ian suggested that not alone was nature hugely beneficial for children's mental and physical health, but it also would turn them into environmental activists in the future when they witnessed places of natural tranquillity that provided them with physical and mental pleasure being destroyed for development.

Harry stated that it contributes to children's feel-good factor and well-being. Molly agreed and stated that it has life-changing qualities. Niamh surmised that it made children more caring and engenders a more caring society and increases immunity to physical ailments.

'And it does bring out a hopefully gentler society'. 'If you're out of doors you're exposed to various elements and your physical immunity is built up and your physical health'.

Jack too believed it made children more caring not alone towards plants and animals but to people as well.

'Without a doubt I think...by getting that philosophy [a caring mentality] well-grounded in children they'll become responsible...but they'll become responsible in every way...towards people...and nowadays we are talking about recycling'

He often went to a particular natural area himself when he got frustrated and annoyed to be soothed and calmed,

'listening to silence...and often a bird-sound would come through and you're completely overcome by the beauty of it all'.

(See Section 2.2, where a caring attitude towards nature forms one facet of the conceptual framework for this study)

He was of the opinion that if he found this type of solace in nature, children would find it too.

4.5.7 The benefits to children's spiritual and aesthetic development from being connected to nature.

Looking back at the literature again it can be seen that Kellert (2002) in his typology of nine values in nature identified 'aesthetic' and 'moralistic' values as two of these.

(Table 2.1) 'Aesthetic' refers to the 'physical attributes and appeal of nature' and 'moralistic' refers to the 'ethical and spiritual relations to nature' (p.130). These concepts were conceptualised by Van Wieren and Kellert (2013) as

an aesthetic sense of beauty, pattern and order, wonder and discovery; and the expression of such spiritual attributes as feelings of solace and peacefulness, commonality and connection, happiness and feeling at one with and at home in nature, a power greater than oneself, and a sense of divine presence or mystery' (p. 247)

A subjective question on this aspect of nature was undoubtedly one of the most difficult to answer because of its philosophical overtones. Nevertheless, most of the respondents answered it with enthusiasm.

Jack was overcome with awe when he discovered a queen wasp hibernating in a log pile when he was gathering firewood and stated that something very simple can leave one thunderstruck. He made no comment on children's spiritual and aesthetic development.

Niamh suggested that when art is linked to nature it creates a sense of awe. Drawing a leaf or a tree or the petals on a flower, for example, brings this out.

'Maybe they're doing pictures of ladybirds or flowers for Easter or whatever and the teacher brings in a leaf or something...and they have actually got to look at the leaf...they have to actually look at a tree and see how all the branches come out. I think it does give them a sense of awe'.

Robert too, referred to a sense of wonder and awe and thought that the word *'transcendental'* was an apt one to describe the spiritual and aesthetic aspects of it. He also stated that we should be

'being mindful about the greater scheme of things; gaining a sense of respectful wonder shall we say. I mean, these are kind of semi-philosophical ideas, but I think children are open to that and their questions reflect that.'

He was again critical of the SESE part of the revised curriculum (DES, 1999b; 1999d) because in his opinion it was too constrained and functional and didn't take the philosophical aspect of nature into account, mirroring, Littledyke in Section 2.2 and Bonnett in Section 2.2.1. He believed that children were capable of philosophising and the questions they asked reflected this. This balancing of the scientific with the aesthetic concurs with the view of Selby (2017). [Biology education] ... 'can cultivate nature intimacy that fuses the scientific and the aesthetic' (p.24). Harry believed that this sense of

wonder and awe manifested itself in children when he gets them to look at species under a microscope.

Children love to look through a microscope...science...this is real science...they can see things...even in a buttercup. A buttercup is quite a common plant, but I can show you nectar and pollen through the microscope and they see a whole new world...it's just there in the grass, in the lawn'

Molly and Ian offered no opinions on this aspect of nature.

4.5.8 Children, technology, and nature.

O'Neill and Dinh (2015) conducted a two-year research on online usage by 500 children in the nine to 16-year old bracket in seven European countries. Results were compared to the findings of a similar study in 2011 (O'Neill, Grehan, & Ólafsson, 2011). Increased usage was evident across the board with Irish children using the internet several times a day or at least once a day, a usage which was above the European average of 59%. Surprisingly, 40% of under 11-12-year olds had a social networking profile despite an age restriction of under 13 for this. This rose to 90% for 15-16-year olds. Forty-four percent of 9-16-year olds owned a home games console and 40% a smartphone all of which have the potential to produce addictive behaviour.

In his book on behavioural addiction Alter (2017)) described six ingredients of addictive behaviour:

compelling goals that are just beyond reach; irresistible and unpredictable positive feedback; a sense of incremental progress and improvement; tasks that become more difficult over time; unresolved tensions that demand resolutions; and strong social connections (p.9).

He explained that all behavioural addictions such as Instagram have at least one of these ingredients. The increasing online usage by children is one of the factors which Louv

(2005) blamed for a decreasing contact with nature by young people in the USA. Louv's disconnection from nature theory mirrors that of Harry, Robert, Molly and Niamh.

Harry suggested that screens everywhere was a factor in children's disconnection from nature. He was nostalgic for the days when children made their own entertainment climbing trees, collecting sticklebacks, picking blackberries etc. However, he believed that all was not lost and that modern-day children would enjoy the same activities if they were allowed the opportunity to engage in them. He gave an example of a day spent in the woods with a school.

'they enjoyed tree-hugging, collecting seeds, kicking up the leaves, feeling the drops of rain fall on their faces, getting their hands dirty and watching the birds on the lake'.

He believed, however, that online usage by children had positive attributes in that there were excellent websites on nature and Facebook was wonderful for sharing information and answering questions about identification of species.

Robert's views on technology tallied somewhat with Harry's. In general, he was the most pessimistic regarding what he perceived as its negative effects on nature connection. He conjectured that teachers over-used screen technology such as the interactive board to the detriment of hands-on nature activities.

'They should get their hands dirty. They should go out and use their senses.

Understand the world around them from first hand rather than virtually'.

Niamh, too, was of the view that children were too preoccupied with technology from an early age. As a result, children miss out on reading and playing outside.

Molly, like Harry, considered that it was problematic but saw the positive inputs of technology on nature education and asked was the amount of time spent by children using technology any different from the amount of time she spent as a child looking at TV? She recommended that parents should set an example and bring children outside and *'engage*

with what they are engaging in’ i.e. use technology like the iPad to connect them to nature. (It is interesting to note here that in Section 6.4.4 nearly half of the teachers used the interactive whiteboard for teaching about nature; twenty seven percent used the internet). If children are engaging with nature vicariously in the classroom this could have a negative effect on the amount of time that is available for direct and indirect contact with nature.

4.5.9 Children learning about nature through games.

As discussed in Section 2.12.6, Pyle (2002) was very critical of the games-orientated approach to learning about nature. ‘...outdoor education’s common emphasis on games, team-work, and motion militates against deliberate and ruminative natural history’ (p.310). This researcher has experience of the games/teamwork approach to nature engagement by taking part in Forest School activities and outdoor education seminars and sees its benefits for increasing children’s confidence levels and socialisation skills as well as contact with nature. However, he believes that this approach would be enhanced by having more emphasis on identification skills and conceptual development.

Molly favoured a balanced approach when it came to the use of a games-based approach and stated that children enjoyed this approach and they were educational. She explained that the lack of focus on plant and animal identification amongst nature-educators was because these educators had a lack of knowledge of them.

‘I think people freeze when they go outdoors, and they go: “I don’t know the name of that tree so there’s no point in me talking about it”. So, they tend to focus on games’.

In contrast, Niamh was very much in favour of the games approach.

‘I mean, running through the leaves and having them all rustling...isn’t that something super and the colours coming down and climbing up the branches’.

Robert was against the games-approach and felt that at the end of a game experience in nature children learned very little. He did agree that it fostered socialisation but, in the

end, there was little knowledge of nature gained. (See Section 5.7 for a discussion on the games-approach).

4.6 The School Grounds as an Area for Engagement with Nature

In Section 2.11.2 the design of school grounds in Ireland has been discussed and it was found that DES policies regarding them needed to change in order to enhance them for nature education. Evidence was also cited from Keitz et al (2015) that green schoolyards enhance pupils' physiological and psychological well-being.

4.6.1 Experts' views on school grounds.

In general, Ian was critical of school grounds he had encountered. Replying to the question concerning the suitability of school grounds for learning about nature, he answered:

'I'd say over half of the schools don't have the school grounds...at least don't have the hedgerows beside the school grounds. There are a couple of schools that I can think of that are completely tarmacadamed'.

In Section 6.6.2.1 it can be seen that 16% of the 219 teachers who responded to the questionnaire stated that they had a hedgerow in the school grounds and less than 43% stated that trees featured in them.

He recommended that they should have native trees, pollination gardens, vegetable gardens, wildlife gardens. Native trees have more insect species dependent on them than non-native, pollination gardens and wildlife gardens are rich in biodiversity and vegetable gardens help children to understand food-production and the cycle of the seasons.

Niamh was also critical of architects when asked if the school grounds were designed for nature.

'Not at all. They [architects] don't even plan the school so that the sun is not shining on the blackboard never mind anything else and as for the school grounds it totally depends on the principal...'

This is true because only if principals or the board of managements request it, green school grounds won't be created when new schools are being built (DES, 2017a)

She also mentioned that there was no overall plan when it came to school-grounds design.

'Ah well, there's no such thing as school grounds and design. Goodness me! Every school you go into is different'

Again, Niamh is correct with this statement. The design of school grounds in Ireland is arbitrary. (Darmody et al, 2010; DES, 2017a).

Robert did see instances of schools with swift boxes erected on school grounds, but they were put there by the local Tidy Towns Association. He saw several instances of school grounds that had inputs for nature education such as the above, but these initiatives came from outside the schools and they were not instigated by the teachers. He referred to these initiatives as *'enlightened self-interest'*. He explained this statement by saying

'it's a kind of peripheral thing that's feeding into the school rather than the school demonstrating their independence in doing what they do'

It is better, nonetheless, to have them provided by whatever means rather than having none at all.

Harry mentioned that

'some schools have an excellent green space that includes trees, wildflowers and even a garden pond. Others are tarmac or just grass and do not have a single tree'

He was complimentary of An Taisce's Green Flag Scheme for making a difference to school grounds. This scheme has a biodiversity flag and in participating in the gaining of

this flag schools often create wildflower meadows, mini-woods, log habitats, native hedgerows and bird and insect areas to attract wildlife to the grounds ('Biodiversity, n,d).

Jack proposed that there should be a co-ordinated approach from staff and maintenance people to create school grounds for learning. He believed that a lot of them were too manicured and that there was a case for training caretakers to make them more bio-friendly.

'I think in lots of cases there's far too much use of the lawnmower and strimmer'.

Molly was generally positive in her views about school grounds and stated that if there's a green spot something can be done with it. But she did say that they could be made better and turned into outdoor classrooms.

4.6.2 Experts' views on school gardening.

The National Foundation for Educational Research, (NFER (2010) found that school gardening with children contributed to a broad spectrum of 'cognitive, affective, behavioural, physical and interpersonal outcomes' (p.6). These are good reasons why the DES¹⁷ should be more pro-active in its approach to the design of school grounds.

Molly concluded that teachers don't have any time to engage in it because of the pressures they are under and that they needed huge support to engage with it. She suggested that the gardening should be carried out by an interested group outside of the school staff. This group would work with the school and establish a space for teachers to engage in with their students. (In Section 6.7.4 teachers cited lack of time as the greatest barrier for not engaging with school gardening)

Robert proposed that school gardening was an aspect of outdoor learning that was done more than anything else.

¹⁷ In England the DfES initiated and funded Growing Schools in 2001 to promote school gardening. No such initiative has been provided by the DES in Ireland. In 2017 they provided some support to the Incredible Edibles programme which promotes the growing of fruit and vegetables in schools in a small way.

'Rarely do I go into a school where I don't see the beds side by side and ...well-tended'.

He did not see much evidence of gardening to enhance biodiversity in the school grounds. Gardening tended to be mostly growing vegetables and not done throughout the school. It would be unique to witness a whole-school approach to this aspect of learning.

Ian too maintained that a lot of the gardening enterprises were driven by one teacher and that it was a hit and miss affair.

'If there's a teacher with a little bit of knowledge, a bit of enthusiasm that's not afraid of planting a few things, it's great. If there's not, it doesn't happen'.

Niamh's comments on school gardening tallied somewhat with Robert's. She believed, too, that school gardening was an outdoor activity that occurred more than any other outdoor pursuit.

'In general, what the schools do is school gardening and I must say it can be very good in fact'.

Jack's views on school gardening tallied somewhat with Ian's regarding the unmethodical nature of the activity.

'Some gardens are very well done. They have their raised beds and they have lovely rotation going through and they have their compost heaps and that...unfortunately it's hit and miss'.

He surmised that this arbitrary nature of the activity was the norm.

Harry's views on school gardening coincided generally with Niamh's and Jack's. He felt that some gardens were good because the school might have invited in an expert to help who knew how to plan and rotate crops so that harvesting could be accomplished in June. He believed that if the children did not see the results of the enterprise it was not beneficial for them. Even if the plants grew on over the summer there was usually no one to take care of them unless the caretaker worked during that period. As a result, he had

seen lots of school gardens that had gone wild. He followed up this remark by stating that the majority of school gardens that he had seen were actually overgrown and gone to seed. He reiterated his view regarding the use of an expert to support the teachers in his concluding remarks.

It seems then from the experts' viewpoints that school gardening is a very visible outdoor activity in school. However, it also seems that it is carried on in an arbitrary fashion, dependent on enthusiasts so it needs to be more embedded within the curriculum, better funded and promoted in educational policy.

4.7 Experts' Views on the Green School Scheme

All the specialists were very much in favour of the Green School Scheme but, nonetheless, they all suggested improvements.

Niamh considered that the fifth flag-biodiversity one- was too far along the line and should come after the litter and waste one. This would contribute to enhancing the school grounds in a positive manner shortly after cleaning them up. She added that '*going on to save the world with transport and electricity and stuff*' was beyond the reach of school children.

Ian judged that the scheme had a huge influence on the school such as the litter and waste programme. However, he queried why there should be a flag for biodiversity when this area of learning was already on the curriculum. '*Why have a flag for something that should be done anyway?*' He thought it was good to have a new flag for marine-litter & waste but he suggested that there could be flags for nature awareness and school gardening too.

Jack agreed that there should be a flag for nature awareness too. He pointed out as well that there was too much ticking of boxes going on with the achievement of gaining flags. When litter and waste is done schools tick it off and move on to the next flag which is energy. The litter and waste element should continue in the gaining of the new flag. This

would lead to more cumulative learning. Often too, he felt, the scheme is led by only one teacher who is interested. He believed that it could be more holistic within the school.

'It should be coming from a complete project, a complete theme. It's another carriage on the train...they're all pulled along'.

Harry advised that there should be flags for invasive-free areas because alien species can cause such damage to the environment and cause friction amongst neighbours. He also felt that not enough people are recording to the National Biodiversity Data Centre¹⁸ and that there should be a survey and recording flag. Schools would record plants, butterflies, birds etc. to gain this flag. This would provide benefits for the Data Centre and Global Citizenship.

'The schools could have a flag because they recorded so many birds, so many plants, so many butterflies, so many trees'.

Robert believed that the green school scheme was breeding a whole generation of kids who are much more respectful of the environment. He went on to suggest that there should be a flag for school gardening. The flag would emphasise what's going on and give it credibility.

'Gardening...I would put a priority on that. If only for the fact that it's already there. To emphasise that and give it credibility I think it would be a great thing'.

Molly believed that it was a brilliant scheme, but gardening could be incorporated. Maybe there should be a new scheme to ensure everybody in the school community got out more.

¹⁸ The National Biodiversity Data Centre is a national organisation that collates, manages and analyses and disseminates data on Ireland's biodiversity. See <http://www.biodiversityireland.ie/about-us/>

4.8 Summary of Findings and General Discussion

Do the data captured from the HS experts answer any or all of the elements of nature in the main research question: what is the state and status of nature awareness, appreciation and education in the Irish primary school system?

The low *status* and precarious *state* of nature awareness, appreciation and education in the primary system has been examined in the literature through the lenses of history, reports, and policy statements. (Varley, Murphy & Veale, 2008; *Science in the Primary School*, 2008; *Discover Science and Engineering Review*, 2009; Waldron, Oberman, Ruane, Kavanagh, & Murphy, 2011; DES, 2016a).

The experts were not able to ascertain the *status* of nature awareness, appreciation and education in the Irish primary school system because it emerged from the interviews that they are not aware of what is happening when other subjects are being taught. They themselves, however, assigned it high status in the curriculum. After all, they have devoted their lives to studying nature and promoting awareness, appreciation and education of it among children and adults. Neither do the data provide much information on their own status amongst the school communities. Are they admitted to schools because the principal and teachers accord high status to nature engagement or are they admitted because they see nature as another vehicle for children's development?

The data do, however, provide some answers to the question of the *state* of nature awareness, appreciation and education in the Irish primary system. Is it in a healthy state, or is it weak, disjointed and struggling to maintain a significant presence in the primary system? Below is summary of the commonalities between the specialists' responses. These are the opinions of experienced experts with recognised ability in their field and not based on empirical evidence.

1. Teachers' knowledge of nature: one was of the opinion that it was good. The rest conjectured that it was poor to fair. The majority conjectured that older teachers were more knowledgeable than younger ones.
2. Children's knowledge of and engagement with nature: from the interviews four out of the six estimated that children's knowledge of nature was generally poor ; one felt it was good to very good; there was a difference of opinion regarding rural and urban children's knowledge of nature; half of them believed that having children connected to nature made them more caring and contributed to their mental well-being; the majority believed that engagement with nature influenced children's spiritual development and aesthetic awareness and that it was important for children to be able to identify species of plant and animal.
3. The outdoors as a vehicle for generating the development of nature awareness, appreciation and education in children: all criticized the potential of present-day school grounds for the teaching of nature; all believed that children were not being brought outside much; half of them believed that the most effective method of engaging children with nature was to bring them outdoors; one third of them believed that school gardening was the outdoor activity mostly carried on but nonetheless all supported the view that it needed improvement for use as a learning tool.
4. The Green School Scheme and nature education: All made suggestions for improving the scheme. These suggestions ranged from (a) removing the flag for energy and transport as the concepts relating to these aspects of the scheme were outside the realm of children's comprehension; (b) introduction of flags for recording of species, marine litter, biodiversity, school gardening and nature awareness.

5. The Heritage in Schools Scheme: All enjoyed working in the scheme and all were generally happy on how it functioned.

Overall, it would seem from the views of the experts and literature that the state and status of nature awareness, appreciation and education in the Irish primary school system is not as healthy as it should be. If for example, teachers' knowledge of nature in general was rated by the respondents as generally low, how can they engage children fully with this area of learning? Gittomer and Zisk (2015) teasing out research on teachers' pedagogical content knowledge (PCK) and their content knowledge (CKT) hypothesised that teachers who have more knowledge in PCK and CKT not alone teach more effectively but also affect students' learning more positively than those who possess less PCK and CKT. The experts offered no opinions on teachers' pedagogical knowledge (PK).

Biesta (2014) referring to knowledge content stated that it had been neglected in educational discourse with a shift to an emphasis on skills' acquisition or 'learnification' as he termed it (p.29). A perusal of the DES (1999a,1999b, 1999c, 1999d) SESE curriculum confirms Biesta's claim. Skill acquisition is constantly emphasised throughout the science and geography manuals.

One of the respondents was of the opinion that teachers' lack of knowledge was due to the lack of emphasis on nature in the Colleges of Education. After his summer courses on nature they invariably said: '*We should have done this in the College of Education*'. He believed that the tutors in these colleges did not pursue much outdoor work with the students because they themselves did not have the knowledge. There is room for research on this opinion as there is nothing in the literature to suggest that this is actually the case.

Generally, the respondents believed that older teachers were more knowledgeable than younger teachers. There was more emphasis on nature study in the 1971 curriculum and this may be a causal factor.

One respondent believed that children's knowledge of nature was very good, and this viewpoint differed from four of them who estimated that it was poor. It should be noted that this respondent works in a smaller area than the rest and returns to the same schools regularly to engage the pupils and teachers with nature, so this may be a factor in his optimistic assessment because these schools. It would be expected after regular visits that nature skills and knowledge would be high in these schools. He also places no emphasis at all on identification of species and it's quite possible that if he did his assessment would change. Generally, respondents found that children and teachers can identify very few species of plant and animal. According to the literature this is an important skill in nature education (Bebbington, 2005; Randler, 2008; Pyle, 2010). Identification of species is not the only knowledge of course that children require in nature education; knowledge of habitats, food-chains, adaptation, classification of species are just as important.

Four of the respondents believed that nature impacted on children's spiritual and aesthetic development. This aspect of nature is not mentioned in science syllabi of the new revised curriculum (DES, 1999b; 1999d). Half of the respondents believed that nature impacted positively on children's mental health and on nurturing a caring mentality amongst them. The latter benefit is promoted in the curriculum in the strand, Environmental Awareness and Care but there is no mention of nature as a lever for promoting mental well-being (DES, 1999b; 1999d). 'The child should enable to protect flora and fauna (DES, 1999b, p.69); 'The child should be enabled to appreciate the need to protect environments for present and future inhabitants' (DES, 1999b, p.92).

All believed that the practice of nature education was constrained by the poor design of school grounds. The compulsory enriching of school grounds for biodiversity has not been factored into school design yet by the DES, even though the revised curriculum (which places an emphasis on outdoor learning) is 18 years in existence. It was surprising therefore to discern from the HS experts that school gardening, which is invariably

vegetable growing, is extensively carried on in schools even though it is not well-planned, is not practised throughout the school and is not actively promoted and funded by the DES.

All the experts extended praise for the Heritage in School scheme and the Green School scheme. These schemes promote nature awareness, appreciation and education in schools throughout the country. Nevertheless, they believed they could be improved by the addition of more relevant flags in the Green School scheme such as ones for school gardening, and nature awareness and making the Heritage in Schools scheme more attractive regarding a sustainable wage and more holistic by extending the scheme to Northern Ireland.

4.9 Conclusion

The enthusiasm and commitment of the experts to their task of engaging teachers and children with nature is uplifting and one could not be too pessimistic about the future of this area of learning when one sees that 111 of these are visiting schools all over the country throughout the academic year regularly.¹⁹

'I have enjoyed being part of it for all the time since then-basically 20 years' (Robert); *'the reaction from children when they see a frog in their hand or holding up a dragonfly or any of those things...It's just excitement'* (Harry); *'The area that I enjoy most about it is when you can rise the enthusiasm of children about the outdoor...about the creepy-crawlies and about turning over the stones'* (Jack).

The Heritage Council, however, is pressurised by serious restrictions in its budget and only recently employed a wildlife officer after operating for five years without one ("Bridging the funding gap", 2018, editorial).

¹⁹ In the calendar year, 2017, a total of 2017 visits took place: 1675 of these were full day visits and 344 were half-day visits.) Source: Heritage Council). In 2018 due to budget restrictions the scheme ceased in April and was not due recommence until January 2019. However, this decision was rescinded in August 2018.

Nonetheless, serious re-thinking needs to be undertaken by the DES, NCCA, DPSM and other stakeholders on the teaching and learning of nature in primary schools. Firstly, the history of nature education in Irish primary schools which has been covered in the literature demonstrates that nature education in these schools was built on thin foundations. Secondly, it could be argued that its status should be on par with languages and maths because of climate change, biodiversity depletion, and health and food concerns. Languages and maths are important, but a sustainable world is equally as important. According to Sanchez-Bayo & Wyckhuys (2019) in *The Journal of Biological Conservation*, more than 40% of the insect population of the world will disappear in the next few decades due to habitat loss, pollution, diseases and climate change. This will have devastating effects on food production and the world's ecosystems. Meaningful nature education could have the potential to be a key driver to redress this decline.

A reading of the DES (2016) *Action Plan for Education 2016-2019* where there is no mention of nature education, biodiversity, school grounds, school gardening or outdoor education makes it evident that nature-education is not yet seen as a priority learning domain in the Irish educational system.

Chapter 5: Findings, Analysis and Discussion on the State and Status of Nature Awareness, Appreciation and Education Examined Through the Lens of Students Participating in Initial Teacher Education.

Understanding children's knowledge of the characteristics, habitats, and locations of everyday plants and animals is the beginning of understanding children's zoological, ecological and environmental knowledge (Patrick & Tunnicliffe, 2011, p.637).

5.1 Introduction

Chapter 1 outlines the research question for this research: what is the state and status of nature awareness, appreciation and education in the Irish primary school system? Chapter 4 focuses on answering one part of the research question: what is the *state* of nature awareness, appreciation and education in the Irish primary system? It concluded that the HS specialists perceived that teachers' and children's knowledge of nature was generally limited due to many variables. It also mined information from the interviews with HS specialists on the general unsuitability of school grounds for learning about nature, the positive impact that school gardening is having on nature appreciation, awareness and knowledge, the mental, physical, aesthetic, caring and spiritual dimensions of nature as well as the scientific approach, and the paucity of learning opportunities for children learning about nature outdoors.

In contrast, this chapter seeks answers to the broader question: What is the *state* and *status* of nature awareness, appreciation and education in the Irish primary system? It examines the *state* of nature awareness, appreciation and knowledge from answers to a nature-knowledge questionnaire administered to entrants in ITE which was based on the content of the 6th class syllabi in science and geography. It also examines the *status* of

nature awareness, appreciation and knowledge through examining students' experiences of learning about nature in their primary school days.

The revised curriculum, DES (1999a), is now 15 years in operation in Irish primary schools so it would be expected that the nature element of the SESE curriculum is well-embedded into the teaching and learning process. To ascertain if this is the case questionnaires could have been administered to a systematic random sample of 6th class children from across the country (Total: 63,280 pupils for academic year, 2016-2017. Source: Statistics Section, DES.). It was judged that this would not have been feasible for this research due to time limits and financial constraints. Instead, an appropriate sample of first-year B.Ed. students and PME students in two Colleges of Education were targeted to complete a 38-item questionnaire on nature-knowledge. (College A: 65 B.Ed. 1 students; College B: 96 B.Ed. 1 students; College A: 33 PME students; College B: 59 PME students; Total: 253 students). This questionnaire is based on the content from the 6th class SESE syllabi in Science and Geography of the DES (1999b) and DES, (1999d) revised curriculum.

A 38-item questionnaire was utilized to measure the nature-knowledge and nature-engagement of first-year ITE students.

In this Chapter, Excel (v.16.0) and SPSS (v.24) are utilised to conduct statistical analysis on the answers to the questionnaire.

In the description of quantitative terms throughout this chapter the following descriptive terms in Table 6.1 signify the various percentages.

Table 5.1

Quantitative Terms Used in Chapters Six and Seven

Quantitative Terms	Percentages
Almost all	More than 90%
Most	75-90%
Majority	50-74%
Fewer than half	25-49%
A small number	15-24%
A few	Up to 14%

Note: Quantitative terms are the same as those used in *Science in the Primary School* (2008, p.13).

5.2 Test Score Results

An independent-samples t-test was conducted with the significance threshold set at .05 to compare results from a nature-knowledge questionnaire administered to B.Ed.1 students in College A and in College B. Significance of results throughout the chapter are recorded as follows: $p \leq .01$ ** $p \leq .05$ *.

The results suggest that the test scores differed in both colleges. Specifically, the results suggest that the B.Ed. students in College A had a greater knowledge of nature than the B.Ed. students in College B, and a greater knowledge than the PME students in their own college. Notable differences between the means of the two student cohorts in College A and B can be summarised as follows:

- There is a highly significant difference between the mean scores of the **B.ED.1 students in College A** (M=44.71, SD=9.68) and **BED 1 students in College B** (M=35.98, SD=9.45); $t(59) = 5.69, p = 0.000, \alpha = .05$. **
- A *t* test *failed* to reveal a statistically reliable difference between the mean scores of the **PME students in College A** (M=35.50, SD=10.56) and **PME students in College B** (M=32.95, SD=9.47); $t(153) = 1.82, p = 0.055, \alpha = .05$.

- There is a highly significant difference between the mean overall scores in **College A**²⁰ (M=41.63, SD=10.84) and the mean overall scores in **College B** (M=34.83, SD=9.54); $t(251) = 5.24, p = 0.000, \alpha = .05. **$

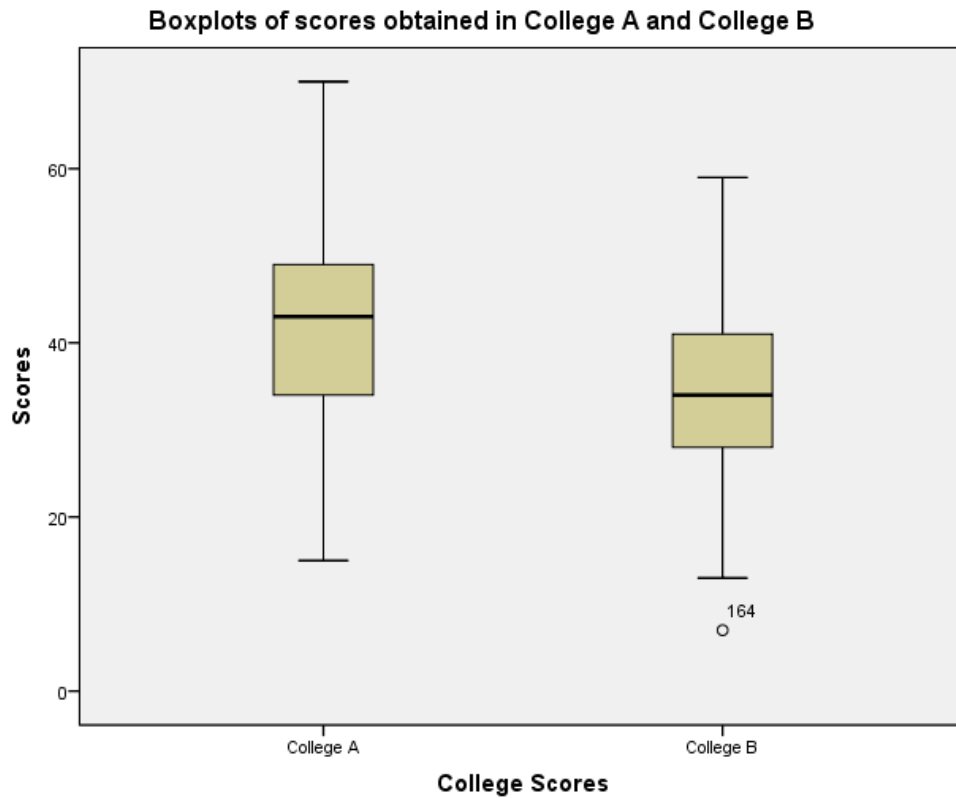


Figure 5.1: Boxplots demonstrating the central tendencies of scores of students in Colleges A and B: College A: M = 41.63; Mdn = 43.0; SD = 10.84, Range: 15 - 70; College B: M = 34.83; Mdn = 34.0, SD = 9.54, Range: 7 - 59.

The two results were combined using SPSS Analyse/Descriptive Statistics and the resultant boxplot which emerged from the computation can be seen in Fig 5.2.

²⁰ This disparity could be due to many variables. One possible variable is the fact that there is a higher points' ceiling for admission to College A.

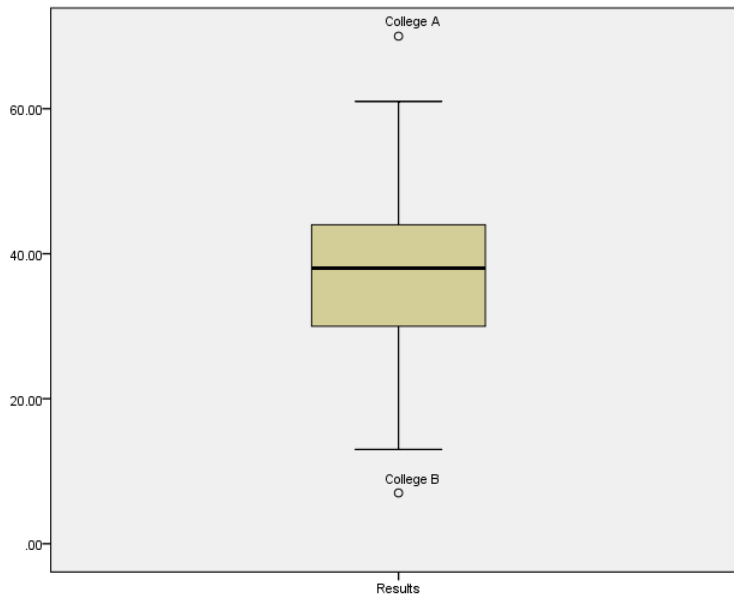


Figure 5.2: Boxplot of overall results of nature-knowledge questionnaire administered to ITE students. $M=37.46$, $Mdn =38.00$; $SD=10.58$, $Range=7-70$.

Figures 5.3 and 5.4 demonstrate that the scores from the nature-knowledge questionnaire administered to ITE students generally appear to be normally distributed.

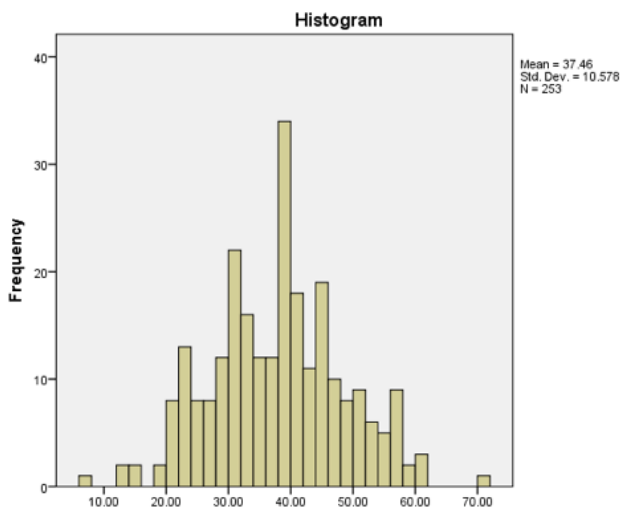


Figure 5.3: Histogram representing scores

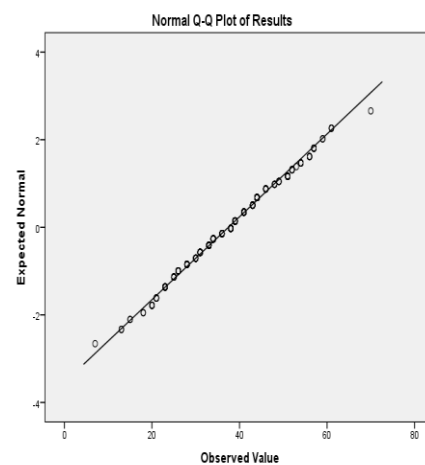


Figure 5.4: Normal Q-Q plot of results

In the Kolmogorov-Smirnov statistic which assesses the normality of the distribution of scores a non-significant result (Sig. value of more than .05) indicates normality (Pallant, 2011). The Sig. value is .035 which indicates normality of distribution.

Using the Case Processing Summary in SPSS 24 there is very little difference between the original mean of the total scores (37.46) and the 5% trimmed mean of the total scores (37.40) which indicates that the extreme scores do not exert a strong influence on the mean (Pallant, 2011).

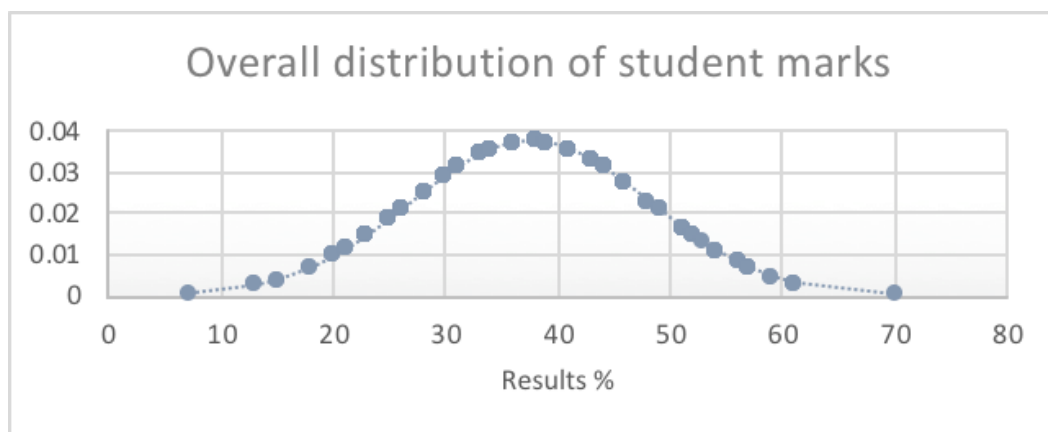


Figure 5.3: Overall distribution of student marks on nature-knowledge questionnaire displayed in bell-curve.

An examination of the distribution of marks demonstrates that **84.13%** of the students scored within 1 SD above the mean. As the mean is 37.5 and the SD is 10.6, this percentage of students scored between 37.5 and 48.1. To calculate this number the percentages from -3SD on the left of the mean in a normal curve (.0013 + .0215 + .1359 + .3413) are added to the percentage on the right (.3413). Most would therefore achieve a D (40 - 54) with 2.5 % failing in the secondary marking system which is the lowest passing grade. At third level 2.5% would also fail and most would achieve a pass grade.

5.2.1 Summary:

- Students in the 17-19-year-old bracket have the highest scores.
- Most of the students' scores are between 36/100 and 48/100.
- If scores were recorded according to the second-level system of marking, most would be scored with a D with 3% failing.

- If scores were recorded according to a third-level system of marking in Ireland (40%-49%=Class 3 Honours-Pass; 50%-59%=2nd Class Hon.; 60%-69%=1st Class Hon.; 70%-100%=1st) most would be given a pass grade with 3% failing.
- B.Ed. students in College A scored significantly higher than B.Ed. students in College B. (It should be noted that there is a higher points' ceiling for admission to College A. This may be a significant variable)).

5.3 General Information on the Student Population

Almost all (92%) students are in the 19-24 years-of-age-group. A few (7%) are in the 25-44-year age-group.

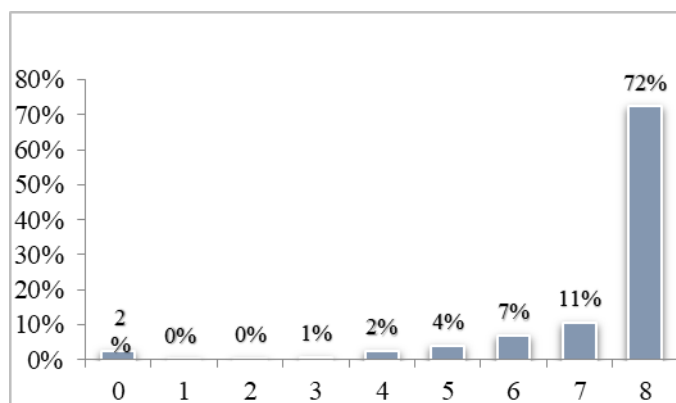


Figure 5.4: Age groups of student cohort (N=253) who completed questionnaire.

Because of this age demographic almost all (94%) were attending primary school for a period of five to eight years when the new curriculum (DES, 1999b; DES 1999d) was in operation. Those students aged 23 and 24 attended school for two or three years while the 1971 curriculum (Curaclam na Bunscoile, 1971) was still in operation. These figures have relevance for this study because the research question is based on the quality and quantity of nature education in Irish primary schools while the new curriculum was in operation (DES, 1999b; DES, 1999d).

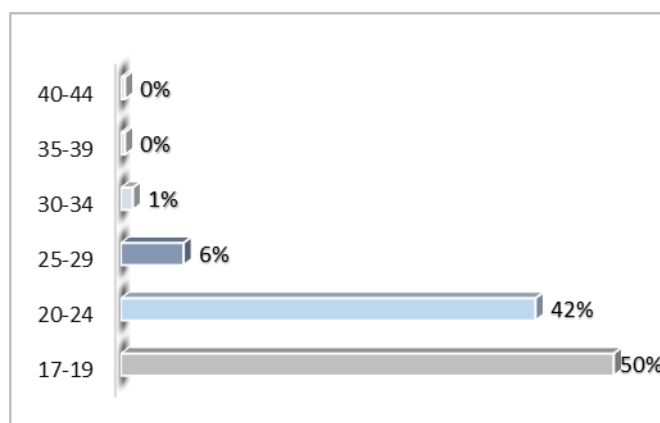


Figure 5.5: No. of years students (N=253) were exposed to new revised curriculum.

A one-way between-groups ANOVA was conducted using SPSS 24 to explore the impact or non-impact of age-groups on scores achieved. There was a very statistically significant difference between the groups as determined by a one-way ANOVA ($F(5,247)=5.884, p=0.000$). The 17-19-year olds ($n=126$) recorded the highest mean-41. This compares with a mean of 34 for the 20-24-year olds ($n=106$). It was expected that both cohorts would have registered similar scoring patterns as both had exposure to SESE in the new curriculum for approximately the same amount of time (DES, 1999b; DES 1999d). Perhaps distance in time from primary/secondary school days was a factor in the dissimilar scoring. Also, because the new SESE curriculum was in operation longer when the younger ITE students engaged with it, perhaps these students' teachers had more confidence and expertise in teaching its content.

5.3.1 Students' engagement with science-related subjects at post-primary level.

Nature education is subsumed in the Science and Geography curricula at primary level. Therefore, it was felt necessary to explore the ITE students' engagement with science (particularly biology and geography) at second-level. The majority of them (70%) had in fact studied biology to Leaving Cert. level; the majority (50%) had also studied geography to this level.

Table 5.2

Percentage of ITE Students Who Studied Science-Related Subjects to Leaving Cert. Level

Subjects	Percentage of students who studied subject (N=253)
Biology	70
Geography	50
Biology and Geography	31
Chemistry	13
Agricultural Science	11
Physics	10
None of the above	6

Nonetheless, of the 35 students who scored 25% or lower in the questionnaire, 66% of them had studied Biology to Leaving Cert level and 43% had studied geography. Of the 35 students who scored 50% or more, the majority (72%) studied biology to Leaving Cert and fewer than half (46%) studied geography.

A Chi-square test of independence rejected the null hypothesis that there was no association between these scores: $\chi^2(1) = 157, p \leq .05$. Studying biology and geography to Leaving Cert. level influenced scores.

The hypothesis that the study of biology to Leaving Cert level had no significant effect on students' nature-knowledge scores was further investigated using a one-way between groups ANOVA calculated assuming equal variances of means. After conducting the test, it was found from the results of Levene's robust test that the assumption of equal variances was violated: $p=0.01$. The Welch test for robust equality of means was therefore used and a p -value of 0.76 was obtained, so the null hypothesis that there was no difference between the nature-knowledge scores in the questionnaire of the biology and non-biology students was rejected. Studying biology to Leaving Cert had a positive effect on scores obtained. However, the effect size was small using Eta squared for ANOVA: $\eta^2=.0005$ (Cohen, 1998).

5.3.2 Summary:

- Almost all had attended primary school after the introduction of the revised curriculum for a period of five to eight years (This does not mean that they were engaging with it, however).
- The majority of students had studied biology and geography to Leaving Cert. level.
- The study of biology to Leaving Cert. level had a small positive effect on students' scores. One would have expected this to have had a more significant effect. Nonetheless, Bebbington (2005) discovered that A-level biology students in England had limited identification skills. Perhaps these are not a priority in the biology syllabus in Ireland either.
- The 17-19-year-old cohort scored the highest marks.

5.4 Backgrounds of student cohort.

Most of the students came from Leinster. Dublin was the home-county of 32%; counties in the rest of Leinster were the home-counties of 37%. All counties, however, provided students for the two colleges.

Table 5.3

Percentage of Students Who Originated from all Counties

County	Percentage of students from this county (N=253)
Dublin	32%
Kildare	7%
Meath	7%
Donegal	6%
Sligo	5%
Westmeath	4%
Wexford	4%

Note. Even though all 26 counties were represented, 19 were the home-counties of <4% of students

The demographics relating to types of school attended (Rural: 38%: Urban: 62%) and to places associated with upbringing (Rural: 43%: Urban: 50%: Both: 7%) generally reflect the rural/urban divide in Ireland which in the census of 2016 was rural: 42%: urban 58% (McMahon, 2010 June 1).

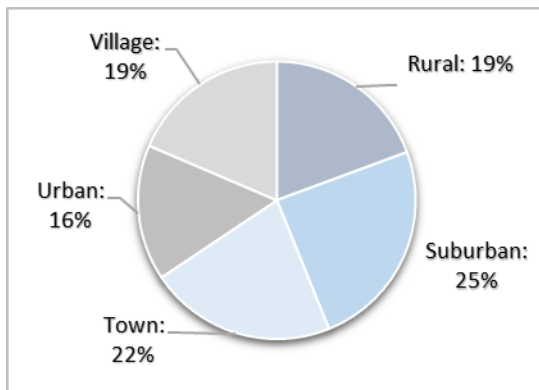


Figure 5.8: Types of primary school students attended.

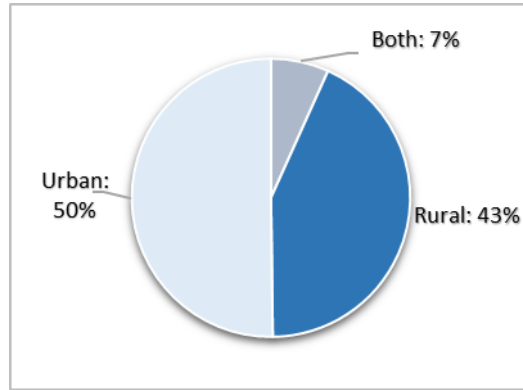


Figure 5.9: Home-communities of students

A one-way between-groups ANOVA was conducted to explore the impact or non-impact of students' home background on nature-knowledge scores. There was no statistically significant difference between the students' marks from the urban and rural groups as determined by one-way ANOVA ($F(2,250)=1.116, p=0.329$). Neither was there any statistically significant difference between the students' marks from suburban and rural schools as determined by one-way ANOVA ($F(4,248)=2.153, p=0.075$). Effect size was calculated using the formula suggested by Cohen (1998). In both cases the effect size was small (.01 and .03 respectively).

5.4.1 Summary:

- The majority of the students came from urban backgrounds and Leinster.
- The majority of them came from Leinster.
- There was no statistical difference between the marks obtained by those with an urban background and those with a rural background.

5.4.2 Gender of ITE students

A small number of the ITE students (16%) questioned were male but most (84%) were female. These figures reflect the demographics of the Irish primary teaching cohort in general where it was reported in 2016 that 87% of teachers were female and only 13% were male (Jones, 2016).

5.5 Overarching Research Question: What is the State and Status of Nature Awareness, Appreciation and Education in the Irish Primary School System? Examining the Question Through the Lens of Teacher-Education.

This question is explored through three categories and five sub-categories. **Firstly:** general examination of the nature-education of the first year ITE students in the two Colleges of Education discussed above: (a) their confidence-levels relating to knowledge of plants and animals; (b) their main sources of knowledge pertaining to nature; (c) knowledge of plants contrasted with knowledge of animals; (d) the amount of time they spent engaging with it both indoors and outdoors in primary school and (e) the quality of the locations outdoors in which it was studied; (e) the quality of the resources used by the teachers; **Secondly:** the state and status of school gardening; **Thirdly:** the actual nature-knowledge of the students themselves after eight years in primary school and five or six years in secondary school.

5.5.1 Nature Content of the New Curriculum (Science and Geography).

As outlined in 5.1, the majority of the students (73%), attended primary school when the revised curriculum was in operation for eight years and a few (11%), attended when it was in operation for seven years. Table 5.4 illustrates the content of the nature syllabus in the Science/Geography curriculum that they should have been familiar with by the time they exited sixth class.

Table 5.4

Synopsis of Nature Topics on the Revised Curriculum

Topics	
Local habitats: observe, identify and examine plants & animals	Awareness of plants and animals from wider environments
Food chains; food webs	Awareness of sun as a source of energy for plants
Adaptation of plants & animals	Classification of plants & animals
Using keys to aid identification	Processes of life: growth, nutrition, reproduction, factors that affect plant growth
Diversity of plants & animals	Rocks & soil
Weather & climate	Natural features such as mountains, rivers

5.5.1.1 Sub-Category 1: Confidence levels of students on their knowledge of plants and animals.

Item 1, Section 2 of the questionnaire contained the following question:

Which one of these descriptors describes how you feel about your knowledge of nature (plant and animal life)?

The ordinal responses are recorded in Figure 6.8.

Most of the students (77%) did not feel confident about their subject content knowledge relating to nature reflects unfavourably on their engagement with nature in the primary and secondary school systems and may have implications on their ability to teach this subject effectively in the future.

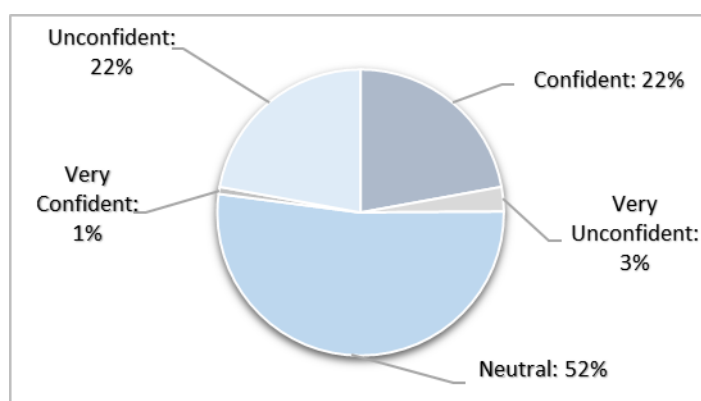


Figure 5.6: Self-reported confidence levels of students (N=253) on their knowledge of plants and animals.

A one-way between-groups ANOVA was conducted to explore the impact or non-impact of students' confidence-levels on nature-knowledge scores. There was a statistically significant difference between the groups as determined by one-way ANOVA ($F(4,248)=11.332, p=0.000$) so the null hypothesis that confidence levels of students made no difference to scores was rejected. Those with the highest confidence levels scored the highest marks. Particularly, there was a significant difference between the scores obtained by those who considered themselves 'confident' and those who considered themselves 'neutral', 'unconfident' or 'very unconfident', $p=.000$. The overall effect size (ETA squared) which was calculated by dividing the between groups sum of squares by the total sum of squares was large at $\eta^2=.16$. **

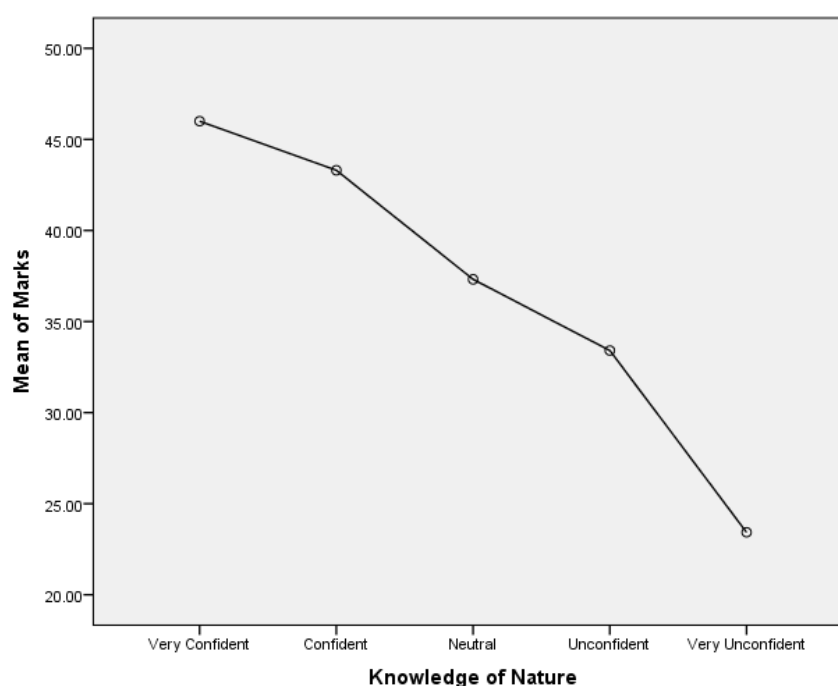


Figure 5.7: Confidence levels of students relating to their knowledge of nature.

Content knowledge as an attribute of a teacher's potential is important as Darmody and Smyth (2016) demonstrated in their wide-ranging analysis of initial teacher education. 'The existing literature has highlighted *content knowledge*, pedagogical knowledge, pedagogical communication and interpersonal skills and attitudes and motivation to teach as important attributes and qualities in a good/effective teacher' (p.34, emphasis added).

Seventy-seven percent of the ITE students reported that they did not feel confident about their content knowledge of nature. The question which this research does not answer is: will the students receive adequate content knowledge in their ITE education programme to become effective teachers teaching this subject?

5.5.1.2 Summary:

- Most of the students did not feel confident about their subject content knowledge relating to nature.
- Those with the highest confidence levels achieved the highest scores. There was a very significant difference in the scores of those who considered themselves ‘Confident’ and those who considered themselves ‘Neutral’ and ‘Unconfident’ which demonstrates that confidence levels relating to nature-content had a bearing on scores achieved.

5.5.1.3 Sub-Category 2: Main source of students’ knowledge about nature.

The main sources of students’ knowledge of nature were people. Parents/guardians were the most important source followed by secondary and primary teachers. Secondary teachers were more influential in their knowledge acquisition of nature than the latter, perhaps because the majority of the students (70%) studied biology up to the Leaving Cert.

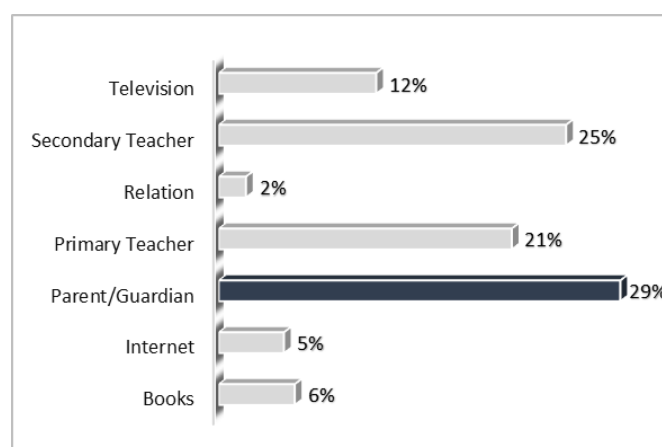


Figure 5.8: Students’ sources of knowledge on nature (N=253)

A one-way between-groups ANOVA was conducted to explore the impact or non-impact of students' main source of knowledge about nature on nature-knowledge scores in the student questionnaire. There was a statistically significant difference between the groups as determined by one-way ANOVA ($F(6,245)=2.35, p=0.03$) so the null hypothesis was rejected. In the Tukey Multiple Comparison Test, it was observed that there was a significant difference particularly *between the mean scores of those influenced by parents/guardians and those influenced by primary teachers, $p=.007$* . Those influenced by parent/guardians had a mean score of 40.00; those influenced by primary teachers had a mean score of 33.32. The overall effect size (Eta squared) was $\eta^2=.06$ which is considered a medium effect (Cohen, 1998). Parents/guardians had more of an influence on higher student scores than primary teachers had. It seems from this result that family influence regarding engagement with nature could be an important contributor to a person's nature-knowledge.

5.5.1.4 Summary:

- Parents/guardians were the main source of students' knowledge of nature.
- The second most influential source were secondary teachers and the third most influential source were primary teachers.
- The mean scores of those influenced by parents/guardians were significantly better than those influenced by primary teachers.

Sub-Category 3: Students' knowledge of plants contrasted with their knowledge of animals.

Item 2, Section 2 asked students: **Which one of these two aspects of nature (a) plants (b) animals, are you more knowledgeable about? Circle (c) if you feel you are equally knowledgeable about both. (a) Plants (b) Animals (c) Plants and Animals.**

The results which showed that the majority of students (67%) believed that they were more knowledgeable about animals are not surprising as research has demonstrated that teachers favour teaching about animals in preference to plants and that children have more interest in, and knowledge of, animals rather than plants (Bebbington, 2005; Lindemann-Matthies, 2005; Patrick & Tunnicliffe, 2011; Robinson, Inger & Gaston, 2016). For example, Bebbington (2005) discovered that 86 of A-level biology students could only identify three or less out of a total of 10 common wild flower species; forty-one percent could only name one or less and surprisingly, 29% of their teachers as well could only recognise three or less.

Nonetheless, according to Lindemann-Matthies (2005), the bias toward animal knowledge and identification could be addressed through education because children become interested in plants if they are introduced to them by name. This finding links with Section 4.5.4 where identification of plants is explored as a necessity for learning more about them according to Robinson et al (2016), Stagg and Donkin (2016) and Randler (2008). According to Stagg and Donkin (2016) there should be an urgency to learn about plants now more than ever and to become skilful in identifying them because they are declining, and this could have severe consequences for preserving and conserving ecosystems. This view was echoed by Robinson et al. (2016) when referencing widespread research on the decline of identification skills. They suggested that a lack of plant-identification skills could not alone lead to a diminished interest in protecting them but could also lead to lessening the ability of people to monitor invasive species and a lessening of appreciation of nature in general.

5.5.1.5 Summary:

- The majority of the students believed that they were more knowledgeable about animals rather than plants and this finding concurs with general research findings.

5.5.1.6 Sub-Category 4: Amount of time students spent studying nature in school.

The majority of them spent an insignificant amount of time studying nature. This finding part-answers the sub-question: What is the *status* of nature awareness, appreciation and education in the Irish primary system? The majority of students (72%) indicated ‘sometimes’ or ‘seldom’. Fewer than half (27%) studied nature ‘frequently’ or ‘very frequently’. Ten students never studied nature.

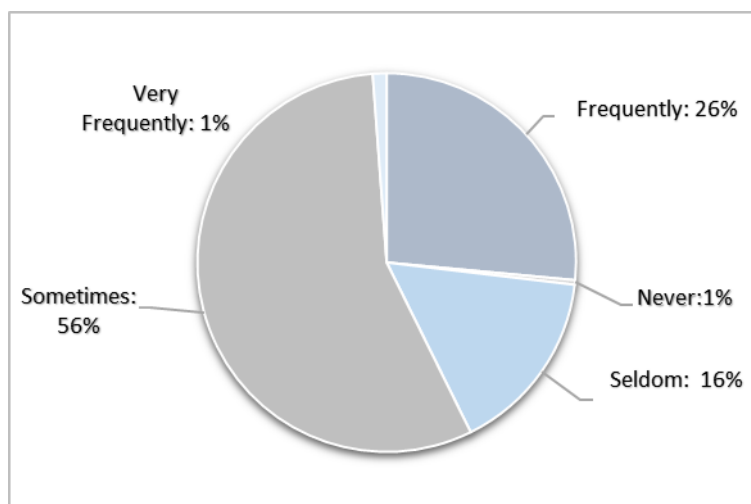


Figure 5.9: Frequency in which students (N=253) studied nature in primary school.

The accuracy of this data could be questioned, however, because the students’ recollections may have faded since they attended primary school. Nonetheless, this researcher remembers clearly studying nature very frequently in his primary school over sixty years’ ago probably because it was so different from the rest of the subjects.

A one-way ANOVA was conducted to determine if there was a significant difference between the scores of the students who studied nature very frequently, frequently, sometimes, seldom and never at primary school. The null hypothesis that frequency of studying nature had no impact on scores was rejected after conducting the test. ($F(4,248)=3.23, p=0.013$). The frequency of studying nature in primary school had an influence on students’ scores.

Engagement with nature outdoors did not occur often and the figures generally correspond with the low-level engagement with nature itself. The majority of the students

(75%) did not go out frequently and this figure corresponds with those in Figure 5.13 where the majority of students (73%) had a low-level engagement with nature in the primary school.

It also corresponds with the low engagement with the outdoors reported by Varley, Murphy & Veale (2008) in *Science in Primary Schools, Phase 1, Final Report*. ‘...of the 906 depictions of school science that were classifiable as to the setting, only 53 (5%) showed pupils outdoors, the majority (86%) depicting activities within the classroom’ (p.71). This lack of outdoor engagement was also commented on by the inspectors in their report on science in the primary school (*Science in the Primary School*, 2012). Reporting that the strand unit, Plant and Animal Life was one of the weaker units they observed, they stated that from interviews with teachers they discerned that at least one third of pupils were never brought outdoors.

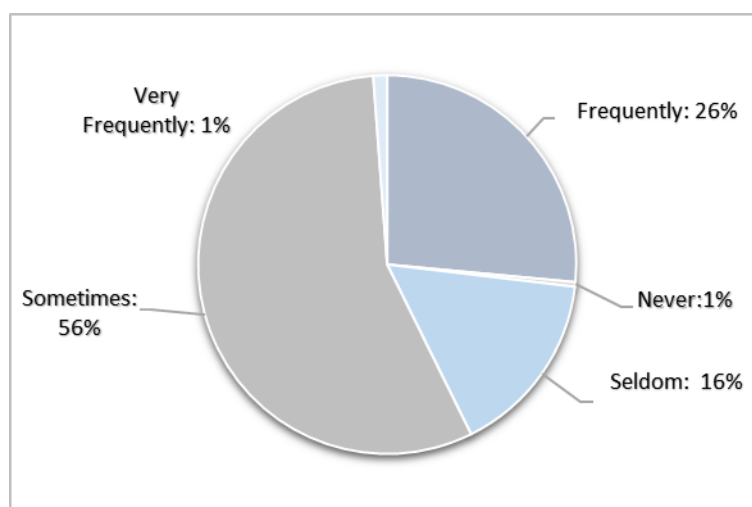


Figure 5.10: Frequency in which students (N=253) went outside to study nature in school.

Pike (2011) also found that schools were not using the children’s knowledge of their locality enough when engaging with geography. She suggested that learning about their local environments in school did not happen for most children and that what they did learn in school was about places that were far away. Outdoor engagement with nature and

geography is therefore constantly promoted for meaningful engagement with these subjects.

A one-way between-groups ANOVA was conducted to explore the impact of going outside to study nature on students' nature-knowledge scores. The null hypothesis that there was no significant difference between the mean scores obtained by the groups who studied nature outside very frequently, frequently, sometimes, seldom, never was not rejected after conducting a one-way ANOVA in SPSS 24. ($F(4,248)=1.843, p=0.121$). The frequency of going outside to study nature in primary school had no influence on students' scores. The effect size (Eta squared) was calculated by dividing the between groups sum of scores by the total sum of scores and was found to be small to medium, $\eta^2=.05$ using Cohen's formula (Cohen, 1988).

This result is significant because one would have surmised that frequency of engagement with nature outdoors would have influenced scores. Perhaps this finding demonstrates that the *quality* of outdoor engagement is mediocre; perhaps it demonstrates too that the school grounds do not possess the nature-enrichment required for meaningful learning outdoors. Perhaps it demonstrates that going outside does not affect conceptual learning. This topic is discussed further in the following sections: 6.4.2, 6.4.3, 6.6.2, 6.6.2.1, 6.6.2.2 and 6.6.2.3.

The inspectors recommended in *Science in the Primary School* (2008) that 'School grounds should be developed and used as a resource to support the learning of simple ecological concepts and the skills required to use and make identification keys' (p.40). As discussed in 2.11.2 and 4.6.1, the DES has not initiated a decisive and holistic policy for ensuring that school grounds are suitable for engaging with nature outdoors.

The opinions of HS experts regarding their suitability for working outdoors with children on nature activities was explored in Chapter 4. They felt constrained by poor school ground design. Considering these factors, one must question the depth and breadth of the nature experience in their own school grounds in which most of the students (83%) engaged. Figure 5.11 demonstrates that most of their teachers used the school grounds for studying nature outdoors but most (75%) did not go outdoors to study nature often (Figure 5.10 above).

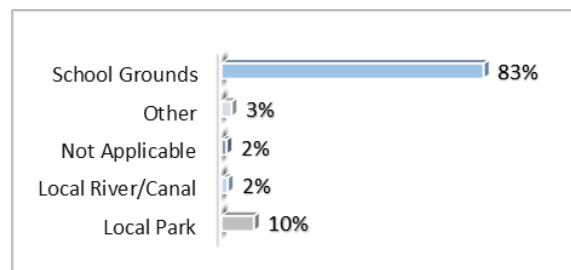


Figure 5.11: Locations outside the classroom where students studied nature (N=253).

The inner-city school on which the garden on the right is attached was built in 1930 and has various wildlife habitats for engaging children in outdoor nature-education. The modern grounds on the left are not suitable for engaging with nature outdoors.



Figure 5.12: Images of two contrasting school grounds.

Recommendations are made in Chapter 7 for the provision of grounds such as those on the right in every primary school so that the quality and quantity of outdoor nature-

education experiences can improve. Perhaps if the students had school grounds like those on the right they would have gone out more frequently to study nature.

5.5.1.7 Summary:

- The majority of the students did not recall spending a significant amount of time studying nature in the primary school.
- The amount of time students spent studying nature in primary school had a positive influence on their scores in the nature-knowledge questionnaire.
- The majority did not recall going out frequently to study nature.
- The frequency of going outdoors to study nature had no bearing on scores achieved in the nature-knowledge questionnaire. (This result is discussed in 5.5.1.6)
- The school ground was the location mostly used by students to engage with nature outdoors. Currently the DES has no comprehensive policy in place to enable these to be enriched for wild-life. Therefore, these grounds may not have been nature-rich.

5.5.1.8 Sub-Category 5: *The quality of the teacher-resources used by the primary teachers of ITE students.*

The DES, *Primary Science Curriculum Guidelines* (1999e) advised that textbooks and workbooks had limited potential for teaching science. Following on from this, the inspectors in *Science in the Primary School* (2008) report found that two-thirds of teachers used textbooks ‘appropriately’ (p.19) in planning science lessons as a support. However, they also found that one-third over-used them for planning and these were the teachers that exemplified poor to fair planning in science. In the same report, it was revealed that pupils were ‘unsure or disliked their science books’ (p.131). Examining the ITE students’ responses, the textbook was the primary resource used by their teachers in teaching science

(where nature study is embedded). Fewer than half (41%) used actual specimens to engage them when they were pupils.

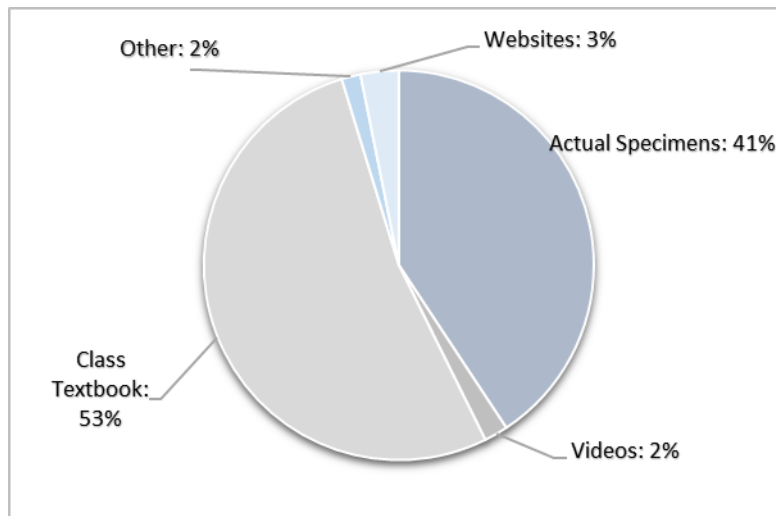


Figure 5.13: Resources used by the ITE students' teachers in primary school.

A one-way between-groups ANOVA was conducted to explore the impact of five different teacher resources on students' nature-knowledge scores. After conducting the test, it was found from the results of Levene's Robust Test that the assumption of equal variances was violated: $p=0.03$. The Welch Test for Robust Equality of Means was therefore used and a p -value of 0.71 was obtained so the null hypothesis was not rejected. The resources used by the teachers at primary level did not influence students' scoring abilities. One would have surmised that teachers using actual specimens would have resulted in students achieving higher scores.

The use of the nature table as a resource by primary teachers was explored separately. The INTO (1988) reporting on the new curriculum (Curaclam na Bunscoile, 1971), stated that '87% of teachers surveyed [n=789] reported the presence of a nature table in their classroom' (p.31). It would seem however, from Varley et al (2008) that this feature of nature study had disappeared with the introduction of the revised new curriculum (DES,1999a) when they reported: 'The "Nature Table" is long gone, and instead, many pupils are gainfully employed in science lessons which use interactive,

hands-on strategies” (p158). A counter-argument would suggest, however, that the nature table encouraged ‘interactive, hands-on strategies’ and that by engaging with it, pupils were ‘gainfully employed’. This was the view of the biologist Sue Tunnicliffe (Tunnicliffe, 2006, p.100) when she observed: ‘The Nature Table, which has, regrettably, almost disappeared from primary schools can be an excellent tool in introducing pupils to scientific nomenclature and classification – starting with their everyday knowledge’ (p.100).

The responses from the students conflicted with the above report by Varley et al. (2008) too because most (87%) reported that they had a nature table in a classroom at some stage in their primary education journey.

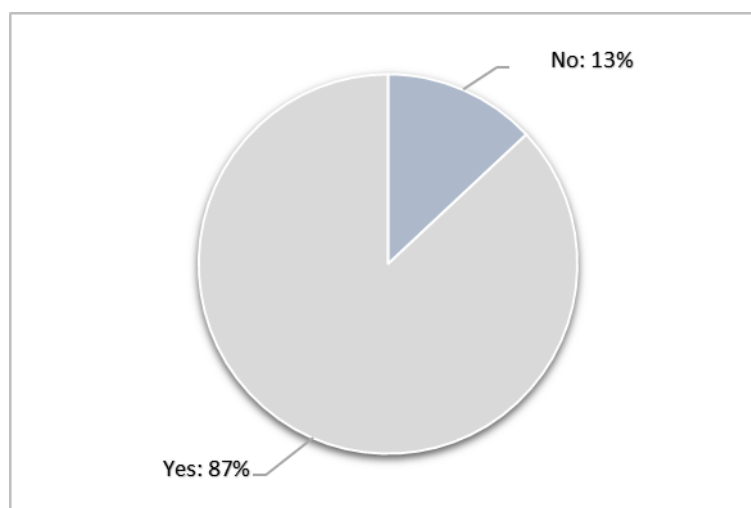


Figure 5.14: Proportion of students (N=253) who had a nature table in the classroom.

5.5.1.9 Summary:

- The majority (53%) of the ITE students recalled that their primary teachers used the class textbook to teach them about nature.
- Fewer than half (41%) recalled used actual specimens to teach about nature.
- The resources used by the teachers did not have appear to have a significant effect on the ITE students’ scores in the nature-knowledge questionnaire.

- Most of the ITE students (87%) encountered a nature table at some stage of their primary school days. The latter finding conflicts with research on the teaching of science in the primary school by Varley et al. (2008).

5.6 Category 2: The State and Status of School Gardening: ITE Students'

Engagement with School Gardening in Primary School

The majority of the students (57%) engaged in school gardening while they were in primary school. This was probably due to teacher interest because, as discussed in Chapter 2, there was limited attention given to school gardening in the SESE sections of the revised curriculum (DES, 1999b;1999d).

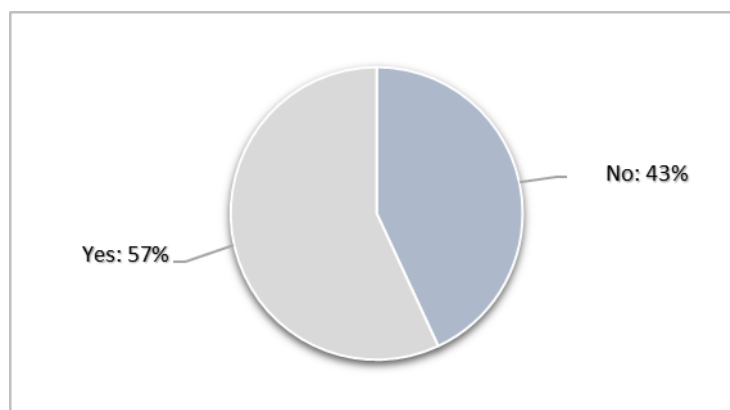


Figure 5.15: Engagement of students (N=253) with school gardening in primary school.

Chapter 2.12 provides an insight into the chequered history of school gardening in Ireland and apart from a period around the duration of the first world war there was no concentrated effort from government departments to promote it. As outlined in Chapter 2.12.2, school gardening received some mention in the new curriculum, (Curaclam na Bunscoile, 1971) but no syllabus was provided, and it was not compulsory. As outlined in the same chapter (2.12.3), school gardening received less mention in the revised curriculum (DES, 1999b; 1999d).

Nonetheless, it started to thrive in primary schools and the timeline in section 2.12.3, outlines briefly a history of school gardening in Ireland from 1985 to the present. It

demonstrates that school gardening is being pioneered by various bodies and individuals external to the DES. It would be expected that the DES should be driving this movement

5.6.1 Summary:

- The majority of the students engaged with school-gardening when they attended primary school.

5.7 Category 3: Nature-Knowledge of Students After Eight Years in Primary School and Five to Six Years in Secondary School.

Mohneke, Erguvan & Schluter (2016), Randler (2008) and Bebbington (2005) concluded that if one can identify and recognise a living thing one's relationship with it is deeper and more respectful than with an unknown organism, that identification of species generates caring for the environment qualities and that this was a necessary skill for learning about biodiversity and biology. This is disputed by Cornell (1998) and The Forest School movement²¹. The importance of the identification of species skill is discussed in Section 4.5.4 and Section 5.5.1.4

5.7.1 Sub-category 3(a): Students' knowledge of trees.

Six of the items administered to students were multiple-choice questions with four variables and a 'don't know' one relating to their knowledge of common trees. These trees were: oak, ash, beech and rowan. They were asked to identify an oak leaf and a rowan leaf, the fruit of a beech and an ash, the bud of an ash and to choose from a list of four variables the part of a tree that produces food using the sun's energy. This latter item was taken from Wells (2015).

²¹ The Forest School movement emanated from Scandinavian countries and is based on their philosophy of *friluftsliv* which entails a deep emotional affinity with the outdoors. In an educational context this philosophy entails immersing children regularly in a woodland setting under trained practitioners where a child-centred, play-based approach in engagement with the natural environment is pursued. Schools which partake in this regular immersion are called 'Forest Schools'. In 2016 the Irish Forest School Association was founded.

The DES (1999b) science handbook is very specific about tree identification from infants up to second:

Infants: ‘The child should be enabled to observe, discuss and identify a variety of plants and animals in different habitats in the immediate environment: *common trees and other plants* (emphasis in original, p.24).

First and second: ‘The child should be enabled to...*identify common trees and other plants*’ (p.42).

Third and fourth: ‘The child should be enabled to observe, identify and investigate the animals and plants that live in local environments’ (p.62).

Fifth and sixth: ‘The child should be enabled to observe, identify and examine the animals and plants that live in local habitats and environments’ (p.84).

In the students’ nature-knowledge questionnaire relating to five common trees and the process of photosynthesis none of them correctly answered all the six items relating to them. Five were correctly answered by a few of them (1%) and four were answered correctly by 4%. Three were correctly answered by a small number (18%). Two were correctly answered by less than half (41%). One was correctly answered by less than half (29%). A few (7%) were unable to answer any of the six tree questions.

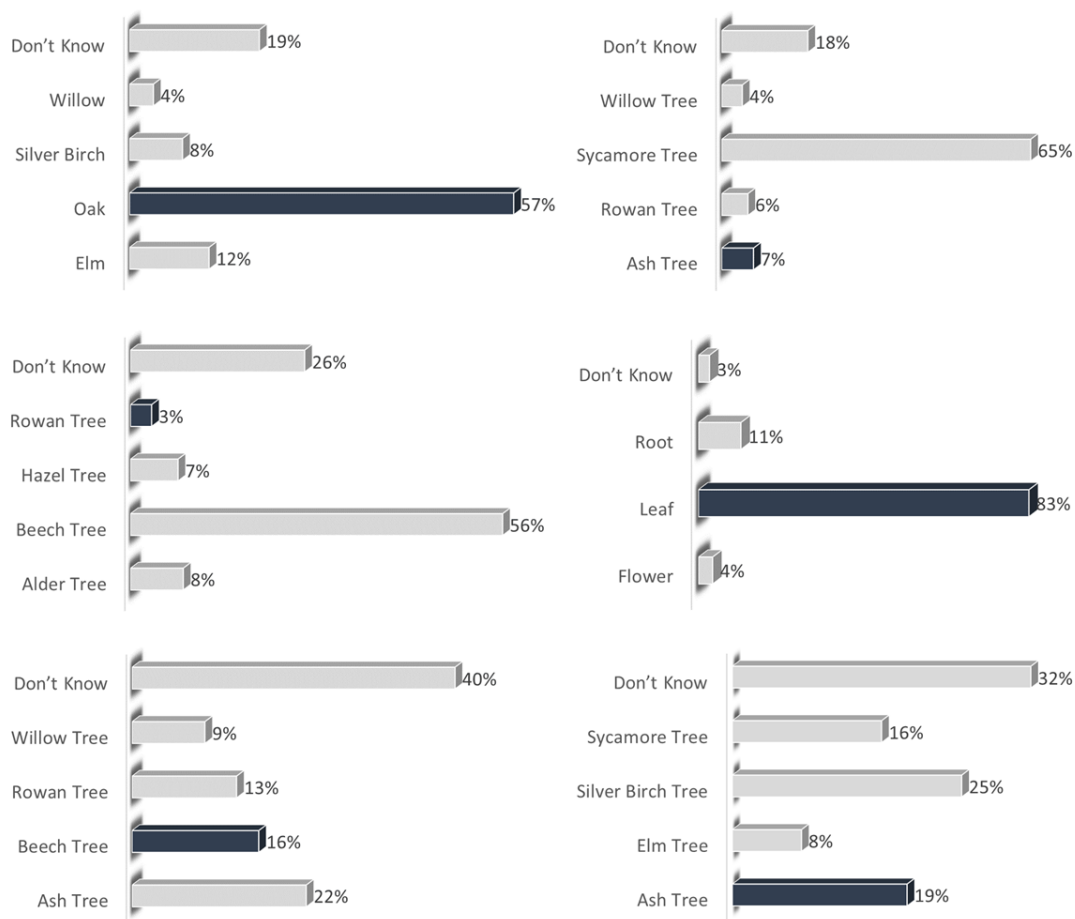


Figure 5.16: Top to Bottom, Left to Right: Identify an oak leaf; Identify the fruit of the ash; Identify a rowan leaf; Specify that a leaf makes food; Identify beech fruit; Identify the ash bud.

These results demonstrate that the majority of the students possessed limited knowledge of the basic facts relating to common Irish trees. Is this the *plant-blindness* which was discussed in 4.3.3, a phrase coined by Wandersee and Schussler (1999)? The result of the item relating to the oak is of interest. Less than half of them (43%) could not identify the leaf of this tree, arguably the most identifiable of all Irish trees with its distinctive lobed leaves. The sessile oak is also the national tree of Ireland. The Woodland Trust (2013) surveyed 2050 young and adult people found that 57% of the adults could identify the oak leaf and only 39% of the 18-24-year olds. In contrast, an article by Spencer (2014) on a survey of 2194 adult by Gardeners' World magazine in 2014 in which

respondents were asked to identify five common trees from their leaves, 91% identified the oak correctly.

The result of the item pertaining to the ash bud is interesting too. This is the most distinctive of all tree buds in Ireland because it is the only one which is black. Yet, most of the students (81%) failed to identify it.

It seems from the results of the question on tree fruits that students confused the sycamore's fruits with those of the ash. The majority of them (65%) believed the ash keys were the distinctive 'helicopters' of the sycamore. According to Gierl, Bulut, Guo, & Zhang (2017) a distractor such as this one is key to the design of a multiple-choice question because this option is similar to another option and plausible. One of the key skills of the scientist is being able to closely observe phenomena and this skill had not been exercised by the students when they looked at the picture of the ash keys which superficially resemble sycamore 'helicopters'. The nature table (See 5.5.1.8) enabled pupils not alone to use this skill of inquiry effectively but also (if used correctly) the basic scientific skills of analysis, inference and argument as discussed by Tomkins and Tunnicliffe (2007). Most of the students (87%) reported that they had encountered a nature table in their classrooms, but the question must be asked: Was it used effectively for teaching and learning and was it used on a seasonal basis?

Perhaps an effective nature table would have engaged students in close observation of autumn fruits and outdoor walks would have accomplished this objective as well. As reported in 5.5.1.3, the ITE students did not participate in nature walks often so they did not have an opportunity in the main to distinguish between the fruits of common trees on the school grounds and use the basic scientific skills of inquiry, analysis, inference and argument.

5.7.2 Sub-category 3(c): Discussion of ITE students' knowledge of plants other than trees.

Presently 21% of the world's plants are under threat of extinction. (State of the World's Plants, 2016). This fact is a cause of concern because plants provide us with food, shelter, medicines, materials, biodiversity of species, alleviation of climate change conditions and enhance the environments we live in. It is therefore important that students know about and understand the importance of the plants in their environment. The dandelion is the most recognisable of Irish wild flowers and almost all the students (94%) identified it correctly. It is worthy of attention that 39% of the ITE students could not identify the primrose which is the iconic flower of spring. Does this imply that some of them are suffering from plant-blindness? (Wandersee and Schussler, 1999). Devlin (2008) observed that it is difficult to confuse the distinctive primrose with other plants in the wild. In the Heritage Council (2010) survey 83% of adults ($N=1000$) and 61% ($N=598$) of respondents' children identified the primrose correctly.

Of the three items relating to flowers, a few of the students (4%) identified the dandelion, the primrose and the rose-hip correctly. The majority (60%) identified two correctly and less than half (36%) identified one. A few (3%) were unable to identify any of the above. Interestingly, six of the seven students who could not identify any of the flowers grew up in an urban community. Even so, it would be expected that all students would be able to identify a dandelion correctly because it is so common.

Less than half of the students (25%) could indicate that the potato is a root vegetable in the multiple-choice question relating to root vegetables. The majority (53%) opted for the correct answer-parsnip. The distractors in this item are plausible and could easily confuse the students. Hips are very conspicuous on Irish hedgerows in the autumn. Even though rose-hips are extremely common in the autumn, 68% of the students did not know that they are fruits of the rose.

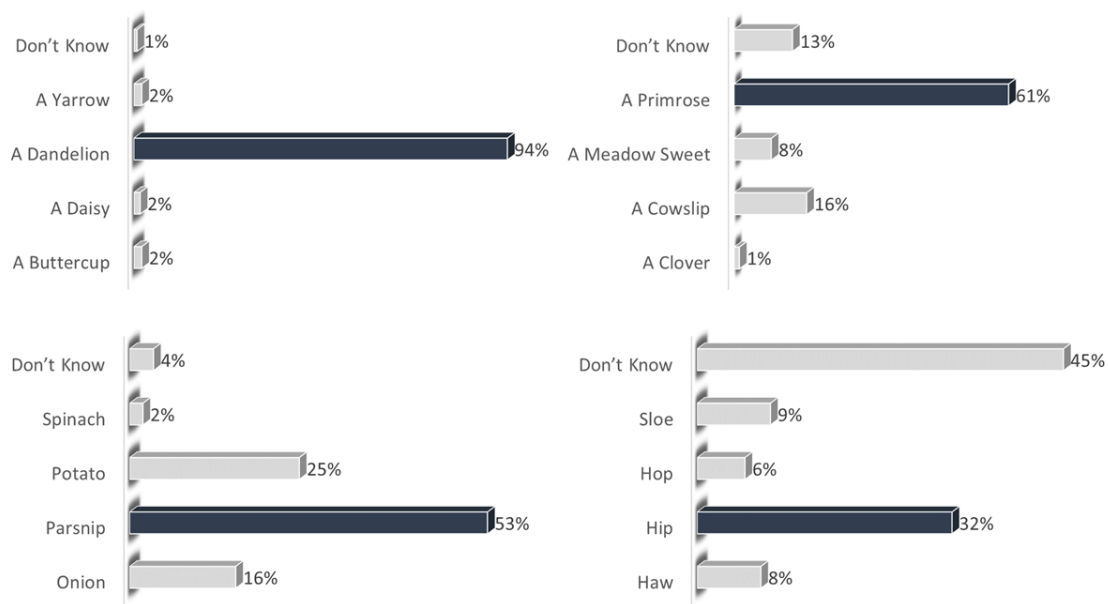


Figure 5.17: Top to Bottom, Left to Right: Identify a dandelion; Identify a primrose; Specify that a parsnip is a root veg; Specify that a hip is a rose-fruit.

The inspectors in *Science in the Primary School* (2012) advocated that a ‘scientific approach’ (p.34) should be undertaken in the study of plant and animal life. This perspective is discussed at length in the literature review where other approaches are examined. Niamh, in 4.5.1, believed that children are knowledgeable about plant science and Harry conjectured that teachers have an excellent knowledge of plant science and also their students because it can be done from a book. The results of item 5, however, does not synchronise with their views entirely because the majority of the students (58%), failed to explain the plant-science behind the synergetic components of nectar and pollination.

Is plant-identification important then? This question has been discussed in Section 4.5.4, Section 5.5.1.4 and Section 5.7 with most of authors in the literature review stating that it is. Whether this is true or not the objectives of the revised curriculum in science (DES, 1999b) clearly state that pupils should be able to *identify* (emphasis added) common plants, trees and animals so therefore they should be able to utilise this skill.

5.7.3 Sub-category 3(d): Students' knowledge of vertebrates.

(a) Vertebrates in general

(Item 12: **Name the 5 main vertebrate classes (animals with backbones).**)

The majority of the students (54%) were unable to provide an answer to the knowledge that was sought in the item and a small number (6%) were aware that fish, amphibians, reptiles, birds and mammals are vertebrates. This item was included in the questionnaire as an introduction to the section on vertebrates.

Table 5.5

Name the Five Vertebrate Species (Item 12)

No. of students who could name:	Percentage of Students ($N = 253$)
None	54%
One	9%
Two	11%
Three	10%
Four	11%
Five	6%

The PCSP²²(Primary Curriculum Support Programme) in its list of recommended and useful books for science teaching listed G.A. Peacock's, *Teaching Science in Primary School* first from a list of 12. Page 61 deals with classifying vertebrates and goes into detail on the characteristics of the five vertebrate groups. This book is also on some Colleges of Education reading lists, so it would be expected that ITE student would be familiar with this basic classification of species.

²² The PCSP mediates the Primary School Curriculum for teachers in order to enable them to implement it in their schools. <http://ppds.pdst.ie/pcsparchive/>

In the DES (1999b) syllabus for 5th and 6th classes it states an objective ‘*The child should be enabled to become familiar with the characteristics of some major groups of living things mammals, insects, arachnids, amphibians, fish, birds, reptiles* (p. 84, emphasis in the original). Item 12 in Table 5.5 on classification of species is discussed further in Section 5.4.10 below.

(a) Mammals

Results from Item 19 demonstrated that a small number of the students (19%) could differentiate a fish (shark) from a mammal (porpoise, whale, dolphin). The majority, (59%), believed that the porpoise was not a mammal. Identification of mammals was better but less than half the students (48%) could identify the smallest mammal in Ireland-the pygmy shrew.

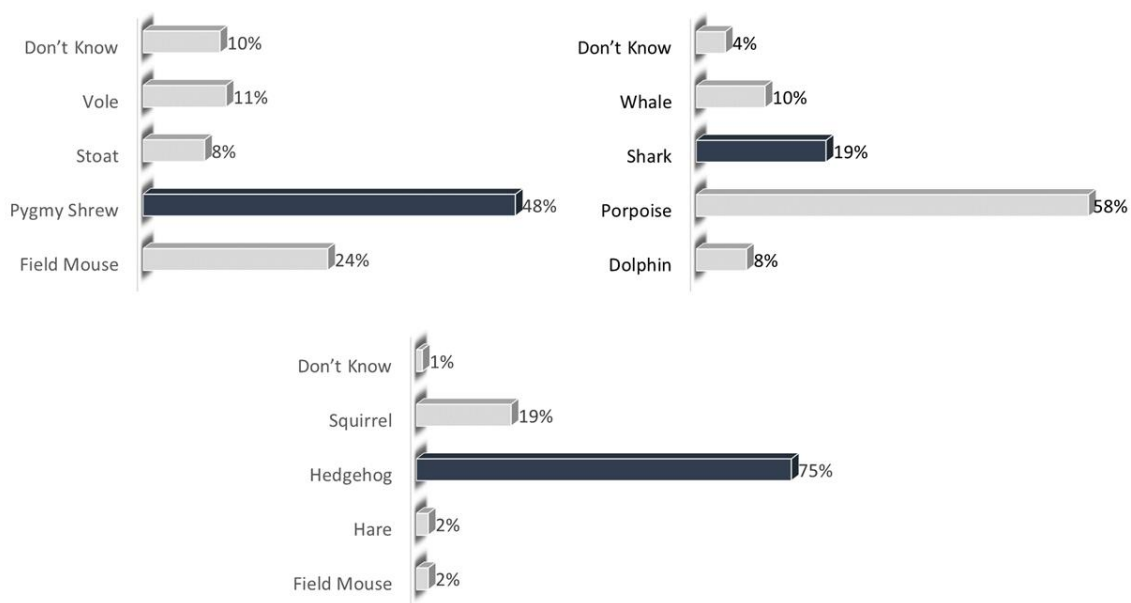


Figure 5.18: Top to Bottom, Left to Right: Identify a pygmy shrew; Indicate that a shark is not a mammal; Indicate that hedgehogs hibernate.

Item 20- [**Indicate that hedgehogs hibernate**]- is based on one of the objectives of the DES (1999b) curriculum: ‘*the child should be enabled to group and sort living things into sets according to certain characteristics hibernation migration...*’ (p.42, emphasis in original). Most of the students (75%) chose the correct response.

Nonetheless, a small number of them (19%) believed that squirrels hibernate. This misinformation corresponds with Niamh's response in Section 4.4.1, relating to children's knowledge of nature. In all the classes that she visited the children informed her that squirrels hibernated, and she conjectured that this misinformation came from the teachers themselves. If so, who or what is the provenance of this misinformation which they received? Perhaps it emanates from the U.S., a country in which *ground squirrels* (chipmunks, marmots and prairie dogs), hibernate. Or perhaps it comes from the textbooks? This is an entry in the Switch on Science First Class textbook for instance which is used in Irish schools: 'Some animals, such as squirrels and badgers, are *partial hibernators...*' (Emphasis added) (Murphy and Jeffrey, 2002, p. 14).

(b) Amphibians and reptiles.

Students were required to outline *two differences* between amphibians and reptiles. As with classification of mammals, students demonstrated limited ability in the classification of amphibians and reptiles and most (82%) scored zero because they failed to outline any differences between these vertebrates. A few (2%) were able to outline the two characteristics as required which differentiate them and a small number (16%) outlined one difference. The objectives of the 6th class syllabus of the revised curriculum (DES, 1999b) clearly state: The child should be enabled to become familiar with the characteristics of some major groups of living things *mammals, insects, arachnids, amphibians, fish, birds, reptiles* (emphasis in original).

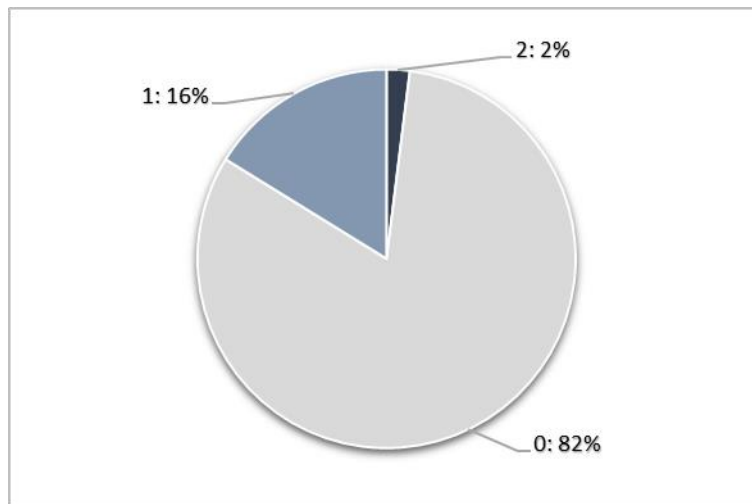


Figure 5.19: Specify two characteristics which distinguish amphibians from reptiles.

In Item 36, the students were asked to specify the reptile that is found living in the wild in Ireland. It was believed by the majority of the students (51%) that the frog (which is an amphibian and not a reptile) was the only *native reptile* found in Ireland. Most (78%) did not know the correct response -common lizard. Fewer than half (41%) made no attempt to answer this question. The findings in 5.7.7 below corroborate these findings relating to students' limited knowledge of amphibians: only a small number (19%) could explain why a meadow with its tall grass for shelter and damp conditions at ground-level is a suitable habitat for them.

(c) Birds.

In Items 24 and 26 students were asked to identify a magpie from a list of crows and to identify a chaffinch from a list of birds. Most identified a magpie but only a small number (14%) could identify the chaffinch.

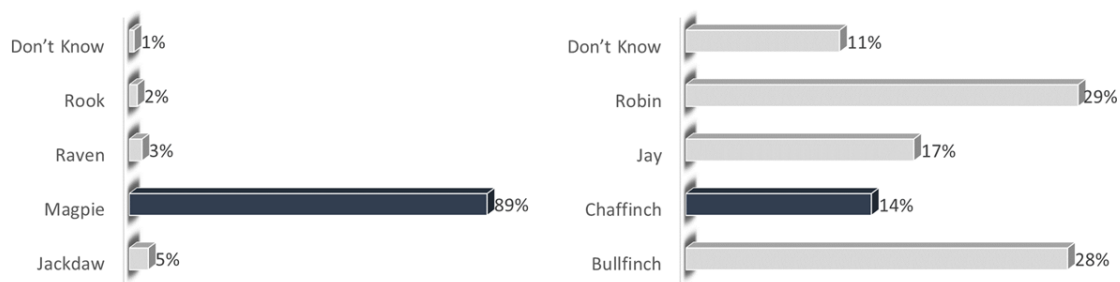


Figure 5.20: Left to Right: Identify a Magpie; Identify a Chaffinch.

The magpie is one of the top twenty most widespread of Irish garden birds. In Ireland's Birds (2017) this bird is described as very easy to differentiate from other birds because of its bold markings. As with Items 8 and 14, this item was inserted as a confidence builder in the multiple-choice questionnaire. Therefore, almost all of the students (90%) succeeded in providing a correct response to this item

Nonetheless, on the same website www.birdwatchireland.ie the chaffinch is also described as one of the top twenty most widespread garden birds. For instance, in a nationwide survey of garden birds in 2015/16 the chaffinch ranked fourth for sightings and its presence was reported in 95.3% of gardens (O' Sullivan, 2016). A small number (14%) could identify this common bird. Fewer than half of the students (29%) confused this bird with the robin. This confusion demonstrates a superficial observance of these birds in their localities because the only slight resemblance between a robin and a chaffinch is the orange splash on the breasts of both. If students had been shown how to study a bird by closely observing the colours of the crown, cheeks, rump, feathers, tail and breast they may have had less difficulty with this item.

Later, in the questionnaire, students demonstrated limited knowledge of the feeding requirements of one common bird and one family of birds i.e., the finch family. In answer to item 37, [**Explain why a meadow is a useful habitat for brown butterflies, amphibians and finches**] two students stated that a meadow was a useful habitat for finches because it provided access to seed. Fewer than half of the students (42%) made no attempt to answer this section of the questionnaire.

In answer to item 25 [**Name 3 birds which migrate to Ireland annually**] a small number, 23%, made no attempt to provide a response. Less than half (46%) could name any of relevance and a few (2%) provided a full response to the item. Eighteen-percent believed that the sparrow was one of these migrants; a small number (16%) believed the robin was one; two students believed that pelicans migrated to Ireland and one believed the

flamingo did. No student mentioned the corncrake, the one migratory bird that has declined severely and is being monitored annually. Three students mentioned the most iconic of all migratory birds-the cuckoo.

The topic of migration first appears in the syllabus for 1st and 2nd classes. It is not mentioned in the 3rd and 4th class and the 5th and 6th class syllabi even though the notion of a spiral curriculum is promulgated throughout the new revised curriculum.

The HS experts varied in their opinions on teachers' knowledge of birds. Two believed bird-knowledge was their best level of knowledge on nature; one was of the opinion that it was fair, and one thought it was poor. Regarding children's knowledge of birds three believed it was poor, one believed it was good and one very good. A study by Huxham, Welsh, Berry & Templeton (2006) of 348 Scottish children aged 4-12 also found that their knowledge of birds was weak with only 19% being able to identify a sparrow and 10% a chaffinch.

This low number of children who could identify the chaffinch (10%) is similar to the ITE students' inability to identify this bird from a picture. There could be varied reasons for the students' lack of awareness of this common bird: lack of familiarity with the wildlife on the school grounds; lack of outdoor engagement with nature; lack of bird-feeders on the school grounds; lack of engagement with birds in general.

5.7.4 Sub-category 3(e): Students' knowledge of invertebrates.

Figure 5.25 demonstrates that the students had considerable difficulty classifying the invertebrates, snails and woodlice. Most (87%) were unable to classify snails, slugs, octopi and mussels as molluscs and woodlice, shrimps, lobsters and crabs as crustaceans.

Figure 5.25 also demonstrates (a) limited knowledge relating to the reason ladybirds hibernate and (b) limited knowledge of their only food-source, aphids. Almost all (99%) were unable to correlate that absence of their only food-source, aphids, caused them to hibernate. They exhibited difficulties too with classifying a spider as a distinct species from an insect. The majority (65%) were unable to explain why a spider is not an insect.

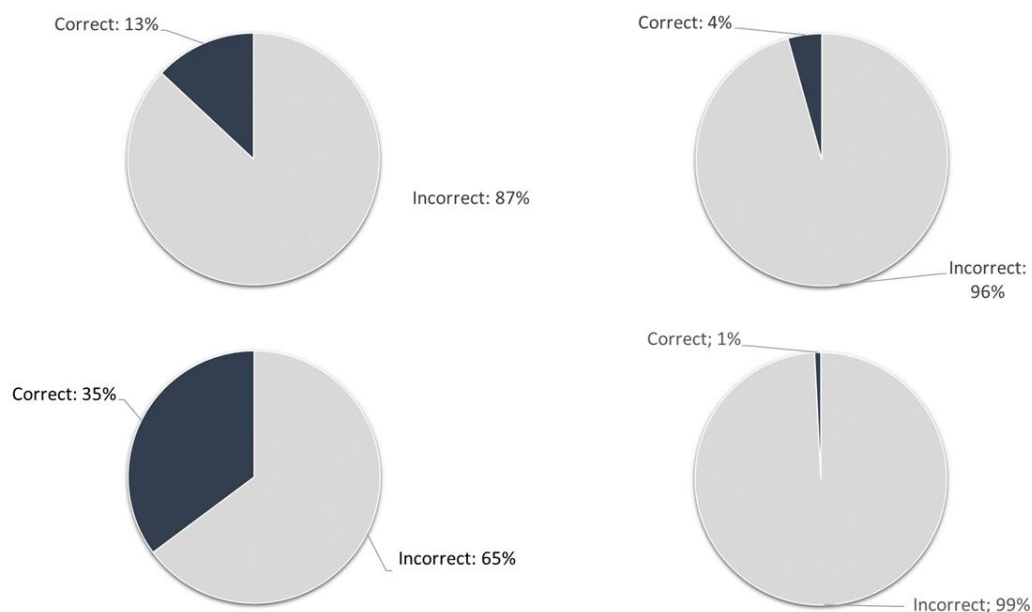


Figure 5.21: Left to Right, Top to Bottom: Classify crustaceans; Classify molluscs; Explain why a spider is not an insect; Explain why ladybirds hibernate.

Huxham et al. (2006) found that among Scottish children aged 4-12, their knowledge of mammals was much better than their knowledge of birds and arthropods and that they had limited knowledge of some common native species like sparrows and earwigs. This finding was mirrored by Varley et al. (2008) in an Irish context when they reported that pupils' most positive attitudes related to learning about world-wide animals and their most negative attitudes related to learning about insects and mini-beasts.

The findings from the interviews with HS experts in Chapter 4 synchronise to some extent those of Varley et al. (2008). One of the experts believed that children's knowledge of mini-beasts was good but two believed children were weak in their knowledge of

invertebrates; another expert believed that they were fair to weak and two offered no opinion.

Students' knowledge of the food sources of invertebrates is limited as discussed below in the section on food-chains (5.5.7). However, of all invertebrate species, their knowledge of butterflies was the most limited. A few (4%) could identify the small tortoiseshell butterfly which is very common in Ireland (Regan et al, 2010). The same number could identify the peacock butterfly which is also widespread and very distinctive (Butterflies of Ireland, 2017). Almost all of the students were unable to specify that the peacock butterfly uses the nettle as a larval food-plant.

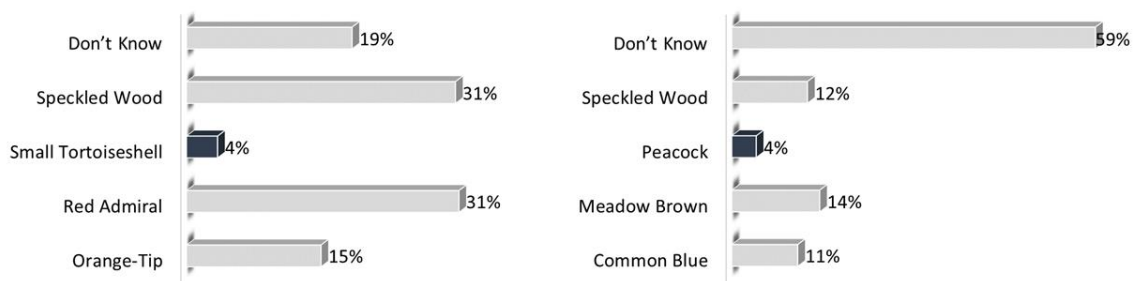


Figure 5.22: Left and Right: Identify a small tortoiseshell butterfly; Identify a peacock butterfly.

Regan et al. (2010) in a comprehensive survey of Irish butterflies found that the small tortoiseshell and peacock were plentiful in Ireland. Harry, in 4.5.1, confirmed the lack of knowledge of the ITE students on basic species of butterfly when he stated that 6th class children could not identify the different species of butterfly.

This lack of knowledge on butterflies is manifested in the identification of their larval food-plants in (Section 5.7.7) below. The students were asked to explain why a meadow was suitable for brown butterflies and no student was able to demonstrate that brown butterflies in Ireland use meadow-grasses as their larval food-plants.

Butterflies are on the decline world-wide due mainly to loss of habitat, over-use of pesticides and climate change so it is important that children are made aware of their larval food-plants. Indeed, the above situation would suggest that introducing a conservation

element into the teaching and learning of butterflies should be a priority. Interestingly, this researcher has not seen a science textbook for primary schools where larval food-plants of butterflies are discussed in some detail and because the majority of the students (52%) stated that their teachers mainly used textbooks to teach the nature aspect of the programme perhaps the poor results from the students are indicative of this. Furthermore, the guidelines in the science syllabi for 3rd/4th and 5th/6th classes (DES, 1999d), are vague on relationships between animals and plants and lack specificity relating to the larval food-plants of butterflies. Fifth/Sixth Classes: '*The child should be enabled to identify the interrelationships and interdependence between plants and animals in local and other habitats*' (p.84, emphasis in original).

The one student who provided the correct answer to both questions 33 and 34 was a female in the 17-19 age-group from an urban community in Dublin. A parent/guardian was her main source of knowledge about nature. Her overall mark was 51%.; most of students (87%) fell short of this mark. This finding seems to indicate that family influence, frequent outdoor engagement with nature and the use of actual specimens as a teaching resource can be powerful influences on a child's knowledge of nature.

It can be discerned from Figure 5.24 below, that students demonstrated limited knowledge of a ladybird's food source. This finding links in with findings on food-chains in 5.7.6 below. The item relating to the reason why ladybirds hibernate produced some interesting responses such as: 'to protect their spots'; 'to recharge their batteries'; 'to reproduce'; 'to develop a new shell'; 'they need sun'; 'because they are tired'.

5.7.5 Sub-category 3(f): Students' knowledge of rocks and soil

Two of the HS experts believed that teachers' knowledge of rocks was low, and one felt that children would be unable to identify rocks. In the nature-knowledge questionnaire a small number of students (23%) did not know that limestone is the commonest rock in Ireland. The majority of the students (52%) could not provide two reasons why earthworms are beneficial to the soil. A small number (10%) did not attempt a response.

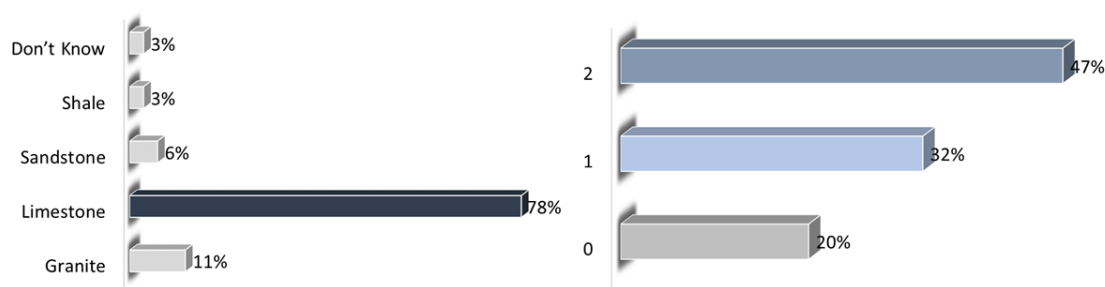


Figure 5.23: Left to Right: Specify that limestone is Ireland's commonest rock; Identify two beneficial effects of earthworms on soil.

The objectives of the 5th/6th class syllabus in the revised curriculum (DES, 1999b) state: *'the child should be enabled to (emphasis in the original) collect and identify some common rocks in the locality; learn about the characteristics of some common rock types and where they may be found in Ireland and in other parts of the world'* (p.80). No assessment has been made to date of the implementation of the Geography curriculum in schools as has been done with science. (This raises questions about its perceived status in the new revised curriculum). It would have been interesting to compare children's knowledge of rocks with the students' knowledge of them.

Waller (2017) reported that teachers often referred to the subject matter of rocks as teachers' least favourite topic. To bring inspiration to this topic she suggested that one way to do this was for teachers to use fossils and engage the children in making them.

Noteworthy, however, is the fact that the word 'fossils' is mentioned once in the revised new curriculum (DES, 1999b, p.113) so as a result, teachers are probably not provided with an incentive to teach about them.

The PDST (Professional Development Service for Teachers), support material on the topic of rocks and soils could be much broader. In their website, www.pdst.ie the support material is very limited. There is no link provided to the material and geological map in www.geoschol.com, a website which is totally dedicated to the study of rocks in schools. In the section on soils there is no mention of using soil to grow plants or of loamy soil, the best soil for growing those same plants. There is no mention either of investigating air, minerals or earthworms in soil or the usefulness of brandling worms in compost.

5.7.6 Sub-category 3(g): Students' knowledge of food-chains.

The inspectors in *Science in the Primary School* report (2012) stated that 'The concepts of the habitat and the food chain/web and the ability to use and make identification keys are central to the study of plant and animal life' (p.41). Item 21 sought to ascertain students' knowledge of the following food chain:

Sun → Leaf → Aphid → Wasp.

Item 21. Wasps have constructed a nest in the hedge near a gardener's rose garden.

Should the gardener be



(a) Pleased (b) Displeased

Please give a reason for your answer.

To be scored correctly the students had to choose option (a) and state that wasps capture and kill aphids to feed the grubs in the nest thus benefitting the rose-keeper's husbandry of the roses. The majority (55%) were credited with the correct answer and less than half (45%) were not. This accreditation should be explained. Only one student provided the correct answer that was being sought-wasps are beneficial to the rose-gardener because they prey on aphids that attack roses. The rest who were credited with the

correct answer stated that the wasp acts as a pollinator which strictly speaking is of no benefit to the rose gardener.

In Item 27, students were asked to complete a five-part food-chain beginning with ‘sun’, ‘leaf’, ‘snail’. Less than half of the students (31%) were acknowledged with the correct construction. This accreditation should be explained. Of these students a few (12%) completed the chain with ‘bird’ and ‘cat’ and a few (13%) completed it with ‘bird’ and ‘fox’. The use of the word ‘bird’ is strictly not correct, and the student could be referring to a robin, sparrow etc. The correct bird to offer was the *thrush* who has a unique method of cracking open snail shells by dropping them onto an anvil stone.

Table 5.6

Construct a Five-Part Food-Chain (N = 253)

Answers	% of Students
% of students who could construct the chain adding two elements such as thrush and sparrow hawk.	31%
% of students who could construct the chain using one element such as thrush.	9%
% of students who could not construct the chain.	61%

Some of the answers offered demonstrated little acquaintance with the concept of the food chain. Here are examples: fox eats bear; rat eats hawk; slug eats worm; worm eats butterfly; mouse eats cat; woodlouse eats spider; swallow eats fox; fly eats grass; crow eats human; bird eats lion; mouse eats fox; cow eats human; millipede eats rosebush; humus eats insects. A few (9%), made no attempt to respond to this item.

Item 32, from Peacock (2002, p.71) is a pond food-chain, the only type discussed in NCCA (1999d). **Place the following into a 7-part food chain: heron, diving beetle, algae, sun, pike, tadpole and roach (fish).** _____, _____, _____, _____, _____, _____.

A small number (23%) managed to construct the chain; most (77%) were unable to do so.

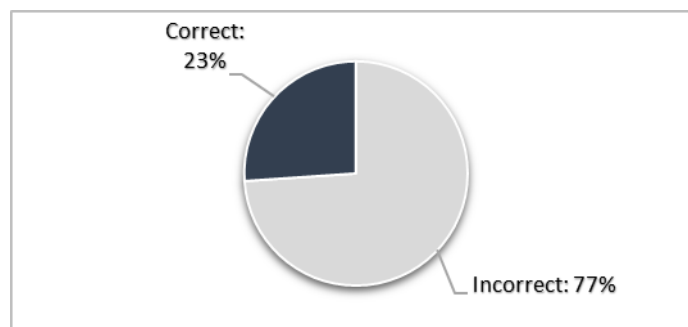


Figure 5.24: Construct a seven-part food-chain.

Item 35 required the students to construct a seven-part food-chain beginning with sun, leaf, aphid. Very few of the students (1%) provided the correct response; nearly a quarter of them did not attempt a response.

Table 5.7

Construct a Seven-Part Food-Chain Beginning with Sun, Leaf, Aphid (Greenfly)

Answers	Percentage of correct answers ($N=253$)
Percentage who got 0 correct	71%
Percentage who got 1 correct	23%
Percentage who got 2 correct	4%
Percentage who got 3 correct	1%
Percentage who got 4 correct	0.4%

These results corroborate with those from item 28: **why do ladybirds hibernate in winter?** (discussed in Section 5.4.5 above). Students needed to know that the ladybirds' food-aphids- die over the winter and so because the ladybirds have no food source, they hibernate.

The inspectors in primary schools considered that the study of food-chains was central to the study of plant and animal life (*Science in the Primary School*, (2012). This belief was echoed by Tunnicliffe (2006):

As a biologist, my concern is the ability of people to recognise the organisms, identify their needs and their interdependence on each other and their habitat. As an

educator, the challenge is to help learners understand the living world and its interrelationships (p.99).

One short section (80 words, p.75) in the DES (1999c) *Primary Science Teacher Guidelines* is devoted to this important concept and in this section only pond food-chains are mentioned. The concept of food-chains does not appear in the science syllabus until children reach 3rd class. It is such an important concept that perhaps it should appear in the syllabus for infants as it does in the *National Curriculum of England* (2013) for year one and two: ‘describe how animals obtain their food from plants and other animals, using the idea of a simple food chain’ (p.10).

5.7.7 Sub-category 3(h): Students’ knowledge of habitats.

Item 14, **which of these habitats is suitable for a woodlouse?** was a confidence builder inserted at the beginning of the animals’ section to inject confidence into the students’ efforts at nearly the half-way stage. Almost all the students (96%) registered the correct answer, **‘rotting wood’**. Even if they did not know the correct answer, the associative dimensions of ‘wood’ and ‘rotting logs’ provided a viable option for those students who did not know the answer.

Item 37 required the students to explain why a meadow is a useful habitat for the following animals: brown butterflies, amphibians, and finches. The answer to this item, however, could not be arrived at as easily as item 14 above because to have answered it correctly students would have needed to know:

1. That brown butterflies use meadow grasses as larval plants.
2. The base of a meadow is damp because of lack of sunlight and is one reason for its suitability for amphibians. It also provides shelter and camouflage and food in the form of invertebrates for these creatures.

3. Meadows are habitats where grasses mature and form seeds. The finch has a short, cone-shaped beak suitable for cracking seeds and therefore the meadow is a suitable habitat for this bird.

From analysing the students' answers, it seems that they have limited knowledge of this habitat. Incorrect answers were provided by most of the students (79%) and no student succeeded in achieving full marks. Less than half of them (29%) did not attempt this item. Less than half the students (46%) did not attempt the amphibian section; less than half (42%) did not attempt the finch section either; (Two students provided the correct response); less than half (39%) did not attempt the butterfly section.

Five students were granted correct responses to the latter section because even though they did not specify that brown butterflies use meadow grasses as larval food-plants, they did specify that they found nectar in the meadow. As outlined in 5.7.7, where 4% of students identified the nettle as the larval food-plant of the peacock butterfly, it would seem that students have limited knowledge of the larval food-plants of butterflies, so they could not explain why a meadow is suitable for brown butterflies. Seven species of Irish butterfly rely on meadow grasses for their larval food. Knowing that meadow grasses and nettles are food-plants for at least 11 Irish butterflies is important for conservation purposes.

Table 5.8

Explaining the Usefulness of a Meadow Habitat for Brown Butterflies, Amphibians, Finches

Answers	Percentage of correct answers (<i>N</i> =253)
Incorrect explanation	79%
Correctly explained for one of the species	19%
Correctly explained for two of the species	1%
Correctly explained for three of the species	0%

5.7.8 Sub-category 3(i) Students' knowledge of adaptation of species.

Item 38 in the questionnaire to ITE students read: **A giraffe is adapted to its environment by having a long neck to reach for leaves high up in a tree. It also has colourings that help to camouflage its presence. Name 2 ways in which any 4 of the following animals are adapted to their environment.**

Camel _____

Whale _____

Duck _____

Eagle _____

Polar bear _____

Bat _____

Students received one mark for each correct statement relating to how an animal is adapted to its environment. A few (4%) received zero marks. A few (2%) received one mark, a few more received two marks (4%) and a few (6%) received three marks. A small number (17%) scored maximum marks and an even smaller number (11%) scored seven marks. Less than half (30%) scored four marks.

Table 5.9

Name two ways Certain Animals are Adapted to Their Environment

Marks relating to naming 2 ways 4 animals are adapted to their environment	Students' Responses (N=253)
0 marks	4%
1 mark (minimum)	2%
2 marks	4%
3 marks	6%
4 marks	30%
5 marks	13%
6 marks	14%
7 marks	11%
8 marks (maximum)	17%

This item was found in the report *Science in the Primary School* (2012, p.34). The inspectors found that just over a quarter of the primary school children who were given this

task completed it in a correct manner. They felt that this was inadequate because they recommended a renewed focus on the strand unit, Plant and Animal life, in the revised curriculum (DES, 1999d).

They did not specify the number of students in third and fourth classes who were assessed in the above task, so it is difficult to compare this result satisfactorily with the students in initial teacher education. It is of interest to note, however, that only a small number of these students (17%) completed the task fully.

5.7.9 Sub-category 3(j): Students' knowledge of classification of species

As can be seen from Table 5.5 above, students displayed significant difficulties naming the five categories of vertebrate. (The majority of them (54%), could not name any; most (82%) could not identify any similarities or differences between a reptile and an amphibian).

Section 5.7.4 deals with the topic of invertebrates. Similar to the task relating to classification of vertebrates, students exhibited considerable difficulties classifying crustaceans. Most (87%) could not and almost all (96%) could not classify molluscs. The majority (65%) could not specify why a spider is not an insect.

In Item 23 students were asked this question: **True or false? A common fly, a worm, a spider and a boy are animals.** The students were given two options to the question relating to whether a common fly, a worm, a spider and a boy were animals. Half of them (50%) stated that the statement was true, and half stated that it was false. A few (1%) did not know whether it was true or false.

It seems that the students had difficulties classifying the common fly, the worm, the spider and a boy as animals. Murphy and Smith (2012) found that in their initial questionnaire to 2nd year student teachers ($N=333$) less than half (35%) considered that a spider was an animal and that a fly was an animal (34%). The majority (56%) considered that a human being was an animal (mean=41.8%). In an exit questionnaire, the majority

(62%) stated that a spider was an animal, and the majority (61%) that a fly was an animal. The majority (73%) considered that a human being was an animal. The second set of results demonstrated that the input in the College of Education on the strand, Living Things had some effect regarding their knowledge acquisition of classification of species. This is encouraging and demonstrates that if ITE students in this College of Education had limited conceptual knowledge of animal-classification in the early years of their ITE, this knowledge would be enhanced before they left.

Rice (2005), lamenting the fact that few connections are made in elementary science teaching, made somewhat similar findings from examining elementary science methods graduate and undergraduate students' responses to whether students classified a human, a dog, a worm and a spider as animals. Most of Rice's students (71%) responded that a human was an animal; almost all (99%) responded that a dog was an animal; less than half (30%) responded that a spider was an animal. Overall, a small number (23%) responded that all four were animals.

Table 5.10

Mean score for responses to Rice's Question on the Classification of Four Species as Animals (N=481)

	Human	Dog	Worm	Spider	All Four
Percentages who classified each species as an animal.	78.8%	99.1%	34.2%	30.3%	22.6%

In the DES (1999b) *Primary Science Curriculum* the science skill of analysing, subdivided into the sub-skills of sorting and classifying, is one of the key skills emphasised for all classes. In the DES (1999c) *Primary Science Guidelines*, Exemplar 15, which provides background information for the teacher on the classifying and identifying of living things of the science curriculum, there is no mention of these five groups of vertebrates (mammals, fish, amphibians, birds, reptiles) and the six basic groups of invertebrates (molluscs, annelids, insects, arachnids, crustaceans and myriapods). However, they are

covered in detail by Peacock (2002) in one of the basic science texts for primary schools, *Teaching Science in Primary Schools*.

Tunncliffe (2006) believed that the branch of science that deals with taxonomy is neglected somewhat and stated: ‘We need to be able to catalogue and understand organisms which exist, and which have existed. We need to introduce learners to ‘grouping’ and help them develop an overall understanding of classification’. (p.100)

Peacock (2002) writing about common misconceptions in science stated that ‘About 4% of primary teachers and about 10% of teacher trainees are reported as having the same problem’ (p.56) i.e. they do not think spiders and worms are animals. Unfortunately, we do not know how many teachers or trainee teachers were questioned. Nevertheless, taking into consideration the statistics from Peacock (2002), Rice (2005), and Murphy and Smith (2012) the misconceptions relating to the classification of animals demonstrated by the students in this study is discouraging. The findings show that students’ demonstrated limited ability to classify common species. The question must be asked: How adequate is the teaching of this skill in the revised curriculum? This skill is promoted in every strand unit from infants to sixth in the Plant and Animal strand unit. (DES, 1999b)

5.7.10 Summary:

- Overall, the responses from the students displayed limited knowledge about nature in general as a summary of the findings demonstrate.
- A few (up to 14%) could identify a rowan leaf, a small tortoiseshell butterfly, a chaffinch, name three birds which migrate, explain why ladybirds hibernate, classify molluscs and crustaceans and the five species of vertebrates, differentiate two differences between amphibians and reptiles, indicate that nettles are the larval food-plants of peacock butterflies and that wasps kill aphids, construct a 7-part food-chain from jumbled parts, name two ways four common animals are adapted

to their environment, and clarify why meadows are important for brown butterflies, finches and amphibians.

- A small number of students (15%-24%) could identify the fruit of a beech and an ash bud, construct a pond food-chain, and indicate that porpoises, dolphins and whales are mammals.
- Less than half (25%-49%) could state that the hip is the fruit of the rose, explain why flowering plants produce nectar, that the spider is not an insect, that earthworms are beneficial to the soil in two ways, identify a pygmy shrew, and add two elements to a five-part food-chain.
- The majority (50%-74%) could identify an oak leaf and a primrose, state that the parsnip is a root vegetable, that the wasp is a beneficial insect in the garden, that the millipede is an herbivore and that the fly, worm, spider and boy are animals.
- Most (75%-90%) could identify a magpie, indicate that hedgehogs hibernate, and that the leaf produces food for the tree using the sun's energy.
- Almost all (>90%) could identify a dandelion, and state that woodlice favour rotting logs as their habitat.

5.8 Trends in Mathematics and Science Study (TIMSS) and Conclusion

There are no national assessments of primary science in Ireland, so no comparisons can be made with these results from the ITE students. However, results can be compared with international assessments of science, particularly the science relating to plants and animals? Trends in Mathematics and Science Study (TIMSS) takes place every four years and students' achievement in mathematics and science are assessed in fourth grade (4th class in Ireland) and/or eighth grade (2nd year in Ireland). TIMSS was initiated in 1995. 4th class Irish students participated in the assessment that year and also in 2011 and 2015. (Murphy, 2013). Three content domains were assessed in science in 2011: Life Science,

Physical Science and Earth Science. The parts of Life Science which are of interest to this research are plant and animal life; the parts of Earth Science which are of interest are rocks, soil and weather and environmental awareness and care.

Overall in science, Irish students performed well, achieving a national score of 516 which was 'significantly higher than the scale centrepoin't (Murphy, 2013, p.181). However, students achieved similar scores in 1995 when the 1971 curriculum was in situ (Curaclam na Bunscoile, 1971). (The science aspects of this curriculum were predominantly geared towards the natural sciences with minimal input on the physical science). The fact that there was no significant change in pupils' scores and that there was a drop in those reaching the advanced benchmark is surprising because in 2011 the revised 1999 curriculum in science was in operation for eight years.

Martin, Mullis, Foy and Stanco (2013) reported on the results of the TIMSS 2011 study. In the Life Science domain in which 45% of the assessment items were placed Irish students received a mean score of 513 with 26 countries out of 50 scoring higher and well below the three countries with the best scores-Singapore (597), Finland (574) and Republic of Korea (571). (The TIMSS international mean is 500). In contrast, Ireland's nearest neighbour, Northern Ireland received a mean score of 519 in this domain and England scored significantly better with a mean score of 530. So, in this science domain Irish 4th class pupils were above average but well behind the scores achieved by similar pupils in England. (It should be noted that pupils in England received 76 hours of science instruction annually, Northern Ireland 72 and Ireland 63. Thirty-four countries received more instructional time than Ireland)

At the advanced benchmark on the item relating to plant structure and function, 10% of Irish pupils were successful in comparison to 1/3 of pupils in Singapore, 29% in Korea and 20% in Finland. The international average was 21%. Thirty-seven countries scored above Ireland's score which was significantly below the international average. At the

second benchmark the average score was 58% and Irish pupils scored this figure with 31 countries scoring above them. Of the 22 items relating to Life Science Irish students scored significantly above the international average on eight items and significantly below average on five items. These latter items related to migration, plant science, classification of vertebrates and living/non-living things in a pond.

In TIMSS 2015, Irish 4th class pupils achieved a mean score of 529 which was significantly above that of 2011 (516). Fifteen countries significantly outperformed them however, including England. Irish pupils were significantly better than pupils in Northern Ireland (520). In the Life Science domain Irish pupils scored a mean of 531 which was significantly above that of 2011-(513). Pupils in England scored an average of 536 in this domain which was again above the Irish average. Pupils in Northern Ireland scored an average of 521 which was significantly below that of Irish pupils.

Summing up the overall performance of Irish fourth-class pupils in TIMSS 2015, Clerkin et al stated: 'Overall, therefore, we can say that more fourth-class pupils in Ireland have attained a basic level of scientific understanding than in previous years but there has been little change in percentages of higher performers' (p.29). Time allocation to science in Irish primary schools could be cited as a factor in Irish pupils' not making gains at the higher benchmark levels. Eevers and Chubb (2017) in their assessment of the Irish education system stated that there was a sharp decline from 2011 in the amount of time allocated to science-from 63 hours per week to 32 hours per week. 'For science Ireland was well below average in the amount of time allocated at primary level' (p.20). However, there was no drop in the hours allocated; the hours given for 2011 related to Life Science, Physical Science and *Earth Science*. The latter is incorporated in the geography curriculum which also receives 32 hour a week. Earth science was also tested in 2015 so the hours for geography should have been considered.

It should be noted, however, that the items in TIMSS are generic in content and not specific to any country so they do not assess the state of nature awareness, appreciation and education in the context of any particular country. In contrast, the nature-knowledge questionnaire which was administered to the ITE students assessed plant and animal identification skills, hibernation, migration, conservation, food-chains and specific larval food plants and habitats such as the meadow and rotting logs which are all relevant to Ireland and neighbouring countries like Northern Ireland and England. Neither, does TIMSS assess the status of Life Science in the countries assessed.

Taking everything into consideration then, it seems that the concept of food-chains, classification of species, knowledge of habitats, identification of birds, butterflies, trees and fruits, migration, hibernation and conservation need to be seriously addressed not only in the Irish primary school curriculum but also in the secondary system.

The question is: Do teachers have the knowledge, the opportunity and the commitment to engage their students more with nature in an overcrowded curriculum? Tunnicliffe and Ueckert (2007) referring on the one hand to test-centred curricula imposed on teachers by political interests and on the other hand to how these ubiquitous tests militate against engagement of students with the natural world, suggested that the balance is weighted heavily towards the testing and teachers should challenge this imbalance.

The Irish primary curriculum has not had to cope with an over emphasis on testing yet, but this may change in the future. Nonetheless, a different balance effect prevails in this curriculum. Chapter two discusses the fact that the literature seems to demonstrate that physical science has dominated the primary science curriculum since 1999 and that nature has been relegated to a lesser status. Perhaps if this imbalance were addressed by the NCCA in planning the next curriculum, knowledge of and connection to nature would attain a healthier position than it is in at present.

Chapter 6: Findings, Analysis and Discussion on the State and Status of Nature Awareness, Appreciation and Education Examined Through the Lens of Practising Primary Teachers in Primary Schools

Come forth into the light of things, /Let Nature be your teacher.

(Wordsworth, 1798).

6.1 Introduction

As outlined in Chapter 3, 510 primary teachers 137 schools in Ireland were targeted because they worked in either large (>200), medium (>100<200), small (<100) or DEIS schools. They were requested to fill in an online questionnaire on the phenomenon, nature in the primary school system. Part 1 of the questionnaire asked for details about their school; Part 2 asked questions about their own experiences of learning about nature in the primary school they attended as children; Part 3 asked questions about their experience of learning about nature in ITE; Part 4 asked questions about their experiences of teaching nature. All in all, the questionnaire sought information to answer the research question: What is the state and status of nature awareness, appreciation and education in the Irish primary school system at present?

6.2 Response to the Questionnaire

The following is a timeline of the correspondence made to schools from Nov. 2016 to Feb. 2017. Nov. 2016: emails to all schools; end of Nov.: 1st deadline; early Dec.: phone calls to schools; mid-Dec.: deadline extended to end of January 2017; mid-Jan. 2017: reminder emails to schools; late Jan.: reminder emails sent to schools; early Feb.: deadline extended to Mid-Feb; early March.: schools that did not respond or had signified that they would not respond were replaced in a stratified random sample as outlined in Chap.4 and the deadline extended to early April; mid-March: replacement schools were emailed; end

of March to early April: reminder emails sent to all schools that had not responded. 7th

April: end of fieldwork.

Table 6.1

Final Responses from Teachers (N=510)

Civil Administrative Area	No. of Teachers Targeted	% of responses (Final)
Galway	72	50%
Kildare	50	60%
Waterford	32	41%
Donegal	61	31%
Dublin City Council	135	59%
Dunlaoire & Rathdown	34	29%
Fingal	59	53%
South. Dublin Council	67	27%
Total	510	236 / 46%

Note. After examination of completed questionnaires it was discovered that 17 were invalid because they were resubmitted to the website by teachers who had already submitted. Therefore, the total valid response was **219 / 43%**

Utilising a confidence level of 95%, this response rate allows for a margin of error of 6.59% (Calculate Respondents Sample Size, 2016).

Chap. 3 explains the proportional representation of the schools. For example, Dublin City Council has 111 large schools (>200), 57 medium schools (>100<200), 21 small schools (<100), and 102 DEIS schools. Because 10% of each type of school was targeted for questionnaire distribution the following ratio applied: 10 large: 6 medium: 2 small: 10 DEIS.

To respect the culture of All-Irish schools, correspondence with the principals of these schools was always through the medium of Irish. As schools responded throughout the timeframe of the research, principals were emailed expressing thanks for their school's participation.

Table 6.2 outlines the final response rate from the schools targeted.

Table 6.2

Final Responses from Schools (N=137)

Civil Administrative Area	No. Of Schools Targeted	% of responses (Final)
Galway	29	69%
Kildare	12	100%
Waterford	8	100%
Donegal	26	58%
Dublin City Council	29	86%
Dunlaoire/Rathdown	8	63%
Fingal	12	92%
Sth. Dublin Council	13	62%
Total	137	104 / 76%

The total response rate from teachers was 46% and from schools, 76%. According to Porter (2016) where there is no relationship with respondents prior to the online survey, a response rate of 20% to 30% is considered high. In contrast, Gray (2014) citing the results of a meta-survey of 45 different types of survey stated that a response rate of 6-15% is the average for web surveys. Therefore, the above response rates from teachers and from schools could be considered high. There was a very high response rate in particular, from large schools and from DEIS schools.

6.3 Profile of Respondents

Co-incidentally the demographics of the teacher population surveyed was exactly the same as the students': 84% female and 16% male. These percentages reflect the female: male ratio of the national primary teaching population (87:13, 2016) ratio as discussed in

5.4.2

6.3.1 Age-group of respondents.

Item 2.1 in the questionnaire requested teachers to state when they attended primary school. Figure 6.1 below sums up their age-groups based on responses.

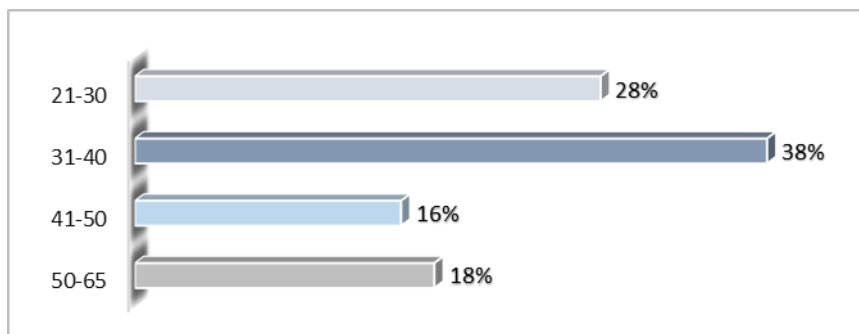


Figure 6.1: Age-groups of teachers who participated in survey (N=219).

When these figures are correlated with the various curricula introduced to primary schools, a few (9%) of these teachers attended primary after the introduction of the new revised curriculum (NCCA, 1999). Most (81%) of them attended primary school when the new curriculum was in operation (Curaclam na Bunscoile, 1971). A few (12%) attended primary school pre-1971. They demonstrate that the teacher sample to a lesser or greater extent had experience of three different primary curricula when they were primary school pupils but very few attended primary after the introduction of the revised curriculum (DES, 1999a).

6.3.2 Teachers' schools.

Table 6.3 provides information on the types of school in which respondents worked and the response rates from the different types of schools. Most of these schools (79%) were urban and a small number (21%) were rural. Most were denominational (79%); a small number were multid denominational (17%)²³; a few (4%) worked in All-Irish

²³ Multidenominational schools included Community National Schools (7%). The latter are new in Irish education. They are multi-faith schools where religion is taught every day as part of the curriculum.

schools²⁴. A small number (24%) were designated as DEIS schools. The majority of schools (69%) were vertical with junior and senior classes; a small number (17%) were junior mixed; a few (6%) were senior mixed; a few too, were junior single-sex (1%) and senior single-sex (6%).

Table 6.3

Percentage of Final Responses from Discrete Schools (n = 104)

Type of School	Percentage of responses
*Large Schools >200	87%
*Medium Schools <200>100	62%
*Small Schools <100	65%
DEIS Schools	83%
All-Irish Schools	60%
Multidenominational Schools	77%
Church of Ireland Schools	63%

Note. 71% of the teachers who responded taught in large schools; 16% in medium schools and 13% taught in small schools.

6.3.3 Summary:

510 primary teachers were targeted to complete the questionnaire. Of these 219 responded which corresponds to a response rate of 45%. 137 primary schools were targeted. These were situated in Donegal, Galway, Waterford, Kildare and in the Dublin City, Dunlaoire/Rathdown, Fingal and South Dublin Council areas. 104 of the schools responded which corresponds to a response rate of 76%. Large schools (>200) and DEIS schools recorded highest response rates. Medium schools (<200>100) recorded lowest response rates. Most of the teachers (81%) attended primary school pre-1999 revised curriculum. Most (38%) were in the 31-40-year age-group.

6.4 Teachers' Experience of Learning About Nature When They Attended Primary School

As outlined in Chapter 2, nature was sporadically taught in primary schools from 1954 until 1971. Possible causes for this sporadic teaching were: (a) nature was not a core

²⁴ 3% of these schools were All-Irish schools outside the Gaeltacht; 1% were within the Gaeltacht.

subject for the primary certificate examination; (b) many teachers in that period had no exposure to nature study themselves when they were primary pupils and (c) because the subject was not examined by inspectors it had a low status within the curriculum. A few of the teachers (12%) in the questionnaire attended primary school pre-1971 and their consequent lack of exposure to nature education is reflected in Item 2.4 in which respondents were asked: 'When you attended primary school did you study nature?' Thirteen per cent recollected studying it either once a term (seldom) or never. Those aged 31-40 (38%) and between 41-50 (16%) all attended primary school when the 1971 curriculum was in operation. This cohort, (54%), which formed the majority of those questioned attended primary school when nature study constituted the core of the science curriculum in the subject area, Environmental Studies (Curaclam na Bunscoile, 1971).

6.4.1 Crosstabulation with students' engagement with nature in primary school.

In Chapter 5.3 it was demonstrated that almost all of the ITE students (94%) attended primary school when the revised curriculum was in situ. In contrast, only a few of the teachers (9%) attended primary school after the introduction of this curriculum. What then was their relative exposure to nature education in the primary school? The hypothesis is this: students had less exposure to nature because nature was embedded in the science syllabus. In contrast, most of the teachers (81%) attended primary school during the period 1971-1999 when the 1971 curriculum was in place.

Table 6.4

Frequency in Which Respondents Recollected Studying Nature as Pupils in Primary School Compared with Frequency in which ITE Students Recollected Studying Nature

Frequency of studying nature	Frequency of response teachers/students (N=219; N=253)	
Very frequently (once a week)	26%	1%
Frequently (once a fortnight)	27%	26%
Sometimes (once a month)	34%	50%
Seldom (once a term)	9%	16%
Never	4%	0%

Note. Analysis of all tables and figures was done using either Excel 16 or SPSS 24. ** Highly significant $p \leq .01$; * Significant $p \leq .05$

A Mann-Whitney U -Test is a nonparametric test that is used to analyse the difference between the medians of data sets for two independent groups to determine if there is a difference in the dependent variable for the two groups. This test was conducted to determine if the amount of time spent studying nature by the teachers was significantly different than that spent by the student-teachers when both groups attended primary school. The U -value was found to be 19258.500; ($z=5.808$); $p = .000$. Therefore, the result is highly significant at $p < .01$ **. Teachers recollected studying nature much more often than the students when both cohorts attended primary school, so they should have more knowledge of nature than the ITE students. It should be noted, however, that some of the teachers had attended primary as much as 40 years' earlier and their recollections may not have been as lucid as the students'.

6.4.2 Outdoor study of nature when teachers were pupils.

The INTO (1996) and Quinn (1996) suggested that there was limited engagement with the outdoors in primary schools. To rectify this lack of exposure of pupils to the outdoor environment, outdoor education was encouraged in the revised curriculum (DES,

1999a). Therefore, the hypothesis is this: Students spent more time engaging with the outdoor environment than the teachers when both groups attended primary school.

Table 6.5

Frequency in Which Respondents Studied Nature Outdoors in Primary School

Frequency studying nature outdoors	Frequency of response: practising teachers / ITE students <i>N</i> =219; <i>N</i> =253	
Very frequently (once a week)	2%	6%
Frequently (once a fortnight)	10%	19%
Sometimes (once a month)	30%	55%
Seldom (once a term)	41%	19%
Never	17%	1%

When the three dependent variables, ‘sometimes’, ‘seldom’, and ‘never’ are collapsed it is evident that most of the practising teachers (88%) and ITE students (75%) did not recollect engaging with nature outdoors as children, frequently or very frequently. These findings concur with the lack of outdoor nature reported by the INTO (1996), Quinn (1996), Varley et al. (2008), *Science in the Primary School* (2008), Darmody, Smyth & Doherty (2010) and the HS experts whose work is discussed in the literature review and in Chapter 5.

A Mann-Whitney U -Test was conducted to determine if the amount of time spent studying nature outdoors by the teachers was significantly different than that spent by the ITE students. The *U*-value was found to be 16128.500, ($z=8.177$); $p = .000^{**}$. Therefore, the result is highly significant at $p < .01$ and demonstrates that the ITE students spent much more time outdoors studying nature than the teachers when both groups were pupils at primary level.

6.4.3 Locations outdoors where nature was studied usually when teachers were pupils.

The school ground was the location chosen by the teachers and ITE students for engaging *usually* with nature outdoors when both cohorts attended primary school. However, these grounds generally lack richness in biodiversity-value: in 4.6.2 the lack of a compulsory policy by the DES on the design of biodiverse school grounds is discussed. (In Section 6.6.2.1 and Section 6.6.2.3 teachers report negatively on nature-friendly school grounds).

Table 6.6

Locations Most Usually Used Outdoors for Nature-Engagement when Teachers and Student-Teachers were Pupils

Location	Percentage frequency of response: teachers / students $N=219$; $N=253$	
School grounds	74%	83%
Local park	13%	10%
Local river / canal	3%	2%
Other	10%	5%

Note. 'Other' for teachers was a place in the locality such as a beach, castle, marsh, lane.

A few (4%) were brought further afield than the locations cited above. A Pearson's Chi-square test was conducted to see whether there was a difference in the outdoor locations used by teachers and student-teachers when both were pupils. It was found that $\chi^2(1) = 6.353$, $p = .096$. This informs us that there is no statistically significant association between the outdoor locations used by teachers and student-teachers when both were pupils. School grounds seem to have been the preferred location for most outdoor engagement with nature for teachers when they were pupils and when ITE students were pupils.

6.4.4 Nature resources used by the teachers' teachers contrasted to those in use by themselves and the resources ITE students encountered in primary school.

One of the resources which the teachers recalled encountering when they were primary school pupils was the nature table which is discussed in detail in 5.5.1.8. When questioned about having a nature table when they were pupils, almost all of the teachers (90%) stated that they remembered nature tables in their schools and these were encountered in several classes. This figure corresponds positively with that given by the ITE students (87%).

Interestingly, when both the teachers and the ITE students were asked to list the resource mostly used by their own primary teachers none listed the nature table and it was not mentioned specifically in responses. This raises the questions: was it used merely for display purposes and not as a teaching resource? Is a nature table which is used to display specimens in itself not a resource? After all, pupils must observe it in the classroom. However, it could be subsumed under the selections 'other' and 'actual specimens' in the ITE student questionnaire (Figure 5.13) and under 'plants and animals' in the teacher-questionnaire (Figure 6.2) because this researcher has seen actual specimens on the nature table and plants and animals.

The majority of teachers (73%) reported that the class textbook was the resource mostly used by their teachers to teach nature to them. In contrast, 53% of the students reported that their teachers mainly used textbooks to teach them (See 5.5.1.8). Only a few of the teachers themselves use textbooks (6%) and a few (6%) use nature books. Actual specimens, understood as plants and animals, were used by 41% of the students' primary teachers to teach nature to them; there has been a significant decrease in the use of these practical resources because only a few of the teachers use these (13%). Counting the

interactive whiteboard and the internet as digital resources, most of the teachers (75%) use these. The use of resources by teachers is discussed in detail below in 6.6.1.

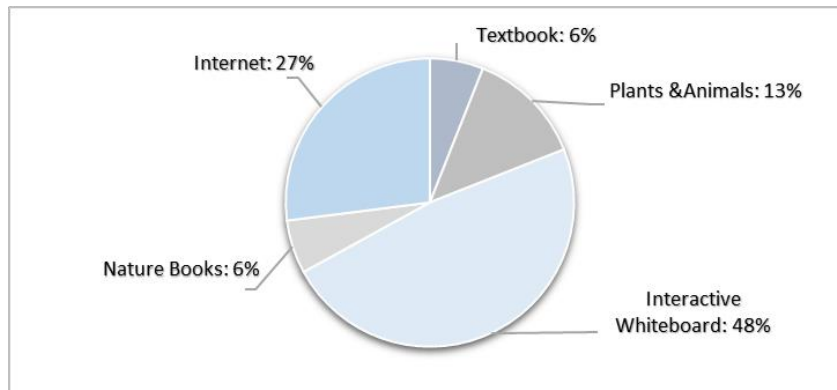


Figure 6.2: Resources used by teachers to teach nature.

6.4.5 Summary:

- Teachers studied nature much more often than ITE students when both groups attended primary school, so they would be expected to have greater content knowledge than ITE students.
- Students spent much more time studying nature outdoors than teachers when both groups attended primary school. This is encouraging because the revised curriculum advocates outdoor engagement with nature.
- School grounds were the outdoor locations usually used for engaging with nature when both groups attended primary school.
- Almost all of the teachers (90%) and most of the students (87%) encountered nature tables at primary school.
- The class textbook was the resource mostly used by the teachers' teachers (71%) in primary school to teach nature. They, themselves, rarely use this resource (6%). (Most, (75%) use the internet and the interactive whiteboard). The majority (56%) of students' primary teachers used textbooks to teach them about nature. These figures seem to imply that the textbook as a resource is at the end-stage and that digital media is replacing them.

6.5 The State and Status of Nature Awareness, Appreciation and Education in the Irish primary School system. Examining Themes Through the Lenses of Primary Teachers' Perspectives

Theme 1: The *state* of nature awareness, appreciation and education in the Irish primary system. **Theme 2:** The *status* of nature awareness, appreciation and education in the Irish primary system. These themes are explored through the following categories and sub-categories: **Theme 1: (1)** Teachers' knowledge of nature (a) general examination of the confidence levels pertaining to teaching nature of practising teachers: (b) their perceptions of the quality of nature education in their Colleges of Education; **(2):** Their experience of teaching nature (a) teaching nature indoors; (b) teaching nature outdoors; **(3):** the state of school gardening from the teachers' viewpoint; **(4):** the nature-knowledge of the pupils themselves. **Theme 2:** Department of Education inspectors' viewpoints on nature awareness, appreciation and education in the Irish primary system are examined through the lens of WSE reports.

Teachers' pedagogical content knowledge (PCK) and subject content knowledge (SCK) is examined briefly in 4.8. Biesta (2014) believed that content knowledge in education had assumed second-place to acquisition of skills and Gittomer and Zisk (2015) believed that effective teachers knew more.

6.5.1.1 Specific confidence levels of teachers relating to teaching about nature.

The lowest confidence-levels (38% on average) were expressed for teaching about shrubs, fish, reptiles, amphibians, invertebrates, rocks, soil, hedgerow, pond and bogland. The highest levels (64% on average) were expressed for teaching about mammals, gardening, birds, flowers and trees.

Table 6.7

Specific Confidence Levels of Teachers Relating to Teaching Nature

Nature Domain	Confident / Very confident / Extremely confident	Neutral / Not confident(N=219)
Id. of flowers	56%	44%
Id. of trees	64%	36%
Id. of shrubs	25%	75%
Mammals	91%	9%
Birds	57%	42%
Fish	34%	66%
Reptiles	43%	57%
Amphibians	43%	57%
Invertebrates	39%	61%
Rocks	40%	60%
Soil	36%	64%
Gardening	63%	37%
Hedgerow	46%	54%
Pond	39%	61%
Bogland	32%	68%
Woodland	51%	49%

To a general extent these findings reflect the observations of the HS experts in Section 4.1 where it was observed that generally teachers' *knowledge of nature* was 'fair to weak', 'not good'. Three experts felt that their knowledge of rocks and soil was especially low. One believed that their knowledge of mammals was good, and another believed their knowledge of birds was best.

6.5.1.2 Sub-category 1(b): Influence of Colleges of Education on teachers' ability to teach nature.

The teachers were asked: How would you rate your initial teacher education as a foundation for the teaching of children about nature?

The findings demonstrate that when the dependent variables 'fair' and 'poor' are collapsed the majority of the teachers (68%) believed that the ITE they received on teaching children about nature in their Colleges of Education was in the variable range poor to fair. When the variables 'good', 'very good' and 'excellent' are collapsed less than half (32%) believed it was in the variable range good to excellent.

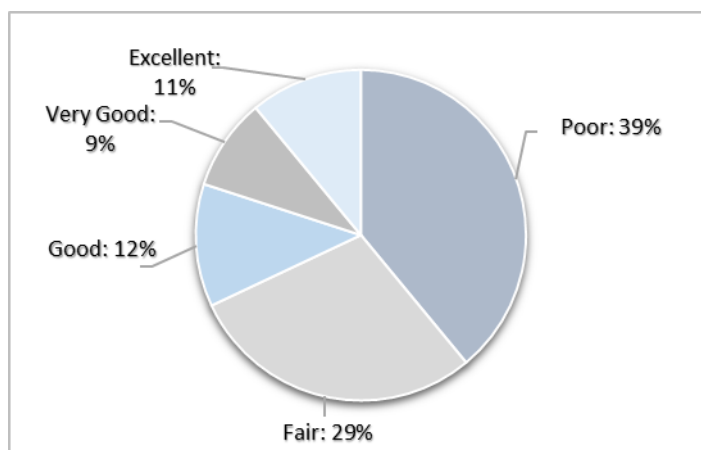


Figure 6.3: Influence of Colleges of Education on teachers' ability to teach nature.

These findings seem to indicate that the teachers believed that the nature-education they received in their Colleges of Education did not adequately prepare them for teaching nature. The majority of the teachers (68%) believed this. (Figure 6.1 above demonstrates that c.66% of them -those aged between 21 and 40-, engaged in ITE when the revised curriculum was introduced). It would have been interesting to discern which college(s) are providing the best courses on content knowledge (CK) of nature and pedagogical content knowledge (PCK) of nature. The questionnaire did not address the provenance of the teachers' ITE.

A HS expert in 4.4 apportioned blame to the Colleges of Education for teachers' lack of knowledge about nature. This expert was of the opinion that the tutors in Colleges of Education had little knowledge themselves about nature and as a result did not bring the students out much.

In a follow-up on these findings **Item 3.3: asked: In initial teacher-education how often did you study nature?** A small number (16%) did not recollect studying nature in ITE. Less than half (36%) recollected seldom studying it and a small number (18%) recollected studying it sometimes. Less than half (30%) recollected studying it frequently to very frequently.

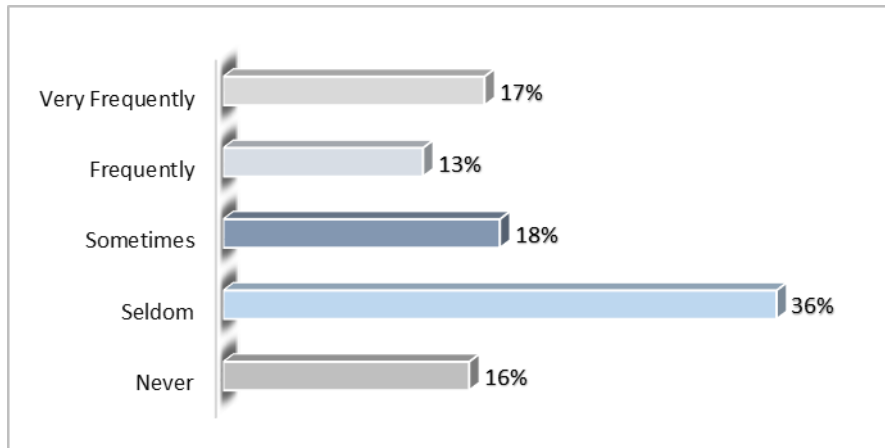


Figure 6.4: Frequency in which teachers studied nature in their College of Education.

The majority of the teachers (66%) attended their College of Education from 1996-2016 and therefore would have engaged with the science and geography syllabi in the new revised curriculum (DES,1999b; 1999d). As can be seen in Fig. 6.4, the majority (70%) reported that the frequency of their engagement with nature in their ITE was never to sometimes. Furthermore, this nature education was mostly conducted indoors because in answer to item 3.4 regarding *where* they studied nature, the majority (59%) recalled that it was done *indoors*.

The above findings correlate somewhat with those reported on by Waldron et al (2009). 'Many students identified their subject content knowledge as an issue and argued that colleges should prepare them better in this' (p.91). It should be noted, however, that in this report the students in the main conceptualised the physical rather than the natural sciences in their responses so either they could not recall studying nature, or they did not conceptualise nature as science.

6.5.1.3 Summary:

- Teachers expressed low confidence levels (38% on average) about teaching about fish, reptiles, amphibians, invertebrates, soil, rock, shrubs, hedgerow, pond, and bogland.
- Teachers expressed high confidence levels (64%) on average about teaching about mammals, gardening, birds, flowers, and trees.
- The majority of teachers (68%) believed that their initial teacher education on giving them the ability to teach nature was poor to fair; less than half (32%) believed it was good to excellent.
- The majority of teachers (70%) believed that engagement with nature in ITE occurred never to sometimes; the majority (59%) also stated that this nature education occurred indoors.

6.6 Theme 1: Category 2: Teachers' Experience of Teaching Nature: (a) Teaching Nature Indoors; (b) Teaching Nature Outdoors

Regarding this category questions were asked about teachers' experiences of teaching nature (a) indoors; (b) outdoors.

6.6.1 Sub-category 2(b): Teaching nature indoors.

As discussed in 6.4.4 above, findings indicate that the use of textbooks for the teaching of nature is on the decline. Instead, other resources are being used. The ITE students recalled that 41% of their teachers used actual specimens to teach them about nature when they attended primary school. (The youngest student teachers left primary school c.2010, 2011 and nearly all of them attended primary school from 1999 to 2011 when the revised curriculum was in operation. (See 5.3)). In contrast, a few of the teachers (11%) reported that their teachers used actual specimens. A few of the teachers (13%) reported that they used actual specimens. This is regrettable because one of the most useful

resources for teaching nature is a relatively cheap children's digital microscope for examining specimens.

The interactive whiteboard and the internet seem to have replaced textbooks as the favoured mode of teaching nature. Forty-one percent of the students encountered teachers using actual specimens. This contrasts to a 13% usage by practising teachers at present. Most of the teachers questioned (75%), used the interactive whiteboard and the internet for teaching nature to their pupils. As the use of the IWB is a new phenomenon in education no assessments can be made yet concerning its appropriateness for teaching about nature. In Cosgrove et al (2013, p.23), 87.4% of primary teachers ($n=2838$) used it 'often' or 'always' during class time for teaching about subjects in general. There is a need for research on its effectiveness. Cosgrove et al went on to state:

Although large majorities of principal teachers across all school categories in the 2013 Census indicated that ICTs had impacted positively on the range of methodologies used by teachers, students' levels of interest and engagement, and performance in literacy and numeracy across the curriculum, no collaborating evidence is available to back this up, (p.54).

Nonetheless, many nature-educators would question its use for teaching a subject that is heavily dependent on learner-development through use of the five senses (Chawla, 1998, 2002, 2006; Louv, 2005; Sobel, 2008; The National Trust, 2012; Selby, 2017).

6.6.2 Sub-category 2 (c): Teaching nature outdoors.

Waite (2010), discussing the values for potential learning in the outdoors expressed the view from examining her own research and that of others that these seem to be rooted in: 'relevance, enjoyment, variety and choice' (p.117) and, because these values engage children, learning takes place.

Almost all the teachers (92%) taught nature outdoors at least once during the school year. This figure contrasts with the findings in 6.5.1.3 where it was found that a majority of

them (59%) never went outdoors to study nature in their College of Education. If the majority never ventured outside to study nature in their College of Education what triggered them to go outdoors at least once during the school year? Perhaps it was a CPD course in nature-education they attended. Perhaps outdoor learning is embedded in the culture of their school. Perhaps, they themselves, see the benefit to their pupils from outdoor engagement with nature.

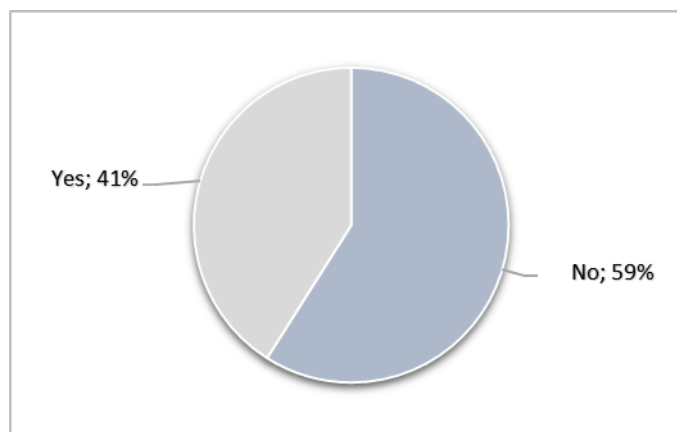


Figure 6.5: Teachers' engagement with nature outdoors in ITE.

Five teachers did not venture outside at all to teach nature. Of those who ventured outside, the majority (63%) mostly used the school grounds. As discussed in 6.6.2.1, these school grounds generally lack wildlife areas rich in biodiversity such as meadows, ponds and butterfly gardens. (Less than 14% of teachers reported that these wildlife areas existed in their schools). This does not mean of that the grounds are devoid of biodiversity features because 44% of teachers reported that they had trees on the grounds. If school grounds generally lack trees and areas of biodiversity it is difficult to envisage them being suitable for studying nature outdoors.

The outdoor locations which they used most frequently were the school grounds (139 responses), the local park (74 responses), the school garden (48 responses), local area (22 responses), trips to places of interest (18 responses) and hedgerow/woodland (14 responses).

6.6.2.1 School grounds.

Item 4.2: What features of your school grounds (if any) are suitable for nature study? Almost all the teachers (92%) provided an answer to this question and there were 17 non-respondents. Perhaps these latter respondents have no features suitable for nature. Five teachers did respond stating that no part of their grounds was suitable. One stated: *'Hanging baskets are the only plants on grounds'*.

The school garden was top of the list with the majority of teachers (58%) stating that this was a feature suitable for nature. This is good news especially since a couple of the HS experts believed that the school garden was the resource mostly used by teachers for outdoor engagement with nature (See Section 4.6.2). However, only a small number (24%) stated that they used the garden for nature study. This could be due to the fact that the garden is just a cultivation area and lacking in wildlife features. Less than half (43%) stated that trees featured on their grounds. Less than half (26%) had access to grassy or 'green areas' which included fields. A small number (16%) had a hedgerow on the grounds and a few (<14%) had a log pile, pond, rock pile, walls, flower areas, wild flowers, bird areas, compost area, and polytunnels. Three teachers reported hen-coops on the grounds.

Nearly all schools therefore, had some access to a nature area on their school grounds. (See Sections 2.11.2, 4.6.1 and 5.5.1.6) for more on the lack of nature-facilities on school grounds). The majority of the teachers perceived the school garden as a feature suitable for nature study. This finding verifies that from the student questionnaire in 5.6, where it was found that a majority (57%) had engaged with school gardening in primary school. All the HS experts who were interviewed witnessed teachers and pupils engaging in school gardening; as stated already two of them believed it was the nature activity pursued most often in schools (See Section 4.6.2). Evidence for the lack of commitment demonstrated so far by the DES towards the school gardening movement in Ireland is discussed in 2.10.1, and 5. 6. (This garden movement is not alone concerned with

vegetable-cultivation, but with enhancing the biodiversity potential of the garden as well. It is supported by the Green Schools' initiative, especially activities concerning the achievement of the biodiversity flag). Nevertheless, as evidenced from the teacher-questionnaire, the observations of the HS experts and the school-ground design policy of the DES there seems to be a lack of biodiverse habitats such as hedgerows, log habitats, ponds, butterfly and bee habitats, wildflower and wild grass areas on school grounds. These habitats are excellent for nature study especially for engaging the children with conservation methods and the concept of the food-chain. Chapter 5.7 for example, discusses students' lack of knowledge of meadow habitats and how they are necessary for the conservation of brown butterflies. No student could explain why meadows are important for these butterflies. Table 5.8 demonstrates that they had difficulties too explaining why meadows are useful for frogs and finches. From Section 5.6 it can be discerned as well that they had difficulties constructing food chains: only one student was able to construct a seven-part food chain beginning with sun, leaf, aphid. If school grounds had meadow areas that were studied perhaps the ITE students' scores on the relevance of meadows for butterflies, birds and amphibians might have been better.

6.6.2.2 Challenges preventing teachers from going outside the classroom.

Waite (2010) found the biggest barriers to going outdoors were in order of significance: funding, attitudes (lethargy caused by lack of time, paperwork), the nature of the outdoor space, weather and safety.

The two biggest challenges the teachers in this study encountered relating to going outside the classroom to teach nature correspond somewhat to Waite's findings: 1: Lack of time (82%) after collapsing ranks 1, 2, and 3); 2: Lack of natural school facilities such as a pond, field or hedgerow (55% after collapsing ranks 1, 2 and 3).

Other challenges they faced were: 3: Lack of knowledge of flora and fauna (52% after collapsing ranks 1, 2, and 3); 4: Safety issues (51% after collapsing ranks 1, 2, and 3).

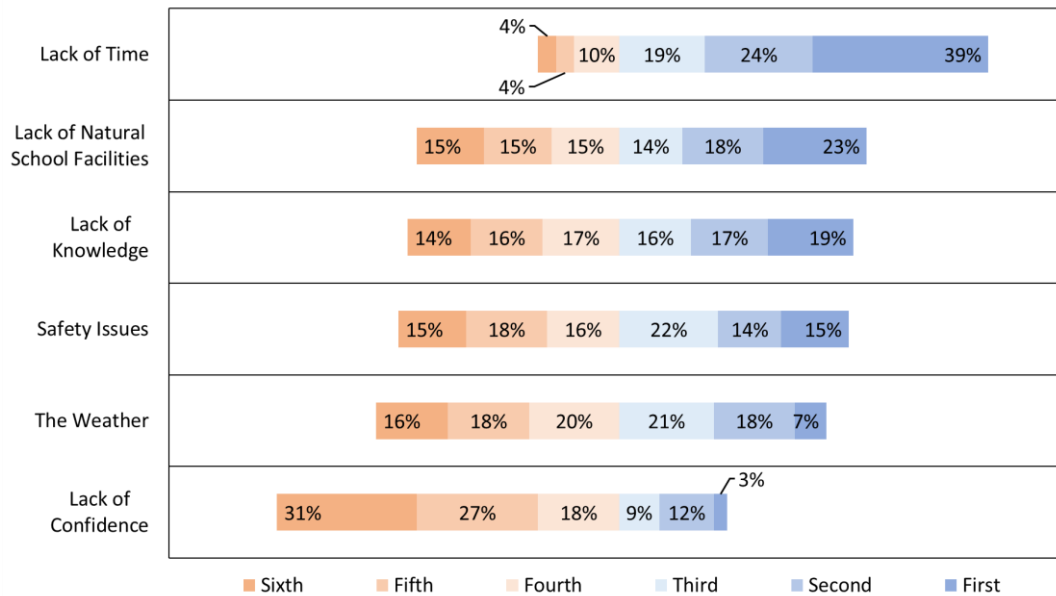


Figure 6.6: Challenges faced by teachers relating to outdoor engagement with nature

Lack of confidence in bringing children outside was not considered a major challenge; neither was the weather. The lack of knowledge reported by teachers is discussed in Section 6.5.1.2 above and the lack of natural facilities in Section 6.6.2.1 above. Another major barrier was the large class sizes and lack of suitable personnel to accompany the teachers and their classes outside. Less than half of teachers (49%; $n=67$) reported this factor when they were asked to cite other challenges apart from the above.

In the *Primary Curriculum Review, Phase 2*, (NCCA, 2008), 36% of respondents, ($n=932$), believed that their greatest challenge to going outside was access to habitats with a small number (20%) stating that the planning and organisation of trips to habitats was the biggest barrier. A small number (21%) reported that class size or age of class was a factor. The habitat findings generally correspond with number two above-lack of natural facilities. In this report (NCCA, 2008), safety issues (17%), lack of time (16%) and weather (6%) were the least problematic for not venturing outside to teach nature. One would have expected the unpredictable Irish weather to be cited as a major challenge to going outside.

6.6.2.3 Other challenges faced by teachers relating to going outdoors to engage with nature.

Large classes and lack of personnel to supervise these classes were by far the greatest of the other challenges reported by 49% of the 67 teachers who responded.

Large classes and limited personnel to supervise them were also cited as major inhibiting factors for not going outside by teachers in the 2008 report, *Science in Primary Schools, Final Report*, (NCCA, 2008).

The problems associated with lack of suitable habitats on school grounds for engaging with nature-education have been discussed in 2.10.2 and it would seem from the responses given by teachers above that there is an urgent need to address this shortcoming in school design.

Table 6.8

Other Challenges Faced by Teachers Re Going Outside to Study Nature (n=67)

Other Challenges	Teachers
Large classes/lack of personnel to supervise same	(49%)
Cost factor	(9%)
Behaviour issues	(8%)
Overloaded curriculum	(5%)
Vandalism	(8%)
Preparation	(5%)
Lack of outdoor resources	(5%)
Staff motivation	(3%)
Miscellaneous	(12%)

Note. Miscellaneous includes limited access to area, parental perceptions, nature not a priority, children's clothing, reprimanded by cleaning staff, manicured grounds, having to justify to others the reasons for going outside.

6.6.2.4 Summary:

- The use of textbooks for teaching nature has declined; they have been replaced by the interactive whiteboard and the internet. Because 13% of teachers reported using plants and animals to teach nature it would seem that the use of actual specimens is in decline.

- In ITE the majority of teachers never went outside to study nature. This lack of engagement with nature outdoors could have implications for the frequency of teachers engagement with outdoor education.
- The majority of teachers use the school grounds for going outdoors to teach nature. Less than half of these have trees; A small number of teachers reported a hedgerow on the grounds; a few have areas suitable for studying biodiversity. So, if they use school grounds generally lacking in biodiverse areas the quality of their outdoor engagement could be diminished.
- The school garden was cited by the majority as a feature of the school grounds suitable for nature. If this school garden has plenty of biodiversity within it this is a very positive finding.
- The main challenges cited for not going outdoors to study nature were: 1. Lack of time. 2. Lack of natural facilities on the school grounds. 3. Lack of knowledge of flora and fauna. 4. Large classes and lack of suitable personnel to assist with their supervision.

6.7 Theme 1: Category 3: The State and Status of School Gardening from the Teachers' Viewpoints

Garden-based learning (GBL) is becoming increasingly important in Irish schools.

The garden is a foundation for integrated learning in and across disciplines – including science, maths, art, geography and history, as well as literacy and numeracy. Growing and caring for plants provides active, engaging and real-world experiences that have personal meaning for learners (Austin, 2016).

Just over half of the teachers in the survey (52%) were engaged in school gardening.

This high-engagement reflects the findings in Item 4.2 where teachers were asked what features of school grounds are suitable for nature. The majority of them (58%), stated that

the school garden was a feature, though according to answers recorded from 4.1, [**What outdoor locations have you used in the past year?**], only a small number (24%) *actually used the school garden as a resource for teaching nature outdoors*. This figure contradicts the findings above where 52% stated that they *engaged in school gardening*. However, the disparity in the figures could be due to the fact that the teachers in question are engaging in school gardening but they do not necessarily have a dedicated garden to pursue this activity. They may be using planters, grow-bags etc. or even gardening indoors. Also, they may not be equating *teaching nature outdoors* with *school gardening*. Nonetheless, they are engaging their pupils with gardening in some way and this is a positive finding.

Another disparity occurs when the answer to Item 11 is considered: '**Mixed messages about policy relating to learning outside the classroom are a barrier to garden use**' (Passy, 2014). **Have you ever taught about plants and animals using a school garden?** Most (78%) answered 'yes' and a small number (22%) answered 'no'. This contradicts the finding from 4.14 where a majority (52%) stated that they *were engaged* with school gardening. The shortfall (26% of teachers) could be due to the wording of question 4.11 which stated, '**Have you ever taught about plants and animals using a school garden?**'. They may be using the garden to teach about earthworms, stems etc. but they may not necessarily be gardening. On the other hand, they could have taught school gardening in the past but are not doing so now or they could have taught it in another school.

The high engagement of teachers with school gardening also reflects the views of two of the HS experts where they stated that school gardening was the outdoor nature activity mostly pursued in schools (5.6.2). The most effective statutory body is SEED which unlike GIY, Incredible Edibles, and Sow and Grow provides no incentives such as prizes for schools to engage in gardening.

Nonetheless, noting that this high involvement of teachers with school gardening is a reason for optimism regarding this form of nature-engagement there is a cautionary note added. In Item 4.12 teachers were asked: **If school gardening is done in your school is it done in all classes according to an overall plan from infants to 6th?** The majority (69%) answered 'no'. This means that very little *cumulative learning* is taking place in school gardening across classes. To be effective school gardening must be done in all classes so that by the time children reach 6th they would be acquainted with many aspects of this activity. The findings suggest that this effective approach to school gardening is not being utilised by the majority of the teachers.

6.7.1 Sub-category 3(a): Colleges of Education and school gardening.

The Colleges of Education seem to have minimal impact on teachers' knowledge of school gardening. None of the colleges had school gardens prior to 2002 when most of the teachers engaged in ITE. Only one college, is affiliated to SEED and school gardening has been carried on there on a continuous basis since 2002 in a garden specially designed for this purpose. One other college presented a minor specialism from 2014-2016 entitled 'Space to Grow'. Aware of this dearth of education in ITE, Austin (2017) pleaded for more emphasis to be placed on GBL and outdoor learning in ITE to enhance literacy and numeracy skills and engage the students with the natural environment. If more emphasis was placed on school gardening in ITE it would seem logical that more practising teachers would engage with it as they would have more knowledge and confidence.

6.7.2 Sub-category 3(b): A comparison between teachers' engagement with school gardening as pupils and ITE student's engagement with it as pupils.

School gardening has become popular as an outdoor activity in the past two decades. Most of the teachers (81%) attended primary school *pre-revised curriculum* with a small number (23%) reporting that they engaged in school gardening in primary school. Most of

the ITE students (89%) attended primary school for six to eight years while *the revised curriculum was in place* with the majority of them (57%) reporting that they engaged in school gardening in primary school. After conducting a Pearson's Chi-Square Test an association between teacher's engagement with school gardening as *teachers* and students' engagement as *pupils* was observed, $\chi^2(3, N=477) = 8.826, p = 0.032$. * This result indicates a significant association between the categorical variables ITE students' engagement with school gardening as pupils and teacher's engagement as teachers.

The finding that school gardening is on the increase since the introduction of the revised curriculum (DES, 1999) is a very positive finding and indicates that if teachers see merit in an educational initiative they will pursue it even if support from relevant stakeholders is minimal.

6.7.3 Sub-category 3(c): Sources of teachers' confidence and knowledge on school gardening.

When 'Confident', 'Very Confident' and 'Extremely Confident' responses are collapsed in Table 6.7, the majority of teachers (67%) expressed confidence about teaching nature. There is a positive correlation between these findings and those summarised in the same table where the majority of teachers (63%) stated that they were confident to extremely confident about teaching nature through gardening.

Family members, books/ magazines, and personal knowledge are teachers' main sources of knowledge about school gardening. SEED, a voluntary body is the principal agency for educating teachers about school gardening.

Table 6.9

Sources of Teachers' Knowledge on School Gardening (n = 113)

Sources of teachers' knowledge on School Gardening	Percentage of Responses
Family members	27%
Books/Magazines	23%
Personal knowledge	23%
SEED ²⁵	16%
Internet	14%
Colleagues	11%
Heritage in School Specialists, Miscellaneous ²⁶	5% each
Incredible Edibles ²⁷	4%
GIY ²⁸ , Coll. Of Ed., Parents of children, Caretaker	3% each
Sow and Grow ²⁹	2%

No teacher mentioned the resources on the Bord Bia³⁰ website or the DVDs on organic gardening which were sent free of charge to every primary school in 2009. It is possible, however, that Bord Bia resources are accessed to some degree as a few teachers (14%) stated that the 'internet' was a source of knowledge on school gardening. Apart from SEED, there seems to be minimal influence on teachers' knowledge of school gardening from the educational framework. Most of their knowledge is gained from outside this framework. There is a need then for more CPD in this area and more input from the DES.

6.7.4 Sub-category 3 (d): Challenges faced by teachers relating to their involvement in school gardening.

The stacked bar graph below demonstrate that lack of time is the biggest challenge faced by teachers involved in school gardening. Most of responses (90%) ranked this issue

²⁵ Founded in 2010 with the objective of promoting school gardening in all schools on the island of Ireland. It promotes this in articles in the INTO's In Touch magazine (cited by 5 teachers), lectures/courses/videos with Paddy Madden (cited by 9), Bloom Festival (cited by 1). Blackrock Rd. Centre (cited by 1). website www.schoolearthed.ie (cited by 2)..

²⁶ Miscellaneous *Figure 6.7: Teachers' rating of the challenges relating to engaging with school*

²⁷ Incredible Edible
vegetables in primary school gardening.

²⁸ Grow it Yourself (GIY): Founded in 2008 by Michael Kelly to inspire communities in Ireland and globally to grow their own food, understand more about it and also cook it.

²⁹ Sow and Grow: A campaign sponsored by a food company aimed at primary school children and organised by GIY to promote food awareness and growing of greens in primary schools.

³⁰ Bord Bia is the Irish Food Board. It promotes growing of fruit and vegetables.

when the three top ranks of importance were collapsed. This finding resonates with those in Figure 6.6 where most of the teachers (82%) in the three top ranks cited lack of time as their biggest obstacle to teaching nature outside the classroom

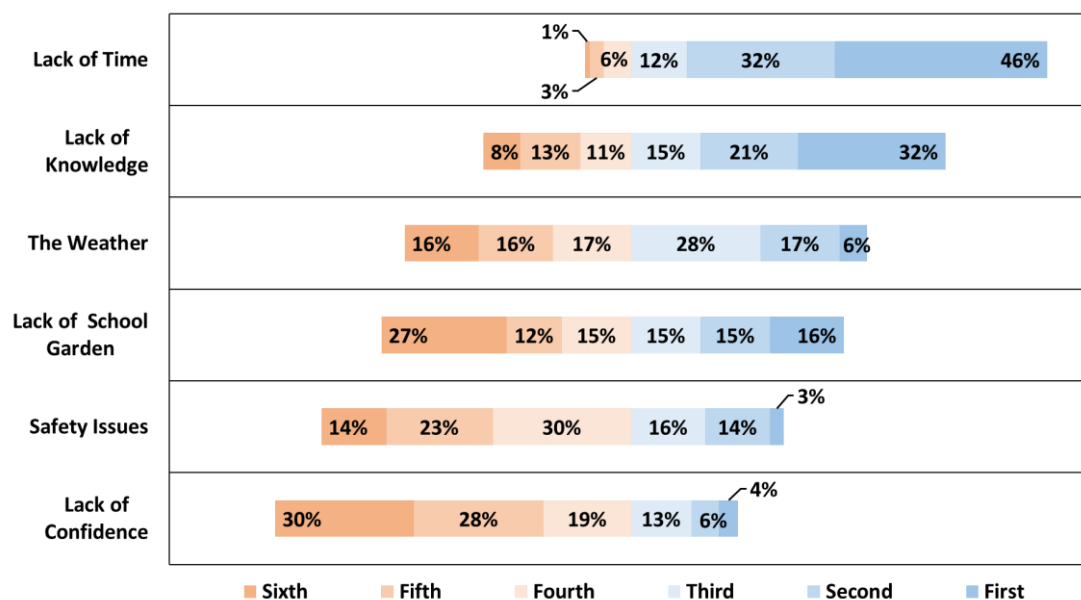


Figure 6.8: Teachers' rating of the challenges relating to engaging with school gardening.

This lack of time alluded to by teachers was addressed in a report by the NCCA (2010). This report, *Curriculum Overload in Primary Schools*, asked teachers for suggestions on reducing content overload. Their suggestions ranged from reducing strand units and time-allocations for each subject and paring-down the curriculum and to more integration of subjects, more specialist teachers and more CPD.

Lack of knowledge of gardening is another major challenge faced by teachers with the majority (68%) placing this factor in the top three ranks of importance. This finding also resonates with that in Figure 2.6 above where the majority of teachers (52%) cited lack of knowledge of flora and fauna in the top three ranks of importance for not going outside to teach nature. Content knowledge of teachers (CKT) and its implications for teaching and learning is discussed in Section 4.8.

A lack of a suitable school garden as a reason for not gardening was listed by 46% of teachers when first, second and third in order of importance are collapsed. Corresponding to this finding, the majority of teachers (55%) ranked in the top three orders of importance a lack of natural facilities such as ponds and hedgerows for not venturing outside the classroom to teach nature. It seems then that around half of the teachers considered that a lack of a school garden and a lack of natural facilities were major barriers for not gardening and going outside to engage with nature. These two issues could be addressed by the provision of grants from the DES to provide both on school grounds.

The two challenges that were ranked least were: 1. Lack of confidence in bringing children outside (23%); 2. Safety issues (33%). Cross-referencing to the two challenges that were ranked least in Figure 6.6 for not bringing children outside to study nature the findings were 1. Lack of confidence in bringing children outside ((24%); 2. Weather (46%). This is a positive finding and seems to indicate that teachers are willing to engage children outdoors with nature and gardening if suitable facilities are in situ on the school grounds.

It is striking that safety issues are not paramount concerns with teachers' engagement with outdoor learning because these are often cited as major concerns inhibiting children's engagement with the outdoors. (Louv, 2005; Ofsted, 2008; National Trust, 2013).

Louv (2005), Ofsted (2008), National Trust (2013) cited safety issues as major barriers preventing children being brought outside to engage with nature. Nonetheless, Sandseter (2011) argued that there should be a balance between risk and safety and that children's emotional resilience should not be stifled by an over-emphasis on safety issues. 'The increasing focus on children's safety on one hand is important, but on the other hand it must not lead to children being restricted from the opportunity for challenge and excitement (Sandseter, 2011, p.5). As seen from the teachers' responses this restriction is not relevant in the Irish primary schools' context.

In sum, it seems that lack of time, lack of knowledge of nature and gardening, and lack of natural facilities and a suitable garden are major obstacles for teachers not going outside to teach nature or get involved in school gardening.

In 2.10.1 Freeman (2017) concluded that school gardening in Ireland was constrained by an overcrowded curriculum, lack of knowledge and confidence in school gardening, funding, and a lack of definition of school gardening in the curriculum. Her first two findings reflect those from the questionnaire to teachers.

6.7.5 Summary:

- Just over half of the teachers (52%) stated that they were engaged with school gardening but only a small number (24%) used the school garden as a resource for teaching *nature* outdoors. These seem to be conflicting responses. However, some may not be conceptualising school gardening as nature and they may be gardening indoors or using containers.
- Most (78%) taught about plants and animals using a school garden. (This finding contradicts the above finding). However, they could have taught about them in another school. This is a significant finding and demonstrates the importance of a school garden for engaging children with nature.
- Minimal cumulative learning is taking place in the school garden: therefore, learning is sporadic. The majority of teachers (69%) stated that it was not carried out according to an overall plan from infants to 6th.
- School gardening has become popular as an outdoor activity in the past two decades. Most of the teachers (81%) attended primary school *pre-new revised curriculum* with a small number (23%) reporting that they engaged in school gardening in primary school. Most of the students (89%) attended primary school for six to eight years while *the revised curriculum was in place* with the majority of

them (57%) reporting that they engaged in school gardening. These are encouraging findings and seem to indicate that school gardening is increasing significantly since the new curriculum was initiated.

- The school garden was top of the list of features on school grounds suitable for engaging with nature with the majority of teachers (58%) stating that this was a feature suitable for nature. Teachers are probably using it to look at invertebrates, soil and plants.
- The sources teachers use for acquiring knowledge on school gardening are arbitrary: family members, books/magazines, personal knowledge, the organisation SEED, the internet and colleagues are the principal sources. These findings seem to suggest that there is more need for input from the DES and CPD into school gardening.
- The main challenges to engagement with gardening faced by teachers are: lack of time, lack of knowledge, and lack of a suitable garden. Lack of confidence is not an issue with the majority of the teachers (63%) stating that they were confident to very confident about teaching nature through school gardening. This is a positive finding because it seems to suggest that if the barriers outlined were eliminated teachers would embrace school gardening wholeheartedly.
- The high engagement of teachers with school gardening also reflects the views of two of the HS experts who stated that school gardening was the outdoor nature activity mostly pursued in schools (Chapter 4.6.2).

6.8 Category 4: Nature-Engagement of Pupils

In Section 4.5.1 children's knowledge of nature was explored from the HS experts' opinions. Two of them reported that it was very poor or very low-or weak and usually non-existent; others reported that they knew more about non-native than native species. One

considered that their knowledge was good to very good and another observed that they knew about wildlife. Generally, they believed pupils' identification and classification skills were limited. However, there was no overall consensus from them regarding children's knowledge of nature.

6.8.1 Sub-category 4(a): Teachers' rating of children's knowledge of nature.

Item 4.8: How would you rate children's knowledge of nature in general?

The majority (54%) were of the opinion that children's knowledge of nature was poor to fair; less than half (46%) indicated that it was good to very good. No teacher responded that it was excellent. This assessment was based on opinion and not on formative assessment of learning.

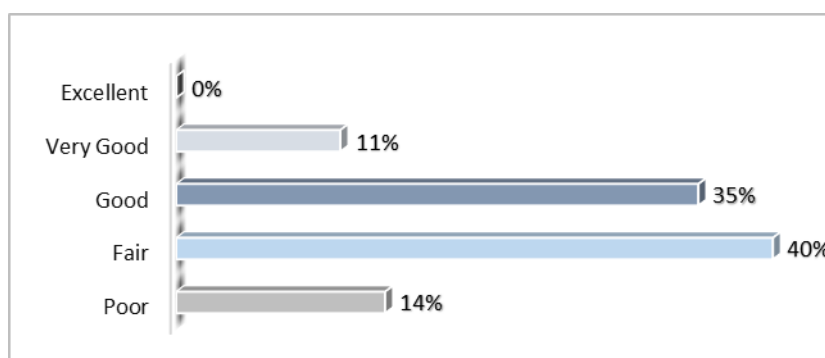


Figure 6.9: Teachers' rating of children's knowledge of nature in their school.

In Section 2.3 children's alienation from nature was explored especially Louv's term 'nature-deficit disorder' (Louv, 2005, p.10). He blamed the ubiquity of technology for this syndrome and this factor was also cited by the National Trust (2012) when they were inquiring into children's engagement with nature in England. The latter found that children had limited knowledge of flora and fauna and this finding was mirrored by the *Wild Child Qualitative Study* initiated by the Heritage Council (2010) in Ireland where it was found that children had a more limited knowledge of nature than their parents. The findings in

Fig. 6.8 reflect the teachers' opinions. These of course are *opinions*; more reliable data would emerge from formative or summative assessment of learning.

6.8.2 Sub-category 4(b): Effectiveness of nature-education in respondents' schools.

Item 4.9: How effective in your opinion is nature-education in your school?

(Effective: children are well-informed about plants and animals, rocks and soil, weather).

Collapsing the results in figure 6.9 below it can be deduced that fewer than half of the teachers (47%) considered that nature-education was effective to very effective. A small number (19%) concluded that it was ineffective to very ineffective and less than half (34%) deemed that it was neither effective nor ineffective.

Again, these findings reflect the *opinions* of teachers. Nevertheless, very few considered nature-education in their school was very effective. Those who considered that it was neither effective nor ineffective suggest in 6.8.2.1 how they think it could be made more effective.

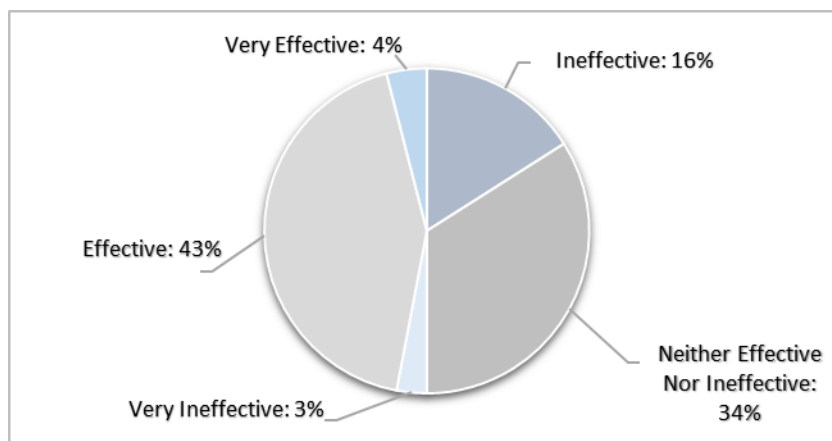


Figure 6.10: Teachers' rating of the effectiveness of nature-education in their school

6.8.2.1 Teachers' suggestions for improving the effectiveness of nature-education.

Forty of the 117 teachers who considered that nature-education in schools was in the range neither effective nor ineffective to very ineffective suggested that it could be made

more effective and listed a series of suggestions for accomplishing this. The open-ended question to them in the questionnaire stated: If your answer is (c), (d), or (e) how do you think it could be made more effective?

Suggestions relating to CPD:

Four teachers believed that quality CPD in nature education was necessary to improve their confidence and knowledge and explained how this might happen.

'Better educated teachers in the area and more encouragement from the top to take an interest'. 'Better professional development for teachers'. 'CPD for teachers to improve knowledge and confidence'. 'I know of very good CPD summer courses, but they are very difficult to enrol on-very popular. More availability would be good'.

Four teachers also maintained that this CPD should take place in the school itself with the whole staff.

'If staff as a whole could be trained in situ to get the most out of what is available within school setting to teach nature...'. 'Whole-school training at Croke Park hours'. 'It requires a teacher to lead in school CPD in this area...'. 'In-service staff training'.

Curriculum:

Four teachers believed that because nature was subsumed in the Science and Geography curriculum areas it had lost its status. This should be redressed in order to give it more emphasis.

'Completely change the SESE curriculum. Nature has been subsumed into Geography and Science, so it cannot currently be viewed as a standalone subject'. 'Greater emphasis should be put on subject. It's getting squeezed out in the pursuit of literacy/numeracy'. 'More of a focus on nature and outdoor education'. 'Nature

would be covered under the science and geography curricula and we could go for a whole month without doing nature as such, for example, when we study magnetism'.

Three others felt that the curriculum was too broad and that a subject like nature with low status tended to be neglected.

'Make the curriculum less wide and more practical'. 'Nature is not a defined school subject-schools are under pressure to cover areas of the curriculum that are deemed more important'. 'The curriculum has become so extensive we've forgotten about the basics...the indigenous plants and animals'.

Time constraints:

Four related that lack of time to engage with nature was a significant barrier coupled with the fact that more adult assistance was required for venturing outdoors to teach it if time became available.

'More time and more flexibility with timetable'. 'More time allocated, and a greater importance put on the subject'. 'More time given to the subject and extra adult help available to help when going outside'. 'Time is a huge barrier'.

Technological issues:

One believed that children's interest in technology was preventing them from engaging with nature and exploring the world around them.

'Many children nowadays are not engaging with nature even in a rural setting.... Also, the impact of technology is massive. Children are more passive nowadays and are only concerned with the small screen and not the huge world around them'.

Outdoor education:

Four believed that children need to get outside more often to a variety of environments so that they could be encouraged to get interested in nature and gardening.

'More trips outside to different environments...'. 'Need time for more field-trips'.

'More experiences outdoors both in school and at home as children rarely speak of family days spent outside'. 'Need to bring children out more often; need to spark their interest in nature; get their hands dirty in the garden'.

School grounds:

Six believed that these could be improved through the creation of more nature areas of interest and more gardening facilities.

'Need to develop a school garden". 'More facilities around school'. 'Hoping to use new polytunnel as an outdoor classroom'. 'Need more nature areas in our school'. 'An enclosed school ground that includes different and deliberate planting'. '...the addition of a school garden...'

Resources:

Five teachers' references to resources suggest that there is a need for more flora and fauna identification tools, better teaching resources and more nature initiatives to get them involved.

'Reference books/resources to assist identification of flora and fauna'. 'Better teaching resources for lessons'. 'More initiatives like Tree week. Adopt a tree project'. 'New resources-information booklets for teachers'. 'Reference books/resources to assist identification of flora and fauna'.

Planning:

Five believed that there was a lack of whole-school planning in nature awareness, appreciation and education and they would benefit from outside expertise in this area of learning. Good planning would lead to cumulative learning.

'Designated whole-school plans and resources by qualified persons in this area'. 'Better whole-school planning to ensure to ensure that children gain knowledge of a

wide variety of animals, plants etc., not the same popular topics each year e.g. hedgehog, squirrel, caterpillar, daffodil. ‘Guest speaker for the children; input at staff meetings from someone who works in this area; putting more focus on the discreet ‘wildlife/nature’ element of our integrated SESE plan’. ‘...a plan dividing up plants and animals to be learned in each class will help because at the moment it is a little vague. Teachers assume things have been taught when they haven’t, and they shy away from basic things the children should be learning such as native plants and birds’. ‘We need better planning with a spiral approach through the school to build on skills and knowledge acquired in previous years’.

6.8.3 Summary:

- The majority of teachers (54%) were of the opinion that children’s knowledge of nature was poor to fair. Children’s limited knowledge of flora and fauna is confirmed by international research.
- Less than half of the teachers (47%) considered that nature-education in their schools was effective to very effective. Nearly 1/5 of them (19%) considered that it was ineffective to very ineffective. This assessment was based solely on teachers’ opinions and not on formative or summative assessment.

To improve nature education in their schools the forty teachers recommended:

- More CPD, especially whole-staff training.
- Greater emphasis on nature in the curriculum. This would entail more focus on nature and outdoor education.
- More flexibility with time schedules.
- Improvement of school grounds; addition of school gardens.
- Better availability of resources especially those dealing with identification skills.

- Better planning for every class so that children can build on their knowledge of nature in every class.

6.9 Theme 2: The Status of Nature Awareness, Appreciation and Education in the Primary System

An insight into teachers' views on the above topic was garnered from several items such as Item 3.5: **How would you rate your initial teacher-education as a foundation for the teaching of children about nature?** Item 4.6: **How often do you teach nature with your current class?** Item 4.10: **[If you consider nature-education in your school as (a) neither effective nor ineffective, (b) ineffective or (c) very ineffective] how do you think it could be made more effective?** Item 4.16: **Have you any general comments to make about nature education or nature in general in primary schools?**

As outlined in Section 6.5.1.2, the majority of teachers (68%) were of the opinion that the nature-education they received in ITE was fair to poor. (66% of the teachers experienced ITE immediately prior to the introduction of the revised curriculum and while it was in operation).

Item 4.6, asked: **How often do you teach nature with your current class?** When choices 'once a month', 'once a term' and 'never' are collapsed, the majority of teachers (52%) answered under these categories. A few (4%) never taught nature during the year; a small number (15%) taught it c.3 times in the year (once a term); less than half of the teachers (33%) taught it c.10 times (once a month) in the year and less than half (27%) taught it once a fortnight). A small number (21%) taught it once a week (37 weeks in the school year). Science and geography are allocated two hours per week (64 hours a year) in all classes of the revised curriculum (DES, 1999b; 1999d)) except infant classes. In the 6th class syllabus for syllabi for science and geography there are 21 strand units. (Two units, Environmental awareness and Caring for the environment are in both syllabi). The strand units, Plants and Animals, Environmental awareness, Caring for the environment, Rocks

and Soil, Weather, The local natural environment could be considered as nature-orientated. Therefore, c. one quarter of the units are devoted to nature themes and out of a 64-hour time allocation for all units, nature-orientated ones should receive an allocation of c.16 hours annually or be taught at least once a fortnight assuming a lesson lasts c. 30 minutes. (This question could be worded better-the length of lesson was not specified). Twenty-seven percent of teachers taught nature at least once a fortnight and 21% at least once a week. If c. half an hour is taken as a lesson period, then nearly half the teachers are allocating adequate time for nature-orientated teaching).

Regarding the effectiveness of nature education in respondents' schools, (Item 4.9), 119 teachers offered suggestions on how it could be made more effective. Some of these suggestions referred to its *status* in the curriculum. See 6.8.2.1 above under the heading 'Curriculum' which captures some views of teachers regarding its status in the revised curriculum (DES, 1999a).

In Item 4.16, where teachers were asked to submit general comments about nature education and nature in general in primary schools, 17 submitted views that have relevance regarding the *status* of nature awareness, appreciation and education in the Irish primary school system.

Lack of emphasis on nature study:

Teachers commented about its low status in the new revised curriculum stating that this had implications for the holistic development of the child.

*'Absolutely needs to be given more priority if we are serious about the development of the whole child'. 'The immediate priorities in the schools now are the core subjects. Good work that schools do in this area [nature education] is rarely even commented on by inspectors'. *(See summary of WSE Reports below) '...the curriculum doesn't allow teachers to dedicate enough time to it'. 'I definitely think it is something we need to put more emphasis on-I would like to see this happen with a*

revised curriculum. *'I think that aspect [nature study] has been dumbed down since the introduction of SESE''*. *'I think it has taken a back seat in education for a lot of people*. *'It is under-valued massively*. *'More emphasis should be placed on it with more resources*. *'I feel there should be more emphasis in schools on nature studies and teaching children about the immediate natural environment around them*'.

Dilution in the curriculum:

They made references to the fact that a subject that was once a stand-alone one within education has now been allocated a slot in the science curriculum and as has been discussed in the previous section its status has diminished.

'I think a lot of it [nature study] has been lost in the Science Curriculum due to the addition of all the other strands'. *'It seemed to be more of a thing when I was in school-as in a stand-alone subject. Nowadays it is being studied as part of our SESE curriculum., so it is seen from a scientific nature rather than a subject in its own right*'. *'Nature education has been diluted through the years. Needs attention to re-engage children with their environment*'. *'Nature and nature studies have been placed on the back burner in Primary schools as more and more time given to other subjects. Curriculum developers and educators don't see the wonderful opportunities for learning that can be achieved through nature*'. *'Nature in general seems to have been largely forgotten when it is in fact one of our most important resources*'.

The revised curriculum:

The revised curriculum (DES, 1999b; 1999d)) was blamed for relegating nature education to a lesser status resulting in lesser scheduling on the timetable and present-day pupils being less informed about nature.

'The 1999 curriculum has without a doubt had a detrimental effect on nature studies. Pupils are less informed than we were in the past'. *This survey has reminded me how*

it has been forgotten'. 'Unfortunately, learning about nature is sometimes not as frequent nowadays due to an overloaded curriculum, a lack of time and lack of knowledge/in-service for teachers. This is a great shame as it is important for children to be aware of their surroundings and be at one with nature'. 'Very hit and miss. Often dependent on teacher-knowledge'.

'Good work that schools do in this area [nature education] is rarely even commented on by inspectors' (p.266 above).

*This researcher examined 220 WSE³¹ reports for the year 2014-15 (DES, 2016d) to ascertain if there was truth in this statement. Of the 220 reports examined less than half of the inspectors (45%) mentioned some aspect of SESE and possible engagement with nature. The SESE/engagement with nature theme was divided into the 12 categories in Table 6.10 and the number of references made to them in the inspectors' reports

Table 6.10

References Made to Engagement with Nature Theme in the Inspectors' Reports (N = 220)

Categories	No. of Inspectors (<i>n</i> = 97)
Environment (Local/Environmental Awareness)	37 references
Green School/Flag ³²	28 references
Grounds	13 references
School Garden	10 references
Field Trips	5 references
Habitats	2 references
Nature	3 references
Living Things	1 reference
Biodiversity	1 reference
Plant and Animal Life	1 reference
Wildlife Garden	1 reference
Green Agenda	1 reference
Planting	1 reference

Note. The total comes to 104. Some inspectors referred to more than one of above in their reports.

³¹ Whole School Evaluations (WSEs) are carried out in primary and post-primary schools. During these inspections, the inspectors evaluate the quality of the school management and leadership, the quality of teaching, learning and assessment, and the school's own planning and self-review (<https://www.education.ie/en/Publications/Inspection-Reports-Publications/Whole-School-Evaluation-Reports-List/>)

³² An awards-programme for schools and Colleges that protect the environment. The programme awards 8 flags: Litter & Waste; Energy; Water; Travel; Biodiversity; Global Citizenship 3 flags).

SESE was assessed in a few (12%) of the schools ($N=220$), (compared to 24% for English, 23% for Irish, 23% for Maths 13% Arts, 3% P.E., 2% SPHE).

‘Environment’, ‘Field Trips’, ‘Green School/Flag’, ‘Grounds’ are assumed to refer to nature engagement, but this assumption could be erroneous as they could refer to some other components of SESE such as history or sustainability. ‘Environment/Environmental Awareness’ and ‘Green Flag/Green School’ could refer to waste, water and energy reduction, and global citizenship which have minimal connection with nature engagement. The Green School Scheme covers biodiversity as a theme, but this term was found only once in the reports. The other categories: ‘School Garden’, ‘Habitats’, ‘Nature’, ‘Living Things’, ‘Biodiversity’, ‘Plant and Animal Life’, ‘Planting’ and ‘Wildlife Garden’ definitely refer to nature engagement. These categories constitute 20/104 or 19% of probable referrals by inspectors to nature in their reports. These aspects of nature were mentioned only once in the specific reports; therefore, it can be deduced that 20 inspectors out of a total of 220 (9%) alluded to a nature category in their WSE reports relating to SESE. This finding implies that it has low status in the hierarchy of school subjects.

6.9.1 Summary:

- The majority (68%) of teachers believed that ITE in nature was poor to fair.
- The majority of teachers taught about nature either once a month, once a term or never. A small number (21%) taught about nature once a week. As c. one quarter of strand units are nature-orientated nearly 50% of teachers are allocating adequate time to teaching nature.
- In general comments teachers remarked on the lack of emphasis on nature-education in schools, the lack of nature-education in senior classes, its dilution in the revised curriculum.

- WSE reports for a whole a year demonstrated that primary school inspectors did not place adequate emphasis on nature-education in their reports.

6.10 Conclusion.

In sum, what insights do the data captured from the questionnaires to practising primary teachers reveal about the state and status of nature awareness, appreciation and education in the Irish primary system?

1. Nearly 50% of the teachers ($N=219$) studied nature sometimes, seldom or never when they were pupils in primary school. The clear majority, 79%, attended primary school after the introduction of the new curriculum in 1971 (Curaclam na Bunscoile, 1971). This curriculum promoted the study of nature in the curriculum area, Social and Environmental Studies which incorporated history, geography, nature study/elementary science, civics. However, as discussed in 2.5 reports on the implementation of nature studies in the curriculum generally viewed this as inadequate with an over-reliance on textbooks to teach it and very little reliance on outdoor engagement with it (INTO, 1992; Inspectors, 1996). Nonetheless, the teachers generally studied it more often than the student teachers who attended primary school in the main after the implementation of the new curriculum in 1999 (DES, 1999a).

2. The majority of teachers and ITE students did not study nature outdoors frequently or very frequently as pupils in primary school. When they were brought outside, the school ground was the preferred location for engagement with nature by both the teachers' and ITE students' primary teachers. These grounds generally lacked biodiverse habitats such as ponds, hedgerows etc. for the study of nature. The three biggest challenges teachers faced regarding going outside to study nature with their pupils were: lack of time, lack of natural habitats on school grounds, lack of knowledge of flora and fauna. As discussed in paragraph one, teachers studied nature more often than ITE students when both groups

attended primary school. Even so, the students studied nature *outdoors* more often than the teachers.

3. The class textbook as a resource for teaching nature was predominantly used pre-1999; after 1999 real objects were favoured over textbooks; in the present decade the interactive whiteboard is the main resource used for teaching about nature. Nature tables were encountered in the classroom by the majority of teachers and student teachers when they were pupils. Fifty-three percent ($N=219$) of teachers still use them as a teaching resource.

4. Less than 50% of teachers expressed confidence concerning their teaching about fish, reptiles, amphibians, invertebrates, rocks, soil, hedgerow, pond, bogland and shrubs.

5. Most of the teachers (79%) engaged in ITE during the past 20 years when the revised curriculum was being taught in the Colleges of Education. Nearly half (47%) stated that they studied nature 'never' to 'sometimes' and most (88%) studied it outdoors 'never' to 'sometimes'. Most (68%) were of the opinion that their ITE prepared them inadequately for teaching children about nature.

6. Just over half of the teachers are engaged in school gardening. This corresponds with the findings relating to the student-teachers: over half of them engaged with school gardening when they were primary school pupils. Their knowledge about gardening was gained from arbitrary sources with three stating that they gained this knowledge in initial teacher education. The challenges they faced relating to school gardening generally corresponded with the challenges they faced regarding going outside to study nature with their pupils: most cited lack of time followed by a lack of knowledge of school gardening and a lack of a suitable garden. Safety issues and weather constraints did not feature in the top three barriers either for studying nature outdoors or gardening.

7. Regarding children's knowledge of nature just over half considered that it was poor to fair. In contrast, forty-seven percent thought it was good to very good. Nineteen per

cent considered that the teaching of nature in their schools was ineffective with 34% stating that it was neither effective or ineffective. These are conjectures and are not based on formal assessment.

8. The teachers provided an overview of the *status* of nature-awareness, appreciation and education in the primary system by giving an insight into what they perceived as its low status in ITE, the lack of CPD in this area, its dilution in the science syllabus and the lack of emphasis placed on it in the revised curriculum (DES, 1999a), the lack of suitable facilities on school grounds and the lack of school gardens to engage children outdoors. The primary school inspectors did not place a high emphasis on nature-education in their 2014-15 WSE reports.

9. Finally, the word-cloud in Fig. 6.10 gives an insight into teachers’ perceptions of nature. ‘Outdoors’, ‘Trees’, ‘Plants’ feature prominently in the cloud; many of the words relate to its effect on mental well-being; the words ‘science’ and ‘biodiversity’ and invertebrates (‘bugs’) are not conceptualised as ‘nature’ to any great extent.



Figure 6.11: Word-cloud of teachers’ conception of the word “nature”.

Comparing this word-cloud to the HS experts' word-cloud in Fig. 3.1 there are many similarities such as trees, plants, well-being, animals, outdoors, life. However, the teachers conceptualise it more at the spiritual and aesthetic levels because they offered such words as 'wonder', 'fascinating', 'harmony', 'creation' and 'humility'.

Chapter 7: Discussion of overall findings and conclusion

Let go, let fly, forget. /You've listened long enough. Now strike your note.

(Heaney, 1984).

7.1 Summary of progress made to date in achieving aims of the research

The main aims of this research are:

1. To explore the *state* of nature awareness, appreciation and education in the primary school system in Ireland.
2. To explore the *status* of nature awareness, appreciation and education in the primary school system in Ireland. These are the research questions that framed the research:
 - What levels of conceptual knowledge of the natural environment do Irish primary teachers and first-year initial teacher-education students (ITE) hold?
 - What levels of confidence do Irish primary teachers and first-year ITE students have relating to the natural environment?
 - What are primary teachers' experiences of and attitudes towards teaching about the natural environment especially in an outdoor context?
 - What is happening in Irish primary schools when children engage with learning about the natural environment?
 - How is teaching and learning about the natural environment weighted within the revised curriculum?
 - Why is engagement with nature not conducted frequently outdoors in Irish primary schools?

The six HS experts were interviewed in 2016/17 and their viewpoints are presented in Chapter four. The nature-knowledge questionnaire was administered in 2016/17 to 253 ITE students from two Colleges of Education. The results from this are presented and

analysed in Chapter five. The online questionnaire to 510 practising primary teachers in 137 schools was administered in 2016/17. The 219 valid responses to this from 104 schools were presented, analysed and discussed in Chapter six. In the same chapter 220 WSE reports for the academic year 2014/15 were analysed and discussed.

7.2 Have the aims been achieved?

The aims have been achieved in that the data which were presented, analysed and discussed in Chapters four, five and six illustrate that the state of nature awareness, appreciation and education in the Irish primary school system is low-quality and that the status is low-ranking.

7.3 How has the research contributed to new knowledge?

The state of nature awareness, appreciation and education within and without the Irish primary system since the introduction of the revised new curriculum (DES, 1999a) was examined to some extent by the inspectorate for primary schools in *Science in the Primary School* (2012), Varley et al. (2008), the Heritage Council (2010), O'Malley (2014), and Kilkelly, Lynch, Moore, O'Connell & Field (2016) and reports from TIMSS. *Science in the Primary School* (2012), Veale et al. (2008), reported issues relating to children's engagement with the plant and animal strand of the curriculum especially in the context of the outdoor dimension. They also focused on issues relating to children's knowledge of nature and engagement with it outside the classroom. *The Wild Child Quantitative Study* by the Heritage Council (2010) focused on children's lack of knowledge on nature topics and lack of exposure to outdoor nature. O'Malley (2014) examined the emotional and intellectual nature connectedness of children within the broad sweep of children's environmental education. Kilkelly et al, (2016) examined children's play in natural environments and recommended more access and more engagement with this form of play.

None of the studies above examined the state and status of nature awareness, appreciation and education in the primary system from the perspectives of a representative population of primary teachers, the broad nature-knowledge of a representative population of ITE students, the outsider viewpoints on nature education of HS experts and whole school evaluations of inspectors. The Heritage Council (2010) examined children's ability to identify insects, flowers and birds from the self-reporting of their parents; in contrast this study examines identification skills of ITE students regarding these aspects of nature, plus trees and mammals, but it also branches out into students' knowledge of food chains, adaptation of animals to their environment, conservation of species, and scientific knowledge of plants. It also explores the nature-richness of school grounds, the frequencies of engagement with outdoor nature-education in primary schools, the quality of ITE nature-education, confidence levels of teachers and ITE students re teaching nature, major influencers on their acquisition of nature-knowledge and the quality of resources used by the teachers to teach about nature. Therefore, this is a comprehensive study of nature awareness, appreciation and education in Irish primary schools.

7.4 Key Findings

The school-grounds which are home-bases for children's engagement with nature need to be made more nature-friendly. In the main, they lack biodiverse habitats such as native hedgerows, safe wildlife ponds, woodland edges, multi-varied meadows, wildlife gardens and native trees and shrubs for meaningful exploration of and engagement with nature-based activities. All the HS experts were critical of school-ground design. There is no comprehensive, detailed policy devised by the DES to embrace all of the above and more when designing new schools. The General Design Guidelines for Schools (2017a) state that 'The external landscape can also include "bio-diversity areas" *if required by the school*' (emphasis added).

ITE students' knowledge of nature relating to identification of common species, simple food-chains, adaptation of animals to their environment, habitats, and conservation and classification of species seems to be limited. Most of the ITE students scored between 36% and 48% of the total marks in the ITE questionnaire (D grade at secondary level assessment criteria; pass grade at third-level-6.2). Studying biology to Leaving-Cert level had only a small positive effect on these scores. Even though the majority came from urban backgrounds this had no bearing on results as there was no statistical difference in scores between urban and rural students. Most of the students did not feel confident about their subject content knowledge relating to nature. This knowledge was mostly learned from parents. The majority of them (73%) did not recall spending a significant amount of time studying nature in primary school and the majority (75%) were not brought outside frequently to study nature. In the main students' teachers at primary level used the textbook to teach them about nature (53%). Most students encountered a nature table in the classroom but their engagement with it was not ascertained (Section 5.5.1.8).

In ITE, the majority of practising teachers (68%) believed it was poor to fair and the majority of them (59%) did not recall going outside to study nature. The majority (60%) believed that engagement with nature occurred never to sometimes (Section 6.5.1.2).

Teachers studied nature more often than the ITE students when both cohorts were primary school pupils. The teachers reported that nature was learnt mostly from textbooks. (Most attended primary school pre-1999 curriculum). ITE students recalled studying nature more often outside than did the teachers.

Teachers seem to possess limited confidence in their ability to teach about rocks and soil, fish, reptiles, invertebrates, amphibians, shrubs, hedgerow, pond and bogland. Lack of time from an overloaded curriculum, lack of natural facilities on the school grounds and lack of knowledge of flora and fauna inhibit them from engaging their pupils more with the

natural world outdoors. The interactive whiteboard is the principal resource used by teachers to teach their pupils about nature. Half of the HS experts indicated that teachers' knowledge about nature was fair; two were of the opinion that they were weak at identification skills and knowledge of insects, molluscs and crustaceans; half of them suggested that their main strength was knowledge of birds. The majority of them deemed that older teachers were more knowledgeable than younger ones (Section 4.4.2).

School gardening is on the increase despite no overall policy or funding regarding this aspect of nature-education being provided by the DES. (Most of the ITE students engaged in this activity at primary level and over half the teachers engaged with it and all the HS experts witnessed it on their visits). The main challenges faced by teachers relating to this activity are similar to the challenges they face for not engaging with nature outdoors. It is generally carried on in an ad hoc basis with very few schools following a meaningful plan of work from infants to sixth which would result in cumulative learning on growing organic vegetables and cooking these. The sources of their knowledge are arbitrary: family members, books, personal knowledge, the organisation, SEED, the internet and colleagues. The HS experts considered that it was not well organised in the main (Section 4.6.2).

The majority of teachers deemed that children's knowledge of nature was poor to fair. Following from this, fewer than half considered that nature-education in their school was effective to very effective (Section 6.8.1).

In agreement with the teachers, most of the HS experts maintained that children's knowledge of nature was poor. Half of the them perceived that the main benefits for children of being connected to nature was that it contributed to their mental well-being and spiritual and aesthetic development, and also to their development as caring individuals. Half suggested that the most effective way to engage them with nature was to bring them outside, but all indicated that children did not venture outside often. All experts believed

the Green School scheme was a positive influence on children's engagement with nature. However, some proposed that there should be flags for nature awareness and school gardening (Section 4.7).

Nature awareness, appreciation and education seems to have a low status within the revised primary school curriculum as evidenced by teachers' comments, ITE and the WSE reports from the primary school inspectors (Section 6.9).

7.5 Recommendations

These are explored on three fronts: policy, practice and research.

7.5.1 Policy and Practice.

Educational policy is discussed under the headings of well-being, conservation of species, outdoor learning, school gardening, the Green School scheme, and nature-centric schools.

7.5.1.1 Well-being.

The Qualifications and Curriculum Authority (2007) stated that 'Personal wellbeing makes a significant contribution to young people's personal development and character. It creates a focus on the social and emotional aspects of effective learning, such as self-awareness, managing feelings, motivation, empathy and social skills.' (p.243)

Pupils' and teachers' overall well-being have been central issues in the Irish educational policy for the past decade (Darmody & Smyth, 2011; INTO 2012; OECD 2011; DES 2013; 2015; NCCA, 2017). However, even though various aspects of well-being are discussed in these reports there is minimal mention of children's immersion in nature as a possible contributor to their well-being. For example, in the INTO³³ (2012) discussion paper well-being initiatives focus on those embedded in the PE/SPHE

³³ The INTO has long been an advocate of nature-education in primary schools. They initiated the Caring for the Earth summer course programme in 1998 and promote it on their union magazine, In Touch.

curriculum: in the 19 recommendations for pupils' and teachers' well-being there was no reference made to the SESE curriculum and the potential of immersion in nature to heighten it. Neither is nature-immersion mentioned in the NCCA (2017) guidelines for Junior Cycle wellbeing.

As a backdrop to these reports, the positive mental, physical, spiritual, cognitive, creative, emotional and aesthetic effects of immersion in nature activities are well documented in Kellert & Wilson (1993); Ulrich (1984); Ulrich et al. (1991); Kaplan & Kaplan (1989); Kaplan (1995); Kellert (2002); Louv (2005; 2011); Williams (2017).

Given this orientation towards pupils' well-being, HS experts' views were ascertained on this dimension of children's development. All concurred that nature contributed to their mental and physical health and the majority believed that it enhanced their aesthetic and spiritual development (4.5.6).

Having nearby nature in schools would facilitate this immersion. Nature-rich school grounds are therefore essential. However, the experts all agreed that school grounds need to be made more nature-centric (4.6.1) and teachers reported that a lack of natural facilities on the school grounds was second to lack of time for not going outside to engage with nature (Figure 6.6).

Therefore, to facilitate good integrative practice to develop children's immersion in nature and contribute to their well-being(a); every primary school at least could have nature-rich school grounds with well-maintained wildlife zones, cultivation zones, and

contemplation zones in natural areas and (b); every educational institute engaged in ITE should have access to similar areas. (Figure 7.1 contains two photos of such areas).

The incorporation of nature-rich school grounds with a school-garden into the design of new schools should be obligatory in all plans and not optional as at present. ‘The external landscape *can also include* ‘biodiversity areas’ if required by the school.’ (DES, 2017, p. 35, emphasis added).



Figure 7.1: Left to Right: Contemplation zone in school; Biodiverse school ground. 2017, p. 35, emphasis added).

The World Health Organisation (WHO) defines health as: ‘A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (Constitution of the World Health Organisation, 1996). Bell and Dymont (2008) found in their broad-ranging review of literature on the health-giving aspects of well-designed green school grounds that the evidence demonstrated that not only did they contribute to all the components of the WHO’s definition of health but also to spiritual well-being. The contribution of green schoolyards to the elimination of stress in students was investigated by Chawla, Keena, Pevec and Stanley (2014). This evidence was corroborated by Keiz, Evans & Roderer (2015) from research on greening schoolyards in rural Austria.

However, in the Irish educational context the design of nature-rich school grounds receives little or no attention by education policy-makers: *Chief Inspectors’ Report*, 2016; *Action Plan for Education*, DES, (2016a); *Well-Being in Primary Schools*, DES, HSE, DOH, (2015). In the latter report, four key areas for underpinning a health-promoting

school are identified. One of these is the ‘Environment’ which as well as being warm, safe, well-kept, clean and tidy would also need to have ‘Plants & Trees’ (p.16). This recommendation could be expanded to include a detailed description of the trees and plants that contribute to well-being.

7.5.1.2 Conservation techniques.

Education and general awareness on the conservation of species has been found to be lacking in learners from the findings of this research so perhaps the class textbooks on science should incorporate more conservation techniques into pages focused on the strands Living Things and Environmental Awareness and Care. There could also be more emphasis on conservation of species in interactive board materials, the Green Schools’ programme for achieving the biodiversity flag³⁴, in CPD courses and in the SEAI and PDST support material.

7.5.1.3 Outdoor learning.

The evidence from the findings in this research and in general from Louv (2005, 2011); Dillon et al. (2005); Skar, Wold, Vegard & O’Brien (2016); Rickinson et al. (2004); Kilkelly, Lynch, Moore, O’Connell & Field (2016) demonstrate that children are not engaging enough with outdoor learning. Therefore, it would be beneficial for children’s development if outdoor education which is a policy of the DES was emphasised more in policies on well-being. Children could be brought outside for c. 15 minutes ‘walkabout’ a day irrespective of weather conditions to use all their senses to observe changes and views in their surroundings such as buds on trees, cloud formation, wind direction, birds etc. Immersion in nature as the most effective way to engage children with nature is

³⁴ Biodiversity is the fifth Green-Schools theme and aims to make participating schools more aware of the significance of our native plants and animals and also habitats. It fosters the creation of biodiverse habitats in schools and their localities.

recommended by half of the HS experts in Chapter 4 and by Mulder ten Kate in the next paragraph.

Mulder ten Kate (2011) advocating for children having direct experiences in nature rather than vicarious engagement with it (75% of Irish teachers reported that they use digital media to teach nature, 7.4.4) proposed that they engage with nature using all their senses in outdoor locations through a threefold process of initiation, immersion, and intimacy. The first process entails short, sensual experiences outdoors; the second entails repeated experiences directly with outdoor nature to strengthen their affinity with nature and develop their sense of wonder; the third entails developing a close respectful, caring, protective connection with organisms as a result of engaging with the first two processes.

7.5.1.4 School gardening.

School gardening connects children to the natural world and contributes to their well-being (Blair, 2009; NFER, 2010; Austin, 2016). Therefore, it should be strongly emphasised in educational policy. The findings show that it is gaining traction in Irish schools, but it seems to be carried out on an ad hoc basis. The findings offer no quantitative evidence as to how frequently it is engaged with outdoors. In order to offer advice to teachers and provide resources for them an organisation entitled 'SEED' was founded in 2010 to promote school gardening in Ireland. This organisation has devised a whole-school plan to engage all classes in the primary school from infants to 6th in diverse gardening activities with the objective that cumulative learning will occur if every class participates annually. If this plan which is available on www.schooleartheid.ie were recommended by the DES for all schools and funding provided to train teachers in its implementation school gardening would become more meaningful, more embrative and more aggregated. Presently, personnel from SEED provide training to whole-school staffs

through the Croke Park Hours programme.³⁵ However, this training is sporadic and only schools that are very interested in school gardening and its educational benefits avail of the training.

7.5.1.5 Green school scheme.

As discussed in 4.7, this scheme has gone from strength to strength with over 3,000 primary schools participating in it in the school year 2016-17. Nevertheless, the six HS experts provided thought-provoking suggestions on improving the scheme.

These ranged from the provision of flags for school gardening, outdoor nature-education, surveying and recording species, and nature awareness. They also recommended that when a flag is achieved, this should not be ticked off in a box and forgotten about when the achievement of the next flag becomes the school's goal. The requirements of the new flag should incorporate some elements of the previous flag. These suggestions could be incorporated into the policies of the Green School Scheme to enhance nature awareness, appreciation and education in Irish primary schools. If they were implemented the waste and energy themes would be enhanced in that the compost and leaf mould made by the schools would be used in the garden to grow vegetables which would education the children on the concept of 'food-miles'. The biodiversity flag would be enhanced by pupils recording species and learning how to identify them before learning about habitat enrichment.

7.5.1.6 Nature-centric schools.

In Section 4.5.5, Robert, one of the Heritage in School specialists, believed that the study of nature was too constrained within the SESE curriculum. He added that there should be a more holistic approach to engagement with it and that it should be linked in

³⁵ Croke Park Hours: An agreement made between teachers and the DES whereby teachers in primary schools agreed to work outside of school hours an extra 36 hours a year for various concessions.

with music, folklore, dance etc. As discussed in Section 2.5.3, this approach is advocated where it is suggested that nature could be integrated across all subjects or even made a discrete subject. Perhaps this integrative approach to engaging children with nature would enable teachers to have more time and space to teach it. (Lack of time is a major barrier for teachers engaging their pupils with nature outdoors and school gardening. See Sections 6.6.2.2, 6.6.2.3 and 6.7.4

In the review of literature in Chapter two this holistic approach was echoed by Pyle (2002), Louv (2005), Bonnett (2007), Littledyke (2008) and Weber (2013). However, the inspectors in primary schools who have a significant influence on what is being taught envisaged nature as being firmly embedded in the science curriculum and taught using ‘a scientific approach’ (*Science in the Primary School*, 2008, p.1) Later in the document they suggested that ‘teachers did not fully understand the key differences between “nature study” and implementing a scientific approach to the study of *Plant and animal life*’. (p.34, emphasis in original).

This rationalistic approach to teaching about plant and animal life was explored in depth by Littledyke (2008) when he suggested that the effective or cognitive domains of science education be integrated closely with the emotional or affective domains to facilitate meaningful learning. His view coincided with Robert’s in Section 4.5.5, when he called for direct experiences in nature to develop their aesthetic appreciation of it and link it to ‘affective activities involving art, creative writing including poetry, music and listening quietly to sounds to appreciate and them and to produce a sound map of the area’. The affective domain in the revised curriculum is discussed in Section 2.15.1.

As outlined in 7.8, this researcher did not become interested in nature in the primary school from pedagogies that adopted a mainly rationalistic approach. When I attended primary school in the fifties and early sixties the topic of nature was woven through the fabric of the curriculum: it was explored through language and maths, as a discrete subject

and as an outdoor homework assignment with a seasonal factor embedded in it. The teacher's two main resources were the interactive nature table and an identification chart divided into various habitats. The teacher therefore had very few resources, yet his methodology was successful. This was probably due to the fact that the nature-engagement happened almost daily, was geared to what was seasonally relevant and the pedagogic approach was both didactic and constructivist. Pupils constantly observed the plants and animals in their environment and shared their findings with the teacher and with each other. This was good practice and should be encouraged in schools.

There should be a policy in nature-centric schools that no student should leave sixth class without being able to identify all the common trees, plants and animals in the locality.

As discussed in Section 5.5.1.4, authors such as Bebbington (2005), Randler (2008), Stagg and Donkin (2015), Mohneke, Erguvan & Schluter (2016), and Robinson, Inger & Gaston (2016) advocated identification skills of common species among learners to facilitate a caring attitude towards the natural environment and learning about biodiversity, invasive plant-species, ecology and plant conservation. The majority of the HS experts considered that identification of species is an important skill. Identification skills are also advocated in the revised curriculum in science and geography (DES, 1999b; 1999d).

Before they leave primary school, all children should be able to identify and be familiar with eight common Irish trees, 16 common Irish wildflowers, 16 common Irish vertebrates, eight common Irish invertebrates (Ní Lamhna, 2009). She has devised a scheme to facilitate identification skills which should inform planning in SESE in all classes to contribute to cumulative learning in these skills by the time children finish in sixth class. If her plan were implemented throughout the school children, the objectives relating to identification of common species would be fulfilled.

7.5.2 Research Agenda

The examination of the relevant literature was broad-ranging for this study which was geared towards providing a back drop for investigating the overarching question: What is the state and status of nature awareness, appreciation and education in the Irish primary school system?

As outlined in Chapter 2 there is a paucity of research in Ireland on topics relating to education on the natural world. Therefore, because the possibilities for further research are broad, I will only touch on what I perceive as critical areas in this section. These are content knowledge of pedagogues, teachers' resources, comparison with other countries, children's, parents' and stakeholders' voices, and school gardening.

7.5.2.1 Content knowledge of pedagogues and pedagogical content knowledge

The importance of content knowledge and pedagogical content knowledge for a teacher's ability to engage with their pupils in a meaningful way has been highlighted by Darmody and Smyth (2016); Sabel, Forbes & Flynn (2016); Gittomer and Zisk (2015). The importance of possessing identification skills and plant-knowledge by pedagogues and learners is explored in Sections 4.5.4, 5.5.1.4, and 5.7 above. Therefore, it would be worthwhile to examine through research (a) the general content-knowledge of, and attitudes to the natural world of lecturers in ITE who teach the science domain of the curriculum (b) a broad spectrum of primary school teachers (c) the inspectors in primary schools.

7.5.2.2 Teachers' resources.

It was reported in 6.4.4 that the interactive whiteboard was the principal resource used by teachers to engage children with nature. Is this an effective resource for teaching this subject? What is the quality of the material used on these boards? A few teachers (12%) used books. What is the quality of the material in these books? These questions

could be addressed in future research because these resources are being presently used by teachers to engage children with nature.

7.5.2.3 A comparative study of nature education in other countries.

The OECD publishes every three years results of tests it administers to 15-year-old students on science, mathematics and reading. In 2015, the top results for science emerged from Singapore, Japan, Estonia, Chinese Taipei and Finland. Ireland ranked 19th out of 72 countries (Jackson & Kiersz, 2016).

It would be interesting to discover in a comprehensive review how the nature-knowledge and attitudes of Irish children in 6th class and/or students in first year ITE students compare to the nature-knowledge and attitudes of similar aged children and ITE students in these countries and in countries such as the Scandinavian ones where nature-education is perceived as effective. A similar type of comparison with pupils and students in the UK and Northern Ireland would be useful (Comparison with TIMSS is done in 5.8, p 236)

7.5.2.4 School gardening.

There has been no comprehensive study of school-gardening in Irish primary schools. Three masters' studies by Swindell (2009), Freeman (2017) and by Austin (2017) examined respectively the positive effects of using a school garden with special needs, primary teachers' experiences of using school gardens and integrated learning by the children in these gardens.

It would be useful to examine the quality of school-gardening across the country and to quantify what is happening to inform policy-makers about this relatively new teaching and learning phenomenon in the Irish educational system. Instances, too, of where it is successful according to established criteria for success such as whole-school and

community involvement would contribute to useful research especially at a time of curriculum reform in Ireland.

7.6 Limitations of this Research

Six HS experts dealing with the natural environment were interviewed and even though they were among the busiest and most popular and represented a broad geographical area there were five more who were equally busy according to the administrator of the scheme and data from them would have enriched this area of the research.

Data on the nature-knowledge of ITE students in two Colleges of Education were captured to answer the research question. There are three other colleges in the Republic, one dealing with ITE in an online context and the others providing face-to-face tutelage like the two colleges from which data were captured. This aspect of the research would have been more comprehensive and thorough if data on the nature-knowledge of their ITE students was captured from them.

It would have been useful, to hear *directly* the voices of the primary school children, (as advocated by O'Malley, 2014), especially those in the senior classes. For example, how would they like to see the school grounds designed? What aspects of nature are they most interested in? What is the source of their nature-knowledge? Which are they most knowledgeable about, nature in Ireland or nature outside of Ireland? How would they like to see school-grounds designed?

Research on parents' views on nature education would have supplemented the data captured in this research. Other stakeholders' views such as those of primary school inspectors, school principals, science lecturers in Colleges of Education and the NCCA would also have complemented the findings.

The questionnaire to practising primary teachers would have benefitted from better timing regarding its administration. It was initially placed online at the end of November

and the early days of December which is a busy time in primary schools. October would have been a more opportune time to have placed it online when teachers had settled into their schools and classes and were less tired.

7.7 A Reflexive Account of my Research Journey

Pillow (2003) and Malthouse, Roffrey-Barentsen and Watts (2014) discussing the sometimes interchangeability of reflexivity and reflectivity were in general agreement that the former concept related to personal intuitive reflection and that the latter dealt with personal reflection where there was also involvement with the outside social world. The reflexivity process outlined here will adhere to Pillow's (2003) description of the process of researcher subjectivity which focuses on: '...how does who I am, who I have been, who I think I am, and how I feel affect data collection and analysis' (p.176).

This self-reflexivity deals with my schooling journey and this journey's influence on the development of my interest in the natural world, my work-experiences and interests and their impact on this research, the effects of my engagement with the research process and research participants and my learning experiences from the overall undertaking (Oliver, 2004).

My journey into a life-long engagement with the natural world began in 4th class in a rural primary school in Whitegate, Co. Clare in the fifties. In 1954, after decades of low status within the primary curriculum due to the pervasiveness of cultural nationalism nature study was finally introduced as an obligatory subject. (See Chapter 3.7).

Mr. Pake Haran, our teacher in 4th, 5th and 6th class was passionate about the subject and engaged us with it on most days. His *modus operandi* was simple but effective: we were required as often as we wished to bring in objects relating to nature such as leaves, flowers, twigs etc. which we picked up on our way to school. These were deposited on a table in the classroom for exhibition and discussion. His only resources for identification

purposes were colourful habitat wall-charts produced by a commercial company and the answers to questions posed to us regarding the provenance of the specimens.

Our learning constituted the type of apprenticeship discussed by Lave and Wenger (1991). We were gradually initiated into the world of nature through a process identified by the above authors as 'legitimate peripheral participation' (p.29). As outsiders and newcomers in the learning process we moved slowly over a three-year period to a certain mastery of many concepts of nature in a community of practice. This was accomplished by listening to stories from the master, from members of the local community, from one another and by imitation. Lave and Wenger (1991) referring to this acquisition of knowledge from peers suggested that 'where the circulation of knowledge among peers and near-peers is possible, it spreads exceedingly rapidly and effectively' (p.93). One pupil became an expert on birds and could relate in detail to us and the master where goldfinches, yellowhammers, wrens etc. had nested in the local area.

The knowledge and the love of nature which I gained in this school has been down through the years 'The anchor of my purest thoughts, the nurse, /The guide, the guardian of my heart, and soul/Of all my moral being' (Wordsworth, 1798).

In ITE, we had no formal lessons on nature because it was a low-status subject. We had some informal lessons outdoors on tree and plant recognition and we were required to submit an optional project on trees.

There was an emphasis on teaching nature in the revised curriculum and a detailed syllabus was put in place (Curaclam na Bunscoile, 1971). Outdoor engagement with nature was encouraged, though few teachers opted to do so (See Section 2.10). From my own perspective, I relished teaching nature indoors and outdoors and to engage children with nearby nature I established the first school wildlife garden in an inner-city, socially disadvantaged school in 1984. The principal was very supportive of nature-based activities for the children and realised that these activities impinged positively on their social,

emotional, cognitive, creative, spiritual and physical development. As well as supporting the wildlife garden he agreed with me that the children should be brought out regularly to the countryside to experience nature away from the school setting. He facilitated this transformative learning by providing the school with its own mini-bus for transporting the children to various venues of outdoor educational interest such as the Wicklow mountains.

Because of the positive experiences I witnessed in this school regarding children's development due to engagement with nature I decided to become a CPD facilitator. From 1996 to the present I have presented hundreds of courses to practising teachers around the country, written two books and many articles to inform teachers about school gardening and nature and co-founded SEED, an organisation that supports school gardening.

In 2001, I began work in the Marino Institute of Education as a lecturer in SESE education. This work which I continued at until 2016 enabled me to interest over 2000 ITE students in nature. During this period, I also worked as a HS expert visiting c. 600 hundred primary schools around the country teaching thousands of children about nature.

As a result of my involvement with teaching nature within the confines of the revised primary school curriculum (DES, 1999b; DES, 1999d), of teaching it to ITE students and practising teachers and teaching it as a HS expert I hypothesised that the state and status of nature awareness, appreciation and education in the primary school system was generally inadequate so I decided in 2014 to enrol in the D.Ed. programme in Trinity College to test my hypothesis by engaging in research.

This programme enabled me to view the topic of nature in a much broader spectrum than the mainly scientific one I utilised at the beginning of my doctoral journey. Initially, I had intended to engage in research on the state and status of plant-science within the primary system. As I read the literature I realised that my focus was too narrow and technical, and that this topic provided limited scope for probing the fields of psychology, philosophy and relevant literary works.

Because of pursuing my research on the state and status of nature awareness, appreciation and education in the Irish primary system I am now able to provide empirical evidence for policy-makers such as the DES and NCCA to inform their planning for the new curriculum that is envisaged for SESE as well as SPHE. This evidence would suggest that there is a necessity for a reappraisal of education on the natural world within the parameter of the science syllabus of the present curriculum.

It is my intention in the future to publish a book and create a website on the teaching and learning of nature in the primary system to inform not alone policy-makers but also practitioners, parents and the general public because this doctoral journey as well as complementing my existing knowledge on this topic has enabled me to advance to a position of authority, mastery and expertise which would not have been possible had I continued in the role of a master practitioner, which in itself is a significant one and possibly as important as that of a researcher. (Gleeson, Sugrue and O'Flaherty (2017), unravel the tensions that exist between the roles of practitioner and researcher in ITE).

In general, I discovered that my hypothesis was supported, and I became somewhat discouraged by the lack of emphasis displayed by educational providers such as the DES and the DPS, regarding nature education. Nonetheless, I am encouraged by the efforts that are being undertaken outside of those stakeholders to promote and strengthen nature education such as an Taisce³⁶, Birdwatch Ireland, Organic Centres, the Tree Council of Ireland, ECO-UNESCO³⁷, the IWT³⁸, the Zoo, the IPCC³⁹, the National Biodiversity Data Centre, NPWS⁴⁰, SEED, some Education Centres, Burrenbeo Trust⁴¹, the Irish Forest School movement, The Irish Times, The Irish Independent and the Heritage Council. Most

³⁶ An Taisce is Ireland's National Trust. It is a charity which was founded in 1948 to preserve and protect the built and natural environment in the Republic of Ireland.

³⁷ ECO-UNESCO raises environmental awareness among the youth of Ireland.

³⁸ IWT (Irish Wildlife Trust) aims to conserve wildlife and the habitats they depend on throughout Ireland while encouraging a greater understanding and appreciation of the natural world and the need to protect it.

³⁹ IPCC (Irish Peatland Conservation Council) conserves peatlands for future generations to enjoy.

⁴⁰ NPWS promotes conservation of ecosystems and awareness of natural heritage and biodiversity issues.

⁴¹ Burrenbeo Trust: A Landscape Trust based in the Burren with the aim of connecting people to places so that they can care for them.

primary teachers, too, endeavour to promote nature-education in their schools but they are constrained by a lack of political will to support them, a lack of knowledge, an overloaded curriculum, lack of resources and its relatively low status within the curriculum.

Finally, Pádraic Fogarty in his recent book on the degradation of natural areas in Ireland, *Whittled Away: Ireland's Vanishing Nature* (Fogarty, 2017), praised local community groups and small organisations such as activists in the Burren and the Bog of Allen for most of the good news items relating to nature in the past twenty years. His final chapter, '*A future for wildlife and people*' offers hope for regenerating Ireland's wildlife and wild habitats but he added a cautionary note that this will not happen unless politicians join the conversation and adopt a long-term vision for ensuring their protection. In the *European Commission Public Opinion Report* (2015), for instance, an average of 31% of respondents from all EU countries cited lack of political will as the main barrier for not applying nature-based solutions in the areas in which they live. In Ireland, 35% of respondents cited lack of political will. (Nature-based solutions comprise parks, urban gardening, green walls etc.).

Nature-based solutions need to be included in education, too, for the improvement of the state and status of nature awareness, appreciation and education within the Irish educational system. Is the political will there to set this in motion?

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Appendices.

Appendix A

Granting of Approval Letters from Trinity College, MIE and Froebel College of Education

Trinity College:

Dear Patrick,

I am in receipt of your research ethics approval form and note that your supervisor has signed off indicating that no further action is needed on the part of the Research Ethics Committee. Therefore, ethics approval is granted for your project on condition that it is carried out as indicated on your approval application.

Should there be a change in your research project design you will need to apply again for ethics approval. You will be required to sign a statement on submission of your thesis to declare that the research was carried out using the design and methods approved.

Best wishes for the success of your project.

Kind regards,

Kristina Karpovas
Executive Officer at the School of Education
on behalf of Professor Stephen Minton
Director of Research

Appendix B

Participation Consent Form for Practising Teachers, HS experts and ITE students

Participant Information Leaflet for Teachers

Nature awareness, appreciation, and education in the primary school system. Researcher: Patrick Anthony Madden, Tuckmilltown, Straffan, Co. Kildare. School of Education, Trinity College, Dublin.
Supervisor: Dr. Colette Murphy.

You are invited to participate in this research project which is being carried out by Patrick Anthony Madden. Your participation is voluntary. Even if you agree to participate now, you can withdraw at any time without any consequences of any kind.

The study is designed to investigate nature awareness, appreciation and education in the Primary school system. It seeks to answer the question: What is the current status and state of nature awareness, appreciation and education in this school system?

If you agree to participate, this will involve you participating in an evaluative ... on the topic specified above.

The completion of this ... will be an individual task and will take approximately ...
There will be no risks involved in this because participants and institutions will be anonymous in any write-up of research.

You will benefit from this research because it's very relevant to your work with children in the primary school.

This research may benefit parents and children as well and also curriculum designers and the natural environment

Any information or data which is obtained from you during this research which can be identified with you will be treated confidentially. This will be done by (a) ensuring anonymity of participants. (b) anonymity of institution. The data will be kept by me at Tuckmilltown, Straffan, Co. Kildare and only my supervisor and I will have access to it.
Data from this research project may be published in future. The original recording and all copies will be available only to the present investigator.

For data protection purposes materials related to the study will be kept in a secure place in Tuckmilltown, Straffan, Co. Kildare which will be locked when researcher is not present.

If you have any questions about this research you can ask Patrick Anthony Madden at 0879028285 or email him at paddy.madden@mie.ie You are also free, however, to contact any of the other people involved in the research to seek further clarification and information. One of them is Dr. Colette Murphy the supervisor of this research.
Email: Colette.murphy@tcd.ie

By completing this ..., you are indicating that you are at least 18 years old, that you have read the participation information leaflet and that you agree to participate in this

Thank you for participating in this study.

Appendix C

Interview Guide for Heritage in School Specialists.

Paddy Madden is my name and I'm a Heritage in School Specialist like yourself. At the moment, I'm doing a D.Ed. in Trinity College on the topics of nature and nature education in primary schools. By taking part in this interview you will be contributing to data which will be used in my thesis. As a practitioner specialising in nature education your knowledge and experience will be invaluable in completing my research. The finished work will also inform your work in the future. You have read and signed the participation consent form but nevertheless I wish to state again that confidentiality is assured.

THEME 1: HERITAGE IN SCHOOLS SCHEME

Question 1:

Tell me about your involvement in the Heritage in Schools Scheme.

Probe 1: What activities do you mostly with children when you visit a school?

What do you do with them on a wet day?

Probe 2: What do you enjoy most about working in the Heritage in School Scheme.? What do you not enjoy?

Probe 3: How could the scheme be improved?

Probe 4: How do the children react to nature activities?

Probe 5: How did you yourself acquire your love of nature?

THEME 2: MOST EFFECTIVE WAYS TO ENGAGE CHILDREN WITH NATURE

Question 2:

Nature can mean many things. What does it mean for you?

Question 3

I'm interested in your views on aspects of nature and nature education which are written into the new revised curriculum. This includes plant and animal life, rocks and soil, environmental awareness and care and weather. What is your opinion the most effective way to engage children with nature?

Probe 1: What about textbooks, videos, TV, websites?

Probe 2: Presently nature and nature education are incorporated in the science and geography syllabuses. Have you any thoughts on this structure?

Probe 2: Have you any thoughts on teaching nature across subjects in an informal manner?

THEME 3: TEACHERS' KNOWLEDGE OF NATURE (Knowledge: being able to identify common plants, animals, rocks and soil, life-cycle and habitat knowledge, air and water knowledge, understanding of food-chains, plant-science, classification etc.)

Question 3:

Teachers teach nature through the Science and Geography syllabuses. Where would you place their knowledge of nature? Excellent, Very Good. Good. Fair. Weak. Following on from this what are their strengths/weaknesses?

Probe 1: What evidence have you to support this answer?

Probe 2: (If it's positive what factors cause this? In which aspect of nature are they most knowledgeable e.g. birds, mammals, rocks, soil, insects, plants, life-cycles, habitats, air and water, food-chains, plant-science, classification etc.

Probe 3: (If it's negative what factors cause this? In which aspect of nature are they least knowledgeable e.g. birds, mammals, insects, plants, life-cycles, habitats, food-chains, plant-science etc.

Probe 4: Do you perceive any difference between younger and older teachers' knowledge of nature?

THEME 4: CHILDREN'S KNOWLEDGE OF NATURE

Question 4:

You stated already that children love/dislike nature. Where would you place their knowledge of nature in general? Excellent. Very Good. Good. Fair. Weak. Following on this what are their strengths/weaknesses?

Probe 1: What evidence have you to support this answer?

Probe 2: (If it's positive what factors cause this? In which aspect of nature are they most knowledgeable e.g. birds, mammals, rocks, soil, insects, plants, life-cycles, habitats, air and water, food-chains, plant-science, classification etc.

Probe 3: (If it's negative what factors cause this? In which aspect of nature are they least knowledgeable e.g. birds, mammals, insects, plants, life-cycles, habitats, food-chains, plant-science etc.

Probe 4: What differences or similarities do you perceive between rural and urban children?

Probe 5: Have you come across a school or class where children were very knowledgeable about nature. Can you describe such a school or class and explain why you think this is so?

Probe 6: Have you come across a school where there was extremely limited knowledge about nature. Can you describe such a school or class and explain why you think this was so?

Probe 7: Some environmentalists suggest that children should be exposed to nature in the form of games and play only. What do you think of this approach? Should children be taught the names of plants and animals?

Probe 8: How would you characterise a child who is deeply knowledgeable about nature?

Probe 9: Which are they most knowledgeable about? Native species of plant and animal or non-native species?

THEME 5: BENEFITS OF BEING CONNECTED TO NATURE

Question 5:

Are there benefits to children when they are connected to nature? (By this I mean deeply knowledgeable about and attracted to nature) The RSPB define it as (a) Enjoyment of Nature (b) Empathy for creatures (c) Sense of oneness (d) Sense of responsibility.

Probe 1: Does it have implications for environmental activism in the future?

Probe 2: What effect does it have on mental and physical health?

Probe 3: What effect does it have on their spiritual and aesthetic awareness? (What I mean here is fostering a sense of awe and wonder and developing their sense of beauty)

Probe 4: How important is knowledge about nature i.e. being able to identify common plants and animals, life-cycle and habitat knowledge, understanding of food-chains etc.?

THEME 6: OUTDOOR LEARNING

Question 6 (a):

Nature immersion and education can be pursued indoors or outdoors. Are children in primary schools brought outside Very frequently? Frequently? Sometimes? Seldom? Never?

Probe 1: What have you seen happening that support this answer?

Probe 2: (If answer to above is negative). What are the reasons for not bringing children outdoors do you think?

Question 6 (b):

What kinds of outdoor education do you see happening most in schools? Outdoor trails? School gardening? Nature Walks? Visits to natural areas outside the school? Nature Games? Other?

Probe 1: What way is school gardening organised?

Probe 2: In what ways are the school grounds conducive to nature education?

Probe 3: How would you like to see school grounds designed in order to facilitate nature education? (mini-wood, pond, butterfly patch, wildflower meadow, native hedgerow, mini-beast habitats)

Probe 4: Have you ever come across a situation where the children were fearful of the outdoors?

THEME 7: ENVIRONMENTAL AWARENESS AND CARE

Question 7:

Does nature education have an impact on environmental awareness and care?

Probe 1: Should children be taught about the consequences of climate change? (Ask about ecophobia)

Probe 2: Is the Green Schools' initiative having an impact on environmental awareness and care throughout the school?

Probe 3: Does the size of school matter when it comes to judging its impact?

Probe 4: Can you suggest any improvements that could be made to the Green School initiative?

Probe 5: Are there any flag gaps? How about having a flag for nature awareness, school gardening?

Thank you most sincerely for your time. Have you anything else to add?

Appendix D
Nature-Knowledge Questionnaire to Students
Nature Questionnaire for pre-service teachers.

Year: B.Ed. _____ PME _____

Name of College which you are now attending

This is a questionnaire about your knowledge of plants and animals and their habitats (nature).

Section 1: Biographical details.

Section 2: Your experience of learning about nature.

Section 3: Your knowledge of nature. The questionnaire should take approximately

I do not want my work to be part of the research. Please tick if relevant.

SECTION 1: BIOGRAPHICAL DETAILS

Please circle the correct answer, tick box or write on line as directed.

1. Are you male or female?

(a) male

(b) female

2. Where did you grow up?

(a) urban community

(b) rural community

(c) both

3. In what years did you attend primary school? _____ to _____

4. In which county in Ireland was it situated?

If you were not educated in Ireland, in which country were you educated?

5. Which type of school was it?

- (a) urban
- (b) suburban
- (c) town
- (d) village
- (e) rural

6. Which of these subjects did you study up to Leaving Cert.?

- (a) Chemistry
- (b) Physics
- (c) Biology
- (d) Agricultural science
- (e) Physics & Chemistry
- (f) Geography
- (g) None of above

Did you study any of these subjects after the Leaving Cert? _____

If yes, which one(s) and for how long?

7. Which age group are you in?

15-19

20-24

25-29

30-34

35-39

40-44

SECTION 2: YOUR EXPERIENCE OF LEARNING ABOUT NATURE**1. Which one of these descriptors describe how you feel about your knowledge of nature (plants and animal life)?**

- (a) very confident
- (b) confident
- (c) neutral
- (d) unconfident
- (e) very unconfident

2. Which one of these two aspects of nature (a) plants (b) animals, are you more knowledgeable about? Circle (c) if you feel you are equally knowledgeable about both.

- (a) plants
- (b) animals
- (c) equally knowledgeable about both

3. When you attended primary school did you engage in school gardening?

- (a) Yes
- (b) No

4. When you attended primary school did you study nature

- (a) very frequently?
- (b) frequently?
- (c) sometimes?
- (d) seldom?
- (e) never

5. When you attended primary school did you go outside to study nature

- (a) very frequently?
- (b) frequently?
- (c) sometimes?
- (d) seldom?
- (e) never?

6. In which one of these places did the outdoor study of nature take place usually?

- (a) school grounds
 - (b) local park
 - (c) local river/canal
 - (d) not applicable
 - (e) other (Please specify)
-

7. When you attended primary school which one of the following resources did your teacher(s) mostly use to teach nature?

- (a) actual specimens
 - (b) websites
 - (c) class textbook
 - (d) videos
 - (e) other (Please specify)
-

8. Did you ever have a nature table in any class?



- (a) Yes
- (b) No

9. Which of the following, in order of importance, is the main source of your knowledge about nature? Place 1 in the most important source. 7 least important.

parent/guardian

relation

primary teacher

secondary teacher

books

television

internet

If none of the above, please specify

SECTION 3: YOUR KNOWLEDGE OF NATURE

1. Is this the leaf of the



- (a) silver birch?
- (b) oak?
- (c) elm?
- (d) willow?
- (e) don't know?

2. Is this the fruit of the



- (a) ash tree?
- (b) rowan tree?
- (c) willow tree?
- (d) sycamore tree?
- (e) don't know

3. Is this the leaf of a



- (a) rowan tree?
- (b) beech tree?
- (c) alder tree?
- (d) hazel tree?
- (e) don't know

4. Which one of these parts produces food for the tree using the sun's energy?



- (a) trunk
- (b) root
- (c) leaf
- (d) flower
- (e) don't know

5. Explain why flowering plants produce nectar.

6. Is this the fruit of the



- (a) beech tree?
- (b) ash tree?
- (c) rowan tree?
- (d) willow tree?
- (e) don't know

7. Is this the bud of the



- (a) elm tree?
- (b) silver birch tree?
- (c) ash tree?
- (d) sycamore tree?
- (e) don't know

8. Is this flower



- (a) a yarrow?
- (b) a daisy?
- (c) a buttercup?
- (d) a dandelion?
- (e) don't know

9. Is this flower a



- (a) a primrose?
- (b) a cowslip?
- (c) a meadow sweet?
- (d) a clover?
- (e) don't know

10. Which one of these is a root vegetable?

- (a) potato
- (b) spinach
- (c) parsnip
- (d) onion
- (e) don't know

11. Which of these is the fruit of a rose?



- (a) sloe
- (b) hop
- (c) haw
- (d) hip
- (e) don't know

12. Name the 5 main vertebrate classes (animals with backbones).

13. Supply 1 word which classifies these 4 animals? Woodlouse, lobster, crab, shrimp.

14. Which of these habitats is suitable for a woodlouse?



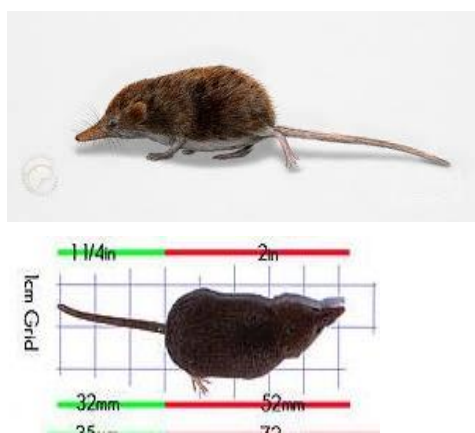
- (a) meadow
- (b) pond
- (c) rotting logs
- (d) lawn
- (e) don't know

15. Is a millipede a carnivore or an herbivore?

16. Supply 1 word which classifies the following animals: snail, slug, octopus, mussel.

17. Name 2 characteristics which distinguish amphibians from reptiles.

18. Name this animal.



- (a) stoat
- (b) pygmy shrew
- (c) field mouse
- (d) vole
- (e) don't know

19. Which one of these animals is the odd one out?

- (a) shark
- (b) whale
- (c) porpoise
- (d) dolphin
- (e) don't know

20. Which one of these animals hibernates in Ireland?

- (a) hare
- (b) squirrel
- (c) field mouse
- (d) hedgehog
- (e) don't know

21. Wasps have constructed a nest in the hedge near a gardener's rose garden. Should the gardener be

- (a) pleased  (b) displeased 

Please give a reason for your answer

22. Explain briefly why a spider is not an insect.

23. True or false? A common fly, a worm, a spider and a boy are animals.

24. Which species of crow is this?



- (a) rook
- (b) jackdaw
- (c) raven
- (d) magpie
- (e) don't know

25. Name 3 birds which migrate to Ireland annually.

26. Name this bird which resides in Ireland.



- (a) robin
- (b) chaffinch
- (c) jay
- (d) bullfinch
- (e) don't know

27. Construct a 5-part food-chain beginning with sun, leaf, snail, _____, _____.

28. Why do ladybirds hibernate in winter?

29. Give 2 reasons why earthworms are beneficial to the soil.



30. Which of these is the commonest rock in Ireland?



- (a) granite
- (b) sandstone
- (c) limestone
- (d) shale
- (e) don't know

31. Name 3 components of soil. _____, _____, _____.

32. Place the following into a 7-part food chain: heron, diving beetle, algae, sun, pike, tadpole and roach (fish). _____, _____, _____, _____, _____, _____, _____.

33. What is the name of this butterfly?



- (a) red admiral
- (b) small tortoiseshell
- (c) speckled wood
- (d) orange-tip
- (e) don't know

34. Which one of these butterflies uses nettles as larval food-plants?

- (a) meadow brown
- (b) speckled-wood
- (c) peacock
- (d) common blue
- (e) don't know

35. Construct a 7-part food-chain beginning with sun, leaf, aphid (greenfly)

_____, _____, _____, _____.

36. Which reptile is found living in the wild in Ireland?

37. Explain why a meadow is a useful habitat for the following animals:

Brown butterflies:

Amphibians:

Finches:

38. A giraffe is adapted to its environment by having a long neck to reach for leaves high up in a tree. It also has colourings that help to camouflage its presence. Name 2 ways in which any 4 of the following animals are adapted to their environment.

Camel _____

Whale _____

Duck _____

Eagle _____

Polar bear _____

Bat _____

Thank you for completing this questionnaire.

Appendix E

Online Questionnaire to Practising Primary Teachers

This is a questionnaire about Nature and Nature Education in the Primary School. Nature and Nature Education relate to Plants and Animals and their habitats, Rocks and Soil, Weather. It will take c.15 minutes to complete.

- 5 Part 1: The school you are teaching in at present.
- 6 Part 2: Your experience of learning about nature in primary school.
- 7 Part 3: Your experience of learning about nature in initial teacher education.
- 8 Part 4: Your experience of teaching nature.

Part 1: The School you are teaching in at present

1. What gender are you?

- Male
- Female

2. Which age group are you in?

- 21-30
- 31-40
- 41-50
- 50-65

3. Which class(es) are you currently teaching?

4. How many pupils are in your class?

- Boys
- Girls

5. How many children with assessed special needs are in your class?

6. Please indicate the size of your school.

- 200 pupils+
- 100-199 pupils
- <100 pupils

7. Is it?

- Urban
- Rural

8. In which of these school categories are you teaching in?

- Denominational
- Gaelscoil
- Gaelscoil sa Ghaeltacht
- Educate Together
- Community National School
- Steiner

9. Which type of school is it?

- Junior - single sex
- Junior - mixed
- Senior - single sex
- Senior - mixed
- Vertical

10. Is your school involved in Delivering Equality of Opportunity in Schools (DEIS)?

- Yes
- No

If yes, is it?

- Band 1 Urban
- Band 2 Urban
- Rural DEIS

Part 2: Your experience of learning about nature as a primary school student

1. In what years did you attend primary school?

2. Which type of school was it?

Urban

Rural

3. When you attended primary school did you engage in school gardening?

Yes

No

If yes, was school gardening done in one class or several classes?

One Class

Several Classes

4. When you attended primary school did you study nature? Choose one option.

very frequently (once a week)

frequently (once a fortnight)

sometimes (once a month)

seldom (once a term)

never

5. When you attended primary school did you go outside to study nature?
Choose one option.

very frequently (once a week)

frequently (once a fortnight)

sometimes (once a month)

seldom (once a term)

never

If you went outside in which one of these settings did the study of nature usually take place?

- school grounds
- local park
- local river/canal
- other

If other, please specify

6. Did you ever have a nature table in your school?

- Yes
- No

If yes, was it in one class or more than one class?

- One class
- Several classes

7. When you attended primary school which one of the following resources did your teacher(s) mostly use to teach nature?

- videos
- overhead projector
- class textbook
- other

If other, please specify

8. Please rank in order of importance the sources from which you gained knowledge about nature when you were in primary school with 1 indicating the most important one and 6 the least important.

- parent/guardian
- teacher
- television
- text books
- books
- radio

If none of the above, please elaborate.

9. Which one of these descriptors describes how you feel about your knowledge of nature?

- extremely confident
- very confident
- confident
- neutral
- not confident

If "not confident", please elaborate.

10. Which of these subjects did you study up to Leaving Cert.?

- Chemistry
- Physics
- Biology
- Agricultural Science
- Physics and Chemistry
- Geography

Did you study any of these subjects after the Leaving Cert?

- Yes
- No

If yes, which one(s) and for how long?

Part 3: Your experience of learning about nature in initial teacher education

1. Which category of student were you?

- B.Ed.
- H.Dip.
- PME
- UK trained

2. In what year did you enter initial teacher education?

- 1970-1995
- 1996-2016

3. In initial teacher education how often did you study nature?

- very frequently (once a week)
- frequently (once a fortnight)
- sometimes (once a month)
- seldom (once a term)
- never

4. In initial teacher education did you sometimes study nature outdoors?

- Yes
- No

If your answer is "Yes," was this done in

- College grounds
- Local park

If not done in any of these places, please elaborate.

5. How would you rate your initial teacher education as a foundation for the teaching of children about nature?

- excellent
- very good
- good

- fair
- poor

Part 4: Your experiences of teaching nature

1. Do you ever teach nature outdoors?

- Yes
- No

If your answer is "Yes" what outdoor locations have you used in the past year?

2. What features (if any) of your school grounds are suitable for nature study?

3. “To summarise, it seems that pupils enjoy working outside but they may be having fairly limited opportunities to engage in science in this context.” (Science in Primary Schools, Final Report 2008).

Please rank in order of importance what you consider to be the biggest challenges to going outside the classroom to teach nature with 1 indicating the most important one and 6 the least important.

- lack of knowledge of flora and fauna
- lack of time
- lack of confidence in bringing children outside
- safety issues
- lack of natural school facilities e.g. pond, field, hedgerow
- weather

What other challenges have you come across?

4. If you teach nature indoors do you mostly teach it using:

- plants and animals
- nature books
- textbook
- internet
- interactive whiteboard
- other

5. Do you keep a nature table in your class?

- Yes
- No

6. How often do you teach nature with your current class? Choose one option.

- at least weekly
- once a fortnight
- once a month
- once a term
- never

7. Please indicate how confident you feel about teaching the following aspects of nature. Please select the relevant boxes.

	Not Confident	Neutral	Confident	Very Confident	Extremely Confident
Identification of flowers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identification of trees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identification of shrubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mammals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Birds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reptiles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amphibians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Invertebrates	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rocks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Soil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gardening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hedgerow	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pond	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bogland	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Woodland	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. How would you rate children's knowledge of nature in general?

- excellent
- very good
- good
- fair
- poor

9. How effective in your opinion is nature education in your school? (Effective-children are well informed about plants and animals, rocks and soil, weather.)

- (a) very effective
- (b) effective
- (c) neither effective nor ineffective
- (d) ineffective
- (e) very ineffective

10. If your answer is (c), (d) or (e) how do you think it could be made more effective?

11. “Mixed messages about policy relating to learning outside the classroom are a barrier to garden use.” (Passy, 2014)

Have you ever taught about plants and animals using a school garden?

- Yes
- No

12. If school gardening is done in your school is it done in all classes according to an overall plan from infants to 6th?

Yes

No

13. Please rank in order of importance what you consider to be the biggest challenges to your involvement in school gardening with 1 indicating the most important one and 6 the least important.

- lack of knowledge of gardening
- lack of time
- lack of confidence in bringing children outside
- safety issues
- lack of suitable school garden
- weather

What other challenges have you come across?

14. If you teach school gardening, please specify the source(s) of your knowledge about school gardening.

15. What word comes to your mind when you think of nature?

16. Have you any general comments to make about nature education or nature in general in primary schools?

Note: By completing this questionnaire, you are indicating that you are at least 18 years old, that you have read the participation information leaflet and that you agree to participate in this survey.

Thank you very much for completing this questionnaire.