# Appendix I: Empirical Context

This appendix provides contextual information about the three studies which are the basis for this book. In each case we offer methodological details regarding sampling and data collection techniques, and describe the contexts in which fieldwork was conducted (information about school/university sites, outlines of lessons or courses observed and discussed with participating students).

## Rickinson Study

### *Methodological Details*

This study sought to address the following research questions:

- How are geography teachers teaching environmental curriculum topics to their Key Stage 3 classes (ages 11–14 years)? Why are they teaching in these ways?
- How are their students experiencing the subject matter-task aspects of these lessons?
- How are the teachers' and students' views of the subject-matter task aspects of such lessons similar and/or different?

The key methodological task was one of generating authentic accounts of teachers' and students' thinking about their teaching and learning during environmental geography lessons. To this end, the adopted methodology was qualitative, being small in scale (focusing on the teacher and four students from one Year 8/9 class in three successive schools) and grounded in approach (following an emergent methodology and a progressive focusing of substantive concerns). Features of particular importance included: a focus on classroom practice and students' and teachers' experiences of this; a concern to generate authentic accounts from both students and teachers; and recognition of the importance of researcher-research participant relationships.

The research comprised three sequential case studies (each in a separate school) of the teaching and learning of environmental subject matter within a small number of Key Stage 3 geography lessons. Each of these case studies involved spending around 2 months in the school attending all the geography lessons of the selected class/teacher (usually 2 per week) during the teaching or all, or part of, an environmental module.

The selected teachers represented a purposive sample of three geography teachers who were:

- Teaching what they perceived to be 'an environmental geography module' to a Key Stage 3 class
- Interested to be involved in such a research project
- Working in schools which were easily accessible.

The first criterion was clearly driven by the focus of the study, the teaching and learning of environmental geography subject matter at Key Stage 3. The second criterion reflected my belief that teachers with a genuine interest in my research would be the ones most likely to yield the rich insider accounts about practice that I was seeking. This was related to the desire to work with a small number of teachers. It also recognised the considerable time commitment that needed to be made by the participating teachers, which, it was felt, would be more realistic with genuinely interested individuals. The third criterion was related to the practicalities of carrying out a study which necessitated frequent school visits at varying times over a prolonged period.

The selection of the class that would be worked with, and the module that would be observed, was decided upon by the teachers in early discussions with me. The only stipulations were that it be a Key Stage 3 class, who were going to be taught what the teachers perceived to be an environmental geography module. As described in more detail below, the observed modules focused on: Tropical Rainforests (case study 1), Energy (case study 2), and The Impact of Development (case study 3). The selection of the student participants within each case study was carried out after the teacher had identified the class to be worked with. In line with the small-scale nature of the study, I decided to work with small numbers of students (four in each case study). The principal concern underpinning this was the importance of generating rich descriptive data from the students, which I believed would be facilitated by working with a smaller number. I was also conscious of wanting to have a number which could withstand pupils being absent from a lesson, or worse still, dropping out during the process.

The selected students in each case study represented a purposive sample of four individuals who:

- Had interacted with me during my early classroom visits
- Were interested to be involved in the study
- Were not uniform in terms of gender or teacher-perceived ability.

After the first case study, I also specifically tried to avoid selecting four individuals who, in my judgement (based on classroom observation, informal interaction with

the class, and discussion with the teacher), were all similarly positive and enthusiastic about their geography lessons. I was hoping instead for a mixture, so that there would be a greater chance of a variety of perspectives upon, and experiences of, lessons.

For each case study, the data generation methods included:

- Informal classroom observation and audio recording of lessons – this focused not only on gaining an audio record of each lesson, but also a written description of the teachers' and case-study students' actions and interactions and any other significant occurrences.
- Teacher and student lesson impression sheets – A4 sheets completed by the teacher and case-study students near or at the end of the observed lesson, which asked questions about their experiences of the lesson e.g. What did you enjoy in geography today? (student) and What did you feel went well in today's lesson? (teacher).
- Semi-structured student and teacher interviewing after lessons – these were characterised by trying to help the research participants to share their perspectives and experiences through creating a supportive atmosphere, grounding discussion in concrete lesson events, asking open-ended questions and then probing the meaning of their phrases and terminology, and concentrating on listening.

Analysis of the data involved detailed examination of the actions and interactions of the teacher and case-study students, particularly during those lessons where the subject matter was seen by the teacher to be issues-based as opposed to purely factual (termed 'issues lessons'). The analysis was based on lesson transcripts and observational field notes (pictures of classroom practice), as well as post-lesson interview transcripts (commentaries on classroom practice) (see Rickinson 1999b).


## *Fieldwork Context: Case Study 1*

The observed curriculum module in case study 1 was entitled 'Tropical Rainforests' and formed part of the school's Year 8 geography course. It constituted a study of 'the characteristics and pressures of a large ecosystem – investigating how physical and human processes interact to influence the character of the vegetation'. The entire module was designed to span 12 lessons over a period of 6 weeks. This was the first time that David, the teacher, had taught this module in this school, although he had taught about tropical rainforests many times before.

An idea of the overall shape of the module can be gained from Table 1, which is a copy of the teacher's plans for the module. This also shows which lessons took place during the research period, and which lessons were analysed in detail as examples of 'issues lessons' (see shaded rows).

The school was a voluntary controlled co-educational comprehensive (1190 students aged from 11–18 years) in a small rural market town. At Key Stage 3 Geography was taught as part of humanities in mixed ability groups.

**Table 1**　A summary of the rainforest module in case study 1

| Lessons | Questions | Activities |
|---|---|---|
| 1 (research) | What is the rainforest like? How is it interdependent? | Watch video and draw picture to show how animals, plants, vegetation, soil and climate are related |
| 2 (research) | How does a rainforest operate? Where are the rainforests globally, and in Brazil? | Add labels from 'How a Rainforest Works' sheet to pictures, do worksheet on Location of Rainforests |
| 3 (research) | What factors cause rainforest climate? | Worksheet questions on Rainforest Climate |
| 4 (research) | What are the climatic differences in Brazil? How does climate produce a rainforest? | Worksheet on 'Journey through Brazil' and 'Rainforests Climate' continued |
| 5 (research) | Who lives in the rainforest? How do the Kayapo live? | Watch Kayapo video and do diary or poem about life as a Kayapo |
| 6 (research) | How are the lives of the indigenous Indians changing? | Watch Emerald Forest film, completing 'story-board' whilst watching |
| 7 (research) | Continued | Continued |
| 8 | Continued | Finish watching Emerald Forest film, discuss and write about issues in the film |
| 9 | What is the history of the Amazon rainforest? Who wants to 'develop' the forest? | Emerald Forest final re-cap, worksheet on Developing the Rainforest (before and after a dam) – colour, cut and paste, and annotate |
| 10 | How are these activities destroying the ecosystem? | Developing the Rainforest sheet continued, and worksheet on impacts of other activities e.g. cattle ranching |
| 11 | Why is the forest being developed? | Watch destroying the Rainforest video, and draw poster in pairs to show what is going on and why |
| 12 | What do the various groups of people think about this issue? | Watch video 'The World this Week' about the Altimira Convention, and complete table about different groups' perspectives e.g. Kayapo Indians, cattle ranchers etc., then prepare in groups to role play one of these perspectives |
| 13 | Continued | Class role play of the Altimira Convention |
| 14 | End of module Assessment | |

## Fieldwork Context: Case Study 2

The module that was focused upon in case study 2 was a 7 week Year 9 module on Energy. This encompassed a series of 14 lessons (Table 2), of which the research period spanned from lesson 6 to lesson 12. While the teacher, Alison, had taught a Year 9 Energy module before, she explained that this was 'a bit different' as she had made a few changes, namely 'introducing a bit on developing countries' and

**Table 2**  A summary of the energy module in case study 2

| Lessons | Questions | Activities |
|---|---|---|
| 1 | What is energy? Why is it important? What types are there? | Written questions using textbook (connections) |
| 2 | How much energy, and what types, does the developing world use? What problems can this cause? | Watch video about Energy in Developing Countries, then written questions using textbook (Key Geography for GCSE) |
| 3 | What types of energy do we use in the United Kingdom? Where are different power stations located? Why? | Worksheet questions and mapping task |
| 4 | Where is Didcot? How is electricity made there? How does electricity reach us? | Worksheet exercise with local OS map |
| 5 | What environmental problems are caused by coal power stations? What is acid rain? How can it be reduced? | Written textbook questions about acid rain, then personal response to overhead transparency of acid rain-damaged trees |
| 6 (research) | What is global warming? | Complete several questions while watching video on global warming, then write paragraph about global warming |
| 7 (research) | What is nuclear power? What are the advantages and disadvantages of nuclear power? | Worksheet task on pros and cons of nuclear power, then writing own opinion of nuclear power |
| 8 (research) | What are the disadvantages of nuclear power? – case study Chernobyl | Writing a paragraph about Chernobyl following teacher-led introduction, written questions on Scottish farm newspaper article, writing of opinion on nuclear power |
| 9 (research) | What is Hydroelectric Power (HEP)? How does it work? What are the advantages and disadvantages? | Worksheet questions on HEP, followed by poster task about HEP |
| 10 (research) | What is alternative energy? Beginning individual enquiry projects into a type of alternative energy | Teacher introduction to the enquiry projects. Gathering information from "Energy Supply" CD-ROM |
| 11 (research) | Continued | Continued individual work using textbook and provided information sheets |
| 12 (research) | Continued | Continued individual project work (which were completed for homework over the half Term holiday) |

'removing the work on oil pollution and putting it into the Water module'. The issues lessons selected for more detailed analysis concerned nuclear power (lesson 7) and the Chernobyl disaster (lesson 8) (see shaded rows).

The school was a mixed, comprehensive upper school with 610 students aged from 13–18 years. Unlike the other two case-study schools, then, students joined

this school from feeder middle schools at the beginning of Year 9, rather than from primary schools at Year 7. It was located on the outskirts of a small sized city. In Year 9 (the only Key Stage 3 year in the school), geography was taught to all students in mixed ability groups.

## Fieldwork Context: Case Study 3

Case study 3 focused on a Year 9 module entitled 'One World'. It spanned 14 lessons but these were divided into two quite distinct sections: (1) Development and Interdependence (lessons 1–5); and (2) The Impact of Development (lessons 6–14). Details of the individual lessons of both of these sections are provided in Table 3, but it should be noted that all of the research undertaken within this case study occurred within the second section ('The Impact of Development'). The issues lessons

**Table 3** A summary of the one world module in case study 3

| Lessons | Questions | Activities |
|---|---|---|
| 1 | I: Development and Interdependence How do we show the countries of the world on a map? How do levels of economic development vary? How useful are indicators of development? | Mapping North/South divide data on world maps, undertaking work sheet on North–South differences, What is Development? worksheet |
| 2 | Continued | Continued |
| 3 | Do all countries have similar resources and opportunities? Are some countries exploited by others? What can we do about our responsibilities to other countries? | Play Oxfam's "Trading Game" |
| 4 | International trade is controlled by countries of the north – what effects does this have on people in the south? What can we do to encourage fairer trade? | Three-way carousel of group activities relating to fair trade issues e.g. looking at fairly traded products and how they are different from other products. |
| 5 | Continued | Written worksheet on world trade and fair trade issues. |
| 6 | II: The Impact of Development What is going on in the Amazon rainforest? Where is the Amazon? What is the rainforest ecosystem like? | Teacher-led introduction to human activities in Amazon using overheads, completion of world map of tropical forests, watch video about rainforests and annotate diagram of forest layers |
| 7 | What is the climate like in the rainforest? How does the ecosystem work? | Stimulus rainforest diary/story activity in groups, completing written fact-file on climate, group exercise to assemble and draw an ecosystem |

(continued)

**Table 3** (continued)

| Lessons | Questions | Activities |
|---|---|---|
| 8 (research) | What are the environmental effects of deforestation? What is the Carajas Project? What are my first impressions of this Project? | Teacher-led class brainstorm on the importance of tress, "Destroying the Balance" worksheet, watch brief video clip of Carajas Project and record initial impressions. |
| 9 (research) | What and where is the Carajas Project? What effects has the project had on the environment and the local inhabitants? How do I feel about this project? | Re-watch Carajas video clip, complete written factsheet about the project, watch pro-Carajas video, record own viewpoint, watch anti-Carajas video, record own viewpoint again. |
| 10 (research) | What different views are there on the Carajas Project? | Brief consideration in pairs of different views on Carajas (on overhead), role play preparation in groups of particular roles, and then in mixed groups |
| 11 (research) | Continued, and How do I feel about this project? | Continued role play preparation, and then videoing of each group's performance, whole class watching of the video of all groups, final recording of own viewpoints. |
| 12 | What effect has rainforest development had upon local inhabitants? | Watch video and complete worksheet about "The Yanomami – The Dying Tribe", completing summary diagram of impacts upon people and the environment |
| 13 | End of Module Assessment | |
| 14 | Continued | |

selected for more detailed analysis were those relating to the Carajas Project, lessons 9–11 (see shaded rows).

This school was a large, mixed comprehensive (2000 students aged from 11–19 years) in a rural market town. Geography was taught in mixed ability groups as part of humanities, along with successive modules of history and religious studies.

# Hopwood Study

## *Methodological Details*

Several classroom- and non classroom-based techniques were used to generate data. The former consisted of: loosely structured semi-participant classroom observation; photocopying pupils' written work; and post-lesson interviews. Two of the four non

classroom-based techniques involved talking to pupils about images and how they relate to school geography. In self-directed photography pupils took photographs using disposable cameras, while images were chosen by the researcher in the supplied photo elicitation technique. Images were replaced with researcher-supplied questions in the geographical questions technique, and a concept mapping task was developed in which pupils considered links between topics they had studied. All case pupils participated in all non classroom-based techniques once, and attended between seven and nine post-lesson interviews. Further details of these techniques are given in Hopwood (2006).

The 3-year timeframe for completion of this study was a constraining factor and meant that fieldwork could not be conducted in more than three sites, especially given the requirement to undertake analysis between sites. Three different school sites brought with them different departments, schemes of work, and teachers, and thus different lesson contexts. The sampling of teachers and schools was determined by criteria set out by the researcher. That of classes reflected practical constraints with respect to timetabling and teachers' wishes and may be described as opportunistic.

Criteria used to identify suitable sites focused more on individual teachers than school-wide concerns. During further piloting, lessons led by several different teachers were observed and used as contexts for one-to-one post-lesson interviews with over thirty pupils. When lessons involved large amounts of note-taking and/or textbook work, or strongly didactic whole-class teaching, post-lesson interviews were consistently more difficult and less effective. This seemed to be because pupils appeared to have less to talk about and there was much less variation in the sorts of comments they made about such lessons.

Conversely, lessons led by teachers who typically set up a variety of experiences within a lesson and who varied the types of tasks from lesson to lesson proved conducive to stimulating lively interactions with pupils and generating rich data. The decision was thus taken to select three teachers who tended to set up lessons in this way. The department through which this research was conducted has close links with schools, and Dr. Graham Corney (primary supervisor for this study) was able to recommend suitable teachers. Initial visits and two-week immersion periods in each class ensured that the chosen classroom contexts were as required.

Had different teachers been chosen, the post-lesson interviews would have focused on different experiences and thus to an extent the choice of teachers influenced the data generated. However post-lesson interview data differed within school contexts, demonstrating that this influence was only limited. The influence of teachers and teaching on pupils' conceptions was not a focus of this study.

All research was subject to the informed consent of the teachers, Heads of Geography and Heads of School involved, to whom a proposal was sent, and from whom a written replying giving consent was obtained.

In each site a Year 9 class was selected as the basis for lesson observation and from which two case pupils were selected. Year 9 was chosen as this is the final

year of compulsory geography study in England and thus pupils had the most experience of school geography before choosing subjects for GCSE.

In some cases teachers ruled out 'lower ability' or 'bottom set' classes. Although banding was not a sampling criterion the possibility that teachers might be less comfortable with researchers in their more challenging lessons was considered. Preference was given to classes whose lessons were in the mornings so that interviews could take place shortly afterwards during the lunch break. At Springfield school geography classes were not streamed, and the choice of class reflected timetabling, while at Belmont and Cedar Grove schools pupils were streamed in geography, and both the teachers and timetable influenced the choice of a 'middle' and 'top' set respectively.

Two pupils (one male, one female) were selected from the chosen class in each school in a process guided by ethical considerations and practical requirements regarding pupils' willingness and availability to participate. During a period of immersion in the classroom and through consultation with the teacher, pupils were ruled out of the study for the following reasons:

1. If they appeared ill at ease in interactions with the researcher during lessons
2. If the teacher advised that they would often not be free to attend interviews due to extra-curricular activities or the likelihood of having to attend detentions
3. If the teacher advised that they might feel pressure to give consent even if they did not want to participate.

This elimination stage followed a criterion-based sampling strategy, and resulted in a pool of around 20 eligible pupils, from which two pupils were selected at random (stratifying to ensure gender balance). Each time the first two pupils approached gave initial consent to participate.

Measures of ability or achievement did not factor in the selection of pupils in the present study, although (as shown below) these qualities did vary among the six case pupils. The aim was not to document learning, nor to identify misunderstandings or misconceptions, so notions of ability or achievement were thus less relevant. Furthermore pilot work, which involved 60 pupils from two 'mixed-ability' classes, did not suggest that pupils' ability or past achievement affect their conceptions of school geography. Rich data involving complex ideas were generated with some lower-achieving pupils, while some higher-achievers generated thinner data based around quite simplistic concepts.

The sampling of classes and the criteria used in sampling pupils may have favoured more 'able' or 'higher achieving' pupils. Information was gathered about the case pupils in this respect, after they had been picked and had agreed to participate. Lisa was among the top five in her class (both in geography and across other subjects), while Bart was described by his teacher as a 'lower-middle achiever' – as was reflected in his past grades. Both Sara and Matt were among the higher achievers in their 'middle set', achieving National Curriculum levels above average for their age. Jenie and Ryan were both selected from a 'top set' and both had attained high marks throughout Key Stage 3 in geography and other subjects, although Ryan's achievement was less consistent than Jenie's.

## *Fieldwork Context: Springfield School*

Springfield school is located in a small market town. It is a voluntary aided comprehensive co-educational secondary (11–18) school, drawing pupils from the town and surrounding rural areas. It is the only secondary school in the town, with around 1200 pupils. Attainment of pupils on entry is average and eligibility for free school meals and ethnic diversity are very low. The 2000 Ofsted report noted above-average attainment in geography and consistently 'good' or 'very good' teaching in the department.

   At the time of research the geography department consisted of three full time teachers (all with geography degrees), and one who taught geography and Physical Education (PE). The teacher involved in this research was Head of Year 9 and in his sixth year of teaching at the school (which he joined as a Newly Qualified Teacher). At Key Stage 3 pupils were taught in eight 'mixed-ability' classes of around 28 students. In the chosen class pupils sat in pairs; Lisa and Bart did not sit together. Springfield school was the site for Lessons A-H.

### Lessons A and B: Population Board Game

Pupils worked on a population board game task for two lessons, having previously studied population structures in the United Kingdom and Tanzania. The task was to create a board game that should explain the population problems either country faces, or encourage changes that would alleviate those problems. The format of the game was left open for pupils to decide.

### Lesson C: West Side Story

Pupils were shown a video clip of the song 'America' from West Side Story. A sheet was given out with the lyrics written out in full. Different pupils read them out, occasionally stopped by the teacher who asked questions about the story about migration being told in the song. While the clip was shown to pupils a second time, the teacher wrote instructions for four tasks, which pupils worked on for the remainder of the lesson: '(1) Briefly explain the song and say what is happening; (2) Say who likes and dislikes America; (3) Give three reasons why for each view; (4) Write what you think would happen to the migrants next'.

### Lesson D: Migration Timelines

An image was projected showing a group of people ('Vicky's family') being driven away from one place and drawn to another. The teacher asked what this was showing and what it had to do with the last lesson. After a discussion of the push and

pull factors which cause migration, pupils were given a sheet with a timeline showing when and why Vicky's family migrated. The teacher explained the diagram and asked pupils to construct 'their own timeline, either about their family, or about a made up person', including as many push and pull factors as possible; the location and timeframe were left open to pupils.

## Lesson E: Britain's Migration History

The lesson began with a discussion of public opinion about migrants living in Britain. The teacher described the aim of the lesson as to understand why there are so many migrants in Britain. Pupils were given a comic strip showing aspects of Britain's migration history. The 'myths' that migrants are responsible for unemployment and have no right to be in Britain were contrasted on this sheet with the 'truths', for example that migrants were invited to Britain and contribute to the present standard of living. Pupils' reacted strongly (but in different ways) to the sheet, and for the remainder of the lesson the teacher managed an impromptu debate on the issue.

## Lesson F: Weather and Climate

The teacher introduced a new topic – 'weather and climate' – and asked pupils what the two terms mean. He then explained the causes of global climate variations using a globe. The first task was to choose two images of different weather conditions from a selection displayed around the room and write five descriptive words about them. Pupils then swapped books and had to work out which image their partner had described. Having swapped their books back, pupils used the descriptors to write five sentences for each image.

## Lesson G: Tropical Climates

Pupils were asked to write 'Characteristics of climates in the tropics' in the middle of a fresh page in their books, forming the centre of a spider diagram. A video was shown during which pupils annotated their diagram with information about tropical climates, in terms of physical conditions and how people have adapted to those conditions. The final task was to shade tropical climate areas on an outline map of the world and, using an atlas, label six countries found within that zone.

## Lesson H: Global Climatic Variations

After a brief discussion of where tropical climates occur and what those areas are like (often rainforests), a video was shown, this time describing changes in climate as latitude increases towards desert regions. Afterwards pupils were asked about the

characteristics of deserts and to create a spider diagram similar to that they had done for tropical climates. The second half of the lesson focused on temperate European climates, and again pupils made notes on their characteristics in the form of a spider diagram. The final task was to shade in the desert and temperate zones on the outline map of the world (from the previous lesson), again identifying six countries in each.

## *Fieldwork Context: Belmont School*

Belmont school is one of three schools in a large market town. It is a comprehensive co-educational 11–18 school of around 800 pupils. Attainment of pupils on entry is average and both the proportion of pupils of non-white ethnic backgrounds and those eligible for free school meals are below the national average. The 2002 Ofsted report noted 'good' teaching and learning, and above average standards in geography.

At the time of fieldwork the geography department consisted of two full time teachers with geography degrees, although some lessons were taught by a member of the senior management team. The teacher involved was Head of Department, in her fifth year of teaching and her second full year at the school. Year 9 geography classes (six classes of 25 to 30 pupils) were banded into 'top', 'middle' and 'bottom' sets (a 'middle' set was chosen in this study). Pupils sat in pairs; Matt and Sara did not sit together. Belmont school was the site for Lessons I–O and Assessments A and B.

### Lesson I – Hurricanes in Haiti

As part of the topic 'Tropical Storms' and addressing the question 'What is happening in Haiti?' (the location of Hurricane Jeanne at the time), pupils used an atlas to find information about Haiti. A video was then shown, telling the story of a Haitian woman, her family, and the hardships they faced. The teacher then showed a report on the BBC News website about the impacts of Hurricane Jeanne. In the plenary discussion the teacher asked pupils why the hurricane had such devastating impacts. For homework pupils were asked to bake cakes or buns for a charity sale, the proceeds of which would be sent to help people in Haiti. (Matt was absent for this lesson but 'caught up' by borrowing a friend's book.)

### Lesson J – Hurricane Formation

This time asking 'How does a hurricane form?', the teacher talked through a 'recipe' for a hurricane which described the conditions and processes involved in its inception, development, and 'death' over land; pupils were asked to make notes during this time.

The task for the remainder of the lesson was to draw a cartoon strip of six boxes, explaining the life cycle of a hurricane. (Matt was absent for this lesson and covered the material in his own time.)

## Assessment A – Hurricane Ivan

The teacher gave details of an end-of-topic assessment in which pupils were asked to research Hurricane Ivan and to write a report following a guide provided by the teacher: (1) introduction – what path it took, how long it lasted, wind speeds; (2) explanation of how the hurricane formed; (3) details of how people were affected by the hurricane; (4) what safety measures people take, are some places better prepared than others? Pupils were given their marked assignments back with comments from the teacher at the end of lesson K.

## Lesson K – Responses to Hurricane Gloria

The final lesson on this topic asked 'How did people respond to Hurricane Gloria?'. The teacher explained that the purpose of the lesson was to classify the different responses of authorities, businesses and individuals. A newspaper report was read aloud and then pupils worked in pairs using three different colours to identify responses associated with each group. A second sheet formed the basis of the final task in which pupils worked individually, writing a paragraph about how the three groups reacted to the hurricane.

## Lesson L – Types of Rainfall

This lesson was a continuation of an unobserved lesson in which a new topic ('weather and climate') was started and processes and types of rainfall studied under the key question 'How does it rain'. The first 10 minutes were spent revising what had been taught the day before. For the remainder of the lesson pupils were asked to draw a diagram of one type of rainfall and write an explanation of how it occurs underneath.

## Lesson M – Rainfall in Britain

In reference to the question 'What is Britain's rainfall pattern like?' pupils were given an outline map of Britain and a textbook to help draw a choropleth map showing areas of high, medium and low precipitation. The teacher asked pupils what they noticed about the pattern and asked them to complete a series of sentences describing and explaining rainfall distribution in Britain. For the plenary task suitable locations were to be chosen for a fictional frog and cactus wanting to thrive in the United Kingdom.

**Lesson N – Climate Graphs**

The key question was 'Can I draw climate graphs?'. The teacher showed a climate graph using the overhead projector, and pupils read off various types of information from it. They were then asked to complete the sentence 'climate graphs show…' before sheets were distributed giving climatic data for London and Manaus (Brazil) so that pupils could draw a climate graph for each place.

**Lesson O – World climates**

This lesson was centred on the question 'What are the main world climates and what are their causes?'. An outline map of the world was given to pupils who were asked to mark on and identify four major climate zones and to match them with descriptions provided by the teacher. The teacher then asked what pupils thought causes different climates before giving out a second sheet showing the sun's rays 'hitting' different parts of the world in different concentrations. Once this had been explained, a video about each of the four main climates was shown, and pupils added information to their world maps describing the climate, vegetation, and people in each zone.

**Assessment B – Tornadoes**

The teacher set up project work which took place during two lessons and a homework slot. The lessons were in the computer room, and pupils were given a list of websites to help them find the necessary information. The task was to produce a poster, leaflet or booklet about tornadoes including the following points: a definition of a tornado; what causes them; what effects they have; pictures and diagrams; and a glossary of geographical words.

## Fieldwork Context: Cedar Grove School

Cedar Grove school is in Papford, formerly a small market town, now home to two large commuter estates. It is one of two comprehensive co-educational 11–18 schools in the town, and draws 1100 pupils from the town, estates, and surrounding villages. Eligibility for free school meals and pupil attainment on entry are below average and the proportion of children with statements is above average. The 2003 Ofsted report noted 'well above average' standards in geography across the key stages, summarising the department as 'very good'.

The teacher involved in this study was Head of Department, in her seventh year of teaching and at the time the only full-time geography teacher with a geography degree. Two members of the senior management team taught some geography lessons. Year 9 geography classes were banded into 'top', 'middle' and 'bottom' sets. The 'top' set selected in this study comprised a number of pupils who were previously in 'lower' sets due to the school policy of 'promoting some pupils for behavioural reasons'. Each of the Year 9 geography sets comprised between 20 and 30 pupils. In the chosen class pupils sat in groups of between four and six; Jenie and Ryan were in different groups. Cedar Grove was the site for lessons P to X and Assessment C.

## Lesson P – What Is Brazil Like?

Under the key question 'What is Brazil like?' pupils wrote a list of things they would like to find out about Brazil. After a class discussion, pupils were given an outline map of the country and the main task was to 'smother it with information' gleaned from atlases and worksheets. During the plenary pupils were asked: Is this what Brazil is really like? What problems/inaccuracies are there with this task? (Ryan was absent for this lesson.)

## Lesson Q – Debate About Deforestation in Brazil

This lesson followed a homework activity in which pupils were asked to research deforestation issues in preparation for a class debate. The big picture was 'Trees or Televisions?' and the key question was 'Does deforestation mean development or disaster?'. The starter activity involved a class discussion about effective arguments and debating. Then every pupil read out a short speech for or against deforestation after which they responded and made counter-arguments. The teacher set up the plenary activity and homework in which pupils wrote the main arguments from the debate on a poster.

## Lesson R – Sustainable Management of Rainforests

This lesson was entitled 'I can recognise sustainable ways to manage the tropical rainforest'. A discussion recalling points from the debate and clarifying the meaning of sustainability preceded consideration of different management strategies. Pupils read information sheets and selected one approach to summarise in their books. In the plenary pupils explained to the class how their chosen strategy worked and reasons for their choice.

**Assessment C – Brazilian Rainforests**

Pupils were given an assignment to complete over the vacation asking them to: explain why the Brazilian Government would want to deforest; name groups who exploit the rainforest and groups who oppose such activities and say why they do so; label a diagram illustrating the impacts of deforestation on people and the environment; outline local and worldwide arguments that arise; explain how they personally might have been involved in deforestation in Amazonia; and to describe two possible management strategies indicating who would support them and who would be affected. Finally pupils explained which they thought was the most suitable plan and how it might affect them.

**Lesson S – Self Assessment of Rainforest Assignment**

In this lesson pupils marked their own rainforest assignments. During the starter activity the teacher asked about what is required if a question asks you to describe, identify, explain, or predict. A guide to possible answers was given out although the teacher stressed that there might be valid alternatives. Pupils then identified two things they could do to improve their work and handed their assignments to the teacher.

**Lesson T – Defining Development**

The key question was 'What do we mean by development?'. In the starter activity pupils jotted down initial definitions of development. The main segment of the lesson involved pupils moving round in groups completing different activities at each table, writing what they had learned about development from each. The resources included an Oxfam appeals video, a series of photographs, sheets detailing working hours around the world, and articles about changes in Papford (the local town). The aim was to produce a more informed and refined definition of development at the end of the lesson (this formed the plenary activity).

**Lesson U – Measuring Development**

Under the big picture 'What is development?' and the key question 'How can we measure development?' pupils discussed in groups what development is, what others think, and why definitions differ. They then reported on their ideas and disagreements to the class. Pupils were given a sheet listing a selection of indicators used to measure development and were asked to rank them in order of importance, justifying their decisions. The main task was to produce a poster showing what development is and how it can be measured. In the plenary discussion the teacher asked about problems with measuring development.

**Lesson V – The Trading Game**

Instructions for a trading game were explained by the teacher. Each group of pupils represented a country and their aim was to produce as many paper shapes of particular dimensions as possible, depositing them at the 'bank' and earning money accordingly. Making such shapes required 'raw material' (paper) and 'technology' (pencils, a ruler, protractor and pair of compasses). Groups were given packs comprising 'raw materials' and 'technology' in different amounts, some finding they had ample supplies and others struggling to produce anything. In the plenary pupils recounted their experiences and the analogy with inequalities in global trading systems was emphasised.

**Lesson W – Banana Trade**

Within the big picture 'Trade and Development', two key questions were posed: 'Is the banana trade fair?' and 'What impact does this have on different groups of people?'. In the starter activity pupils were asked how they thought the profits from the banana trade should be divided. They were then given a printed statement from one of three banana growers. Pupils prepared a speech in which they were asked to 'put themselves in the shoes of their character and describe who they are, what they feel about the banana trade and how it affects them'. Pupils then told others on their table about their character before writing 'Bananas are our survival' as a title in their books for the final task. In this they wrote about the characters and responded to the title statement from three perspectives.

**Lesson X – Fair Trade Poster Picnic**

Pupils brought in Fair Trade products and were allowed to consume them in the lesson. The key question was 'Can Trade be Fairer?' and for the starter activity the teacher asked pupils what they would want to know about Fair Trade, writing their questions on a spider diagram on the board. Using a variety of resources, pupils spent the rest of the lesson working in groups producing posters about Fair Trade. During the plenary the teacher asked whether pupils would encourage their parents to buy Fair Trade products, and a range of views was offered by pupils. Homework was to explain Fair Trade to one of their parents and get them to write a written response for pupils to bring to class.

# Lundholm Study

## *Methodological Details of Doctoral Project*

Lundholm's doctoral thesis comprised three case studies, chosen with an interest in studying students' learning in environmental education in higher education, and were selected with a variation in the course *content*. This was seen as interesting

since previous research had mainly focused on learning in the natural sciences, and also because possible differences in the learning process due to content could be explored. The first case study focused on engineering students following a course in ecology which drew on a range of natural sciences. The second explored biology students' experiences of a course on 'Environmental control for biologists' in which a major assignment involved 'environmental auditing' relating to the social sciences and business and administration. The third case study, on doctoral students' interpretations of environmental research and the task of writing a thesis, was chosen because it involved both the natural and social sciences.

## *Fieldwork Context: Case Study 1*

The Royal Institute of Technology (KTH) is situated in Stockholm and is the largest institute of technology in Sweden, accommodating well over 17,000 undergraduate students. In 1999 an environmental policy and plan of action was put into effect at KTH. As a result the civil engineering programmes contain compulsory courses in either ecology, environmental science or environmental protection.

The compulsory ecology course consisted of twelve two-hour lectures, with the head teacher holding six of them, during the period of March to June 1999. Other teachers in the department held the remaining six lectures. The course also contained 'laboratory' group work and excursions. There were 100 students in the class and 91 of these took the final exam, ten of which subsequently failed. Parallel to the course in ecology the students studied general chemistry, and differential equations and transformations.

The content of the ecology course was as follows (in brief):

- Different parts of the ecosystem including soil (geology), water (hydrology), the atmosphere (meteorology), and living organisms (biology).
- The organization and function of the ecosystem, especially energy flows, the hydrological cycle and the chemical cycles.
- Ecology on an individual, population and social level, with special focus on the aspects of landscape ecology and the conservation of biological diversity.
- Human beings as part of the ecosystems and the effects of human activity.
- The use of ecological knowledge in contexts of planning and exploitation and ecological technology.

The aim of the course, as stated in the student handbook, was that the students acquire knowledge about ecological theories and principles and their connections to adjacent disciplines, and understand applications of ecological science in technology, planning and town and community building.

There were 100 students in the class, six of whom, two women and four men, were selected for interview. The interviews lasted between 50 and 70 minutes. Interview questions concerned (i) their reasons for studying an engineering programme and becoming a civil engineer, (ii) their conceptions of their first year at

university and the ecology course in general, (iii) what they had learnt and (iv) how they related the course content to their future profession.

## *Fieldwork Context: Case Study 2*

In the second case study observations were made of the lectures in a supplementary course at Stockholm University in 1998. Entitled 'Environmental control for biologists', the course was multi-disciplinary in character, adopting societal perspectives on environmental issues with lectures on politics, economy, environment and technology, environmental law and international environmental control. At the end of the course the students were offered five different themes to work with. In the case study reported, a group of four students, three women and one man, chose to work on a task on 'environmental auditing' and the use of 'environmental reports' in business. The students' group work was observed, hand-written notes were made of their activities and the discussions were tape-recorded. The work progressed over a three-week period.

## *Fieldwork Context: Case Study 3*

The third case study was conducted in 1999, also at KTH. Six postgraduate students, four women and two men, were interviewed concerning their environmental research, choice of topic and interest in pursuing postgraduate studies. Three of the students had just begun, or were in the process of planning for their postgraduate studies and the other three intended to present their licentiate thesis within the coming year. The interviews lasted between 60 and 90 minutes. All of the interviews were transcribed in full.

## *Methodological Details of Postdoctoral Project*

Also incorporated into this book are findings from a related postdoctoral project (2004–2007) which aimed at furthering understanding of the ways values play a role in learning and conceptual development. Based on previous findings showing how engineering students' were challenged by different views on nature (anthropocentric and ecocentric) when studying ecology, the assumption was made that economics students could equally find learning about the environment and ecology challenging due to their values and beliefs.

Interviews were conducted with students in a masters course on 'Sustainable Enterprising' with a focus on environmental business and management at Stockholm University. These students were of interest due to their mixed educational

background in biology and economics. They were either studying for degrees in economics or in biology and as part of their programmes took smaller component courses in biology/ecology or economics respectively. Within the group of 11 students, two had degrees in economics, and among the remaining nine students, four had studied at different inter-disciplinary environmental programmes (environmental communication, ecological economics, environmental and sustainability) and five had a degree in biology followed by courses in economics. Thus the group comprised of students who had first studied economics and then ecology, and vice versa.

All the students were interviewed individually. Interviews lasted between 45 to 60 minutes and were tape-recorded and transcribed in full. The following questions provided a general rubric for these interactions:

• Why have you chosen this masters course on Sustainable Enterprising?
• What is your professional and educational background?
• If you have a degree in biology or environmental science, what was your experience when entering the subject of economics?
• How do you perceive the relation between economy and environment?

# Appendix II: Development of the Lenses

This appendix describes in greater detail the processes through which the three lenses used in this book were developed.

## Introduction

The process described here began in 2004 when Lundholm and Rickinson first noticed similar issues emerging in their separate studies. These complementary findings have been reported elsewhere (Lundholm and Rickinson 2005, 2006; Rickinson and Lundholm 2008). Our empirical scope was soon widened to incorporate Hopwood's work (Hopwood 2006, 2007a, b, c, 2008, 2009).

Despite our excitement in looking across our separate studies to find common outcomes, we shared dissatisfaction with the mere reporting of complementary findings on students' experiences and learning. It struck us that there was more that could be said, and learned, from our studies. We felt instinctively that we each had something different to say about the three studies and what we could learn from them.

Our original studies reflected different key research interests in (1) emotions and values in learning (Lundholm), (2) students' conceptions of relevance in environmental education (Hopwood), (3) difference in viewpoints and relations between teachers and students in environmental education (Rickinson). These distinct areas of interest formed the starting points in the development of each lens, and continue to shape them. However the lenses have come to represent, and be informed by, much more than our original lines of inquiry and modes of questioning and analysis, as we demonstrate below.

## Empirical Focus

The first step in translating an individual interest into a useful conceptual device was to share our raw data so that we could review (question, analyse, interpret, make sense of) each other's transcripts in our own distinct ways. This process

involved exploring similarities and differences between data and findings, and meeting to discuss emerging ideas. We conceived our ways of approaching the material as looking at the same thing (students' learning and experiences) through different lenses: the metaphor represents ideas of bringing certain things into focus, offering different but equally valid ways of seeing something.

Over time the way we each looked at, interpreted and understood our own data changed as a result of engaging with the empirical material from the other studies. For example, Lundholm's original work focused on emotions and values as relating to the learner on a personal level, within an affective domain influencing student cognition and learning. The related lens is, however, broader, and also explores learners' views on values and opinions as part of subject matter. Lundholm has thus come to see new things in the empirical material she already understood in depth, and now sees traces of learners grappling with how to learn about values and opinions.

## Engaging Other Research on Environmental Learning

We were mindful that we had to attend both to processes of interpreting our shared data, and to the process of developing robust and useful conceptual tools. Indeed, these were mutually reinforcing, and neither could proceed without the other. An important means to refine each lens involved looking beyond our shared data to other research on environmental learning (remaining within our boundary of formal learning contexts). Looking at this wider corpus of studies through each lens enabled us to better understand where each applied, what it revealed, how it could be defined, what the important ideas and concepts were. As well as providing a mechanism to assist in conceptual development, this process also demonstrated their relevance and utility in making sense of a much larger body of research.

This can be exemplified in the context of the lens which looks at/for issues to do with relevance. In research explicitly aiming to understand the process or experience of environmental education, we found numerous references to issues of relevance. These included the reported desire among Australian learners for practicality and relevance in environmental learning (Connell et al. 1999), and the potential of (perceived) relevance of environmental learning as a means to address student disaffection in English schools (Battersby 1999). Engaging with such studies helped gain a broader sense of what relevance might mean in the context of environmental learning, and also helped us gather together a number of studies to which the lens could be applied. DiEnno and Hilton (2005) explored US high school students' interest in and attitudes towards particular (environmental) content, and Smith-Sebasto and Walker (2005) discuss learner reactions to environmental learning with reference to the affective domain. Studies such as these helped us clarify what the lens did and did not seek to explore, what concepts were most appropriate (e.g. relevance may relate to but does not equate to interest or attitudes).

# Engaging Wider Research and Theory

The conceptual clarity and power of the lenses were also enhanced by looking beyond empirical studies of environmental learning to literature of a more theoretical nature which was often related to other areas of learning (e.g. science, history) or generic (i.e. relating to learning in general) rather than specific to environmental education. The key ideas related to all three lenses are discussed in the chapter titled "Lenses for Understanding Environmental Learning", but we provide a more detailed example here with reference to the lens which looks at/for emotions and values.

Emotions have gained increasing attention in recent years, and have been investigated in different ways, as in students' anxiety in test situations, or in relation to metacognitive skills for dealing with learning tasks (Efklides and Volet 2005). The emotional aspect of learning also relates to motivation and students' engagement in schoolwork and instruction. With regard to the latter, there has been an increasing interest in understanding the ways motivation, emotions and values are an important part of the process of conceptual development and change (Pintrich et al. 1993; Watts and Alsop 1997; Sinatra and Pintrich 2003, Sinatra 2005). Scholars within this field, such as Watts and Alsop (1997), address this need in contrast to the model presented by Posner et al. (1982), which they find looks at the student and the process of learning as being too rational. The work by Claxton (1989) helped us see how we might conceptualise what learners are trying to do when looking at/for emotions and values in environmental learning:

> What they are 'up to' (in all senses) is the outcome of a tacit decision-making process based only on subjective estimates of competing priorities, opportunities, demands, resources and risks, which is, in their terms, sensible and vital. Only if the emotional/motivational factors in this decision permit or encourage intellectual learning and the subjective assessments are accurate, will achievement be limited by such cognitive factors as 'ability' or alternative conceptions. (Claxton 1989, p. 159)

Such literature helped us refine dimensions of the lens relating to questions about learners' emotions and values as part of the learning process. However the initial re-viewing of data across our three studies had pointed towards values and emotions as significant in another way: relating to learners' conceptions of values in subjects and subject matter. Our understanding of how we might look at/for values and emotions in environmental learning was informed by work on scientific literacy, which has explored learning about issues that link natural science and society (including global climate change). Scientific literacy has been discussed as an important aspect of enabling learners to take part in public debate or make justifiable decisions on scientific – often environmental – issues presented in media (Driver et al. 1996). We were able to situate what we had noticed in our original data as learners' reactions to values-rich subject matter in the context of work on scientific literacy, and in studies in which learners were found to distinguish the subjectivity of opinion with the objectivity of scientific knowledge (Zeidler et al. 2002).

## Reflections on the Process

The way we developed the three lenses is best thought of in terms of a number of inter-related processes rather than a step-by-step approach, because there was much iteration and oscillation between processes. This said, we had a clear starting point in the sharing of each other's raw data, and we would suggest this to be a fruitful beginning if others were to attempt a similar process in the future. Engaging with other empirical material, and re-engaging with your own, are complemented and supported by engaging with other studies (from within a particular bounded context – in our case environmental learning in formal contexts), and with literature from less directly related areas (as with reference to conceptual change and scientific literacy in the case of one of our lenses). One aspect that must be stressed is the collaborative nature of the exercise – regular meetings were crucial to help us understand each other's empirical material, verify interpretations, ask critical questions, point to relevant literature, and so on. The process we describe is one which inherently involves more than one person, so that the looking across data, other research, and theoretical literature is complemented by a variety of in-person perspectives.

Our work resulted in three distinct lenses being developed in the context of environmental learning in formal settings. We believe strongly that others might be created which make sense of formalised environmental learning in different – equally valid, useful, insightful – ways, and we would encourage others to build on the lines of enquiry and questioning they are familiar with to develop new lenses which can be used to look across and make sense of collected empirical work in other ways. We also acknowledge that our focus on formal settings excludes many less formal contexts in which environmental learning takes place. It may be that the lenses we have developed offer some purchase on a range of other learning settings – but we would argue that an iterative process of engaging with different empirical and theoretical fields would be likely to generate new lenses which look at or for other things in different ways. The power of the lenses comes from drawing on concepts and being informed by relevant scholarship and their application to contexts other than those in which they were developed. However we can imagine families of lenses which explore similar issues but which draw on the concepts and ideas most relevant to their context.

We now consider conditions that facilitated the processes described here, and in doing so point to some limitations in the scope or potential of similar work being repeated in different contexts. On a practical level, the ability to share and understand each other's raw data was crucial – we needed a common language (Lundholm's transcripts were translated from Swedish to English), and to furnish each other with sufficient methodological detail so we each knew how the data came about. For ethical reasons it was important to ensure any shared data were suitably anonymised. Furthermore, we have found the development of lenses to require considerable time in individual work as well as for face-to-face meetings. The multi-faceted, iterative, and collaborative nature of this type of work does not lend itself to speedy outcomes; indeed a slowness of pace may even be necessary to allow the full richness of the lenses and the range of literature (empirical and theoretical) to which they relate to be identified.

# References

Alexander P, Schallert D, Reynolds R (forthcoming) What is learning anyway? A topographical perspective considered. Educ Psychol

Ballantyne R, Packer J (2002) Nature-based excursions: school students' perceptions of learning in natural environments. Int Res Geogr Environ Educ 11(3):218–236

Ballantyne R, Packer J (2005) Promoting environmentally sustainable attitudes and behaviour through free-choice learning experiences: what is the state of the game? Environ Educ Res 11(3):281–295

Ballantyne R, Connell S, Fien J (1998) Factors contributing to intergenerational communication regarding environmental programs: preliminary research findings. Aust J Environ Educ 14:1–10

Banks F, McCormick B (2005) A case study of the inter-relationship between science and technology: England 1984–2004. Paper presented at the 15th International Pupil Attitudes Towards Technology (PATT) Conference, Haarlem, the Netherlands, 18–22 April

Barratt R, Barratt Hacking E (2008) A clash of worlds: children talking about their community experience in relation to the school curriculum. In: Reid A, Bruun Jensen B, Nikel J, Simovska V (eds) Participation and learning: perspectives on education and the environment, health and sustainability. Springer, London

Battersby J (1999) Does environmental education have 'street credibility' and the potential to reduce pupil disaffection within and beyond their school curriculum? Cambridge J Educ 29(3):447–459

Beane JA (1997) Curriculum integration: designing the core of democratic education. Teachers College Press, New York

Biddulph M, Adey K (2004) Pupil perceptions of effective teaching and subject relevance in history and geography at key stage 3. Res Educ 71:1–8

Bixler RD, Floyd MF (1999) Hands on or hands off? Disgust sensitivity and preference for environmental education activities. J Environ Educ 30(3):4–11

Bogner FX (1998) The influence of short-term outdoor ecology education on long-term variables of environmental perspective. J Environ Educ 29(4):17–29

Bonnett M, Williams J (1998) Environmental education and primary children's attitudes towards nature and the environment. Cambridge J Educ 28(2):159–174

Boyes E, Stanisstreet M (1994) The ideas of secondary school children concerning ozone layer damage. Global Environ Change 4(4):311–324

Boyes E, Stanisstreet M (1996) Threats to the global atmospheric environment: the extent of pupil understanding. Int Res Geogr Environ Educ 5(3):186–195

Boyes E, Stanisstreet M (1997) Children's models of understanding of two major global environmental issues (ozone layer and greenhouse effect). Res Sci Technol Educ 15(1):19–28

Brandt CB (2007) Using landscape to explore the relationships between epistemology and place in science. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, 9–13 April

Brody M, Tomkiewicz W (2002) Park visitors' understandings, values and beliefs related to their experience at Midway Geyser Basin, Yellowstone National Park, USA. Int J Sci Educ 24(11):1119–1141

Brook A, Briggs H, Driver R (1984) Aspects of secondary students' understanding of the particulate nature of matter. Children's Learning in Science Project, Centre for Studies in Science and Mathematics Education, University of Leeds, Leeds

Brooks C (2003) Investigating the geography behind the news. Teach Geogr 28(2):70–73

Bruner J (1960) The process of education. Harvard University Press, Cambridge, MA

Buehl MM, Alexander PA (2005) Motivation and performance differences in students' domain-specific epistemological belief profiles. Am Educ Res J 42(4):697–726

Chan KKW (1996) Environmental attitudes and behaviour of secondary school students in Hong Kong. The Environmentalist 16(4):297–306

Claxton G (1989) Educating the inquiring mind. Harvester Wheatsheaf, London

Claxton G (1991) Cognition doesn't matter if you're scared, depressed or bored. In: Adey P (ed) Adolescent development and school science. Falmer, London

Cobb P, Confrey J, Disessa A, Lehrer R, Schauble L (2003) Design experiments in educational research. Educ Res 32(1):9–13

Connell S, Fien J, Sykes H, Yencken D (1998) Young people and the environment in Australia: beliefs, knowledge, commitment and educational implications. Aust J Environ Educ 14:39–48

Connell S, Fien J, Lee J, Sykes H, Yencken D (1999) 'If it doesn't directly affect you, you don't think about it': a qualitative study of young people's environmental attitudes in two Australian cities. Environ Educ Res 5(1):95–113

Cooper P, McIntyre D (1993) Commonality in teachers' and pupils' perceptions of effective classroom learning. Br J Educ Psychol 63:381–399

Cooper P, McIntyre D (1996) Effective teaching and learning: teachers' and students' perspectives. Open University Press, Buckingham

Corney G (2000) Student geography teachers' pre-conceptions about teaching environmental topics. Environ Educ Res 6(4):313–329

Cotton DRE (2006a) Implementing curriculum guidance on environmental education: the importance of teachers' beliefs. J Curriculum Stud 38(1):67–83

Cotton DRE (2006b) Teaching controversial environmental issues: neutrality and balance in the reality of the classroom. Educ Res 48(2):223–241

Cullingford C (1994) The attitudes of children to their environment. Cambridge J Educ 24(1):7–19

Dettmann-Easler D, Pease JL (1999) Evaluating the effectiveness of residential environmental education programs in fostering positive attitudes toward wildlife. J Environ Educ 31(1):33–39

DfEE/QCA (1999) Geography: The National Curriculum for England, Key Stages 1–3. HMSO, London

DiEnno CM, Hilton SC (2005) High school students' knowledge, attitudes and levels of enjoyment of an environmental education unit on nonnative plants. J Environ Educ 37(1):13–25

Dillon J (2003) On learners and learning in environmental education: missing theories and ignored communities. Environ Educ Res 9(2):215–226

Dole JA, Sinatra GM (1998) Reconceptualizing change in the cognitive construction of knowledge. Educ Psychol 33(2/3):109–128

Dowgill P (1998) Pupils' conceptions of learning geography under the National Curriculum. Unpublished Ph.D. thesis, University of London

Doyle W (1986) Content representations in teachers' definitions of academic work. J Curriculum Stud 18(4):365–379

Driver R (1983) The pupil as scientist?. Open University Press, Milton Keynes

Driver R, Leach J, Millar R, Scott P (1996) Young people's images of science. Open University Press, Buckingham

Edwards D, Mercer N (1987) Common knowledge: the development of understanding in the classroom. Routledge, London

Efklides A, Volet S (2005) Emotional experiences during learning: multiple, situated and dynamic. Learn Instr 15(5):377–380

Elliot J (1995) Reconstructing the environmental education curriculum: teachers' perspectives. In: OECD (ed) Environmental learning for the 21st century. OECD, Paris

Emmons KM (1997) Perceptions of the environment while exploring the outdoors: a case study in Belize. Environ Educ Res 3(3):327–344

Entwistle N, Smith C (2002) Personal understanding and target understanding: mapping influences on the outcomes of learning. Br J Educ Psychol 72:321–342

Erickson F, Shultz J (1992) Students' experience of the curriculum. In: Jackson PW (ed) Handbook of research on curriculum. Macmillan, New York

Ertl H, Hayward G, Wright S, Edwards A, Lunt I, Mills D & Yu K (2007) The student learning experience in higher education. Literature review report for the Higher Education Academy. Accessed 10 November 2008 from http://www.heacademy.ac.uk/projects/detail/lr_2007_hayward

Estabrooks CA (2001) Research utilization and qualitative research. In: Morse JM, Sawnson JM, Kuzel AJ (eds) The nature of qualitative evidence. Sage, London

European Commission (2007) Towards more knowledge-based policy and practice in education and training. European Commission, Brussels

Falk JH (2005) Free-choice environmental learning: framing the discussion. Environ Educ Res 11(3):265–280

Farmer AJ, Wott JA (1995) Field trips and follow-up activities: fourth graders in a public garden. J Environ Educ 27(1):33–35

Fien J (1992) Education for the environment: a critical ethnography. Ph.D. dissertation, University of Queensland

Fourth International Conference on Environmental Education (2007) Moving forward from Ahmebadad … environmental education in the 21st century. Accessed 28 November 2008 from http://www.tbilisiplus30.org/Final%20Recommendations.pdf

Gayford C (1995) Science education and sustainability: a case-study in discussion-based learning. Res Sci Technol Educ 13(2):135–45

Gayford C (2004) A model for planning and evaluation of aspects of education for sustainable development for students training to teach science in primary schools. Environ Educ Res 10(2):255–271

Gee JP (2001) Identity as an analytic lens for research in education. Rev Res Educ 25:99–125

Goodlad J & Associates (1979) Curriculum inquiry: the study of curriculum practice. McGraw-Hill, New York, NY

Grace MM, Ratcliffe M (2002) The science and values that young people draw upon to make decision about biological conservation issues. Int J Sci Educ 24(11):1157–1169

Gutierrez de White T, Jacobson SK (1994) Evaluating conservation education programs at a South American zoo. J Envir Educ 25(4):18–22

Halldén O (1988) Alternative frameworks and the concept of task: cognitive constraints in pupils' interpretations of teachers' assignments. Scand J Educ Res 32:123–140

Halldén O, Haglund L, Strömdahl H (2007) Conceptions and contexts: on the interpretation of interview and observational data. Educ Psychol 42(1):25–40

Hart P (2007) Desires and resistances as drivers and barriers to environmental learning and sustainability: a Canadian perspective. In: Bjorneloo I, Nyberg E (eds) Drivers and barriers for implementing learning for sustainable development in pre-school through upper secondary and teacher education. ESD in action technical paper No 4. UNESCO, Paris

Heimlich JE (2005) Editorial. Environ Educ Res 11(3):261–263

Hopwood N (2004) Pupils' conceptions of geography: towards an improved understanding. Int Res Geogr Environ Educ 13(4):348–361

Hopwood N (2006) Pupils' conceptions of school geography: a classroom based investigation. DPhil dissertation, University of Oxford

Hopwood N (2007a) Environmental education: pupils' perspectives on classroom experience. Environ Educ Res 13(4):453–465

Hopwood N (2007b) Pupils' conceptions of geography: issues for debate. In: Halocha J, Powell A (eds) Conceptualising geographical education. International Geographical Union Commission on Geographical Education/Institute of Education, London

Hopwood N (2007c) Researcher roles in a school-based ethnography. In: Walford G (ed) Studies in educational ethnography, Volume 12: methodological developments in ethnography. Elsevier, Oxford

Hopwood N (2008) Values in geographic education: the challenge of attending to learners' perspectives. Oxf Rev Educ 34(5):589–608

Hopwood N (2009) UK high school pupils' conceptions of geography: research findings and methodological implications. Int Res Geogr Environ Educ 18(3):1–13

Hopwood N, Courtley-Green C, Chambers T (2005) Year 9 students' conceptions of geography. Teach Geogr 30(2):91–93

Huckle J (1994) Environmental education and the National Curriculum in England and Wales. Int Res Geogr Environ Educ 2(1):101–104

Hutchinson F (1997) Our children's futures: are there lessons for environmental educators? Environ Educ Res 3(2):189–201

Jensen B, Schnack K (1997) The action competence approach in environmental education. Environ Educ Res 3(3):163–179

Jovchelovitch S (2007) Knowledge in context: representations, community and culture. Routledge, London

Kaplan S (1985) Cognition and affect in environmental learning. Child Environ Q 2(3):19–21

Knamiller G (1983) Environmental education for relevance in developing countries. Environ 3(3):173–179

Kuhlemeier H, Van den Bergh H, Lagerweij N (1999) Environmental knowledge, attitudes, and behavior in Dutch secondary education. J Environ Educ 30(2):4–14

Kwan T, Miles J (1998) In the words of children and young people: the opinions and concerns about their environments of some Brisbane school students. Aust J Environ Educ 14:11–18

Kyburz-Graber R (1999) Environmental education as critical education: how teachers and students handle the challenge. Cambridge J Educ 29(3):415–432

Lai KC (1999) Freedom to learn: a study of the experiences of secondary school teachers and students in a geography field trip. Int Res Geogr Environ Educ 8(3):239–255

Lam C-C, Lai E (2003) 'What is geography?' In the eyes of junior secondary students in Hong Kong. Int Res Geogr Environ Educ 12(3):199–218

Leach J, Millar R, Ryder J, Séré MG (2000) Epistemological understanding in science learning: the consistency of representations across contexts. Learn Instr 10(6):497–527

Leeming FC, Porter BE, Dwyer WO, Cobern MK, Oliver DP (1997) Effects of participation in class activities on children's environmental attitudes and knowledge. J Environ Educ 28(2):33–42

Littledyke M (2004) Primary children's views on science and environmental issues: examples of environmental cognitive and moral development. Environ Educ Res 10(2):217–234

Lord P (2001) Pupils' experiences and perspectives of the National Curriculum: updating the research review 2000–2001. QCA, London. http://www.qca.org.uk/4831.html. Accessed 6 August

Lord P (2002) Pupils' experiences and perspectives of the National Curriculum: updating the research review 2001–2002. QCA, London. http://www.qca.org.uk/4834.html. Accessed 6 August

Lord P (2003) Pupils' experiences and perspectives of the National Curriculum: updating the research review 2002–2003. QCA, London. http://www.qca.org.uk/4836.html. Accessed 6 August

Lord P, Harland J (2000) Pupils' experiences and perspectives of the National Curriculum: research review. QCA, London. http://www.qca.org.uk/4828.html. Accessed 6 August

Lord P, Jones M (2006) Pupils' experiences and perspectives of the National Curriculum and assessment: research review. QCA, London. http://www.nfer.ac.uk/research-areas/pims-data/outlines/pupils-experiences-and-perspectives-of-the-national-curriculum-and-assessment-fourth-update.cfm. Accessed 13 October 2008

Lundholm C (2003) Att lära om miljö. Forskar- och högskolestuderandes tolkningar av ett miljöinnehåll i utbildningen/ Learning about environmental issues. Undergraduate and postgraduate students' interpretations of environmental content. Ph.D. dissertation, Stockholm University

Lundholm C (2004a) Case studies – exploring students' meaning and elaborating learning theories. Environ Educ Res 10(1):115–124

Lundholm C (2004b) Learning about environmental issues in engineering programmes. A case study of first-year civil engineering students' contextualisations of an ecology course. Int J Sustainability High Educ 5(3):295–307

Lundholm C (2005) Learning about environmental issues: undergraduate and postgraduate students' interpretations of environmental content. Int J Sustainability High Educ 6(3):242–253

Lundholm C (2007) Pricing nature at what price? A study on undergraduate students' conceptions of economics. S Afr J Environ Educ 24:126–140

Lundholm C (2008a) Discourse, cause and change: a study on economics students' conceptions of child labour. In: Öhman J (ed) Ethics and democracy in education for sustainable development: contributions from Swedish research. Liber, Stockholm

Lundholm C (2008b) Contextualisation and learning in economics: an intentional perspective on the role of values. Paper presented at the 6th International Conference on Conceptual Change, European Association for Research in Learning and Instruction, Turku, 22–25 August

Lundholm C, Rickinson M (2005) Exploring students' learning in environmental education. Paper presented at the Biennial Meeting of the European Association for Research on Learning and Instruction, Nikosia, 23–27 August

Lundholm C, Rickinson M (2006) I didn't really feel sorry for the trees, it was just something to write: exploring students' learning in environmental education. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, 7–11 April

Lundholm C, Hopwood N, Rickinson M (2008) Developing lenses for understanding environmental learning. Paper presented at the Annual Meeting of the American Educational Research Association, New York, 24–28 March

Lynch K (2003) Editorial: children's geographies versus adult curricula. Geography 88(3):161–163

Marton F (1994) Phenomenography. In: Husen T, Postlethwaite TN (eds) The international encyclopedia of education. Pergamon, Oxford

Mason L (2003) Personal epistemologies and intentional conceptual change. In: Sinatra G, Pintrich P (eds) Intentional conceptual change. Lawrence Erlbaum Associates, New Jersey

Mason L, Santi M (1998) Discussing the greenhouse effect: children's collaborative discourse reasoning and conceptual change. Environ Educ Res 4(1):67–85

McIntyre D, Peddar D, Rudduck J (2005) Pupil voice: comfortable and uncomfortable learnings for teachers. Res Pap Educ 20(2):149–168

McKenzie M (2006) Three portraits of resistance: the (un)making of Canadian students. Canad J Educ 29(1):199–222

Milton B, Cleveland E, Bennett-Gates D (1995) Changing perceptions of nature, self, and others: a report on a Park/School Program. J Environ Educ 26(3):32–39

Molander B-O (1997) Joint discourses and disjointed courses: a study on learning in upper secondary school. Unpublished Ph.D. thesis, Stockholm University

Morgan J, Lambert D (2005) Geography: teaching school subjects 11–19. Routledge, London

Myers M (2006) Environmental learning: reflections on practice, research and theory. Environ Educ Res 12(3/4):459–470

Nagel NG (1996) Learning through real-world problem solving: the power of integrative teaching. Corwin, Thousand Oaks, CA

Nagel M (2004) Lend them an ear: the significance of listening to children's experiences of environmental education. Int Res Geogr Environ Educ 13(2):115–127

Nagel M, Lidstone J (2008) Green doesn't always mean go! Children's conceptions of environmental education. VDM Verlag Dr Müller Aktiengesellschaft & Co KG, Saarbrucken

Nespor J (1987) Academic tasks in a high school English class. Curriculum Inq 17(2):202–228

Norman M, Harrison L (2004) Year 9 students' perceptions of school geography. Teach Geogr 29(1):11–15

Nutley SM, Walter I, Davies HTO (2007) Using evidence. How research can inform public services. Policy, Bristol

OECD (1995) Environmental learning for the 21st century. OECD, Paris

OECD (2007) Evidence in education. Linking research and policy. OECD, Paris

OECD (2008) OECD workshop on education for sustainable development, Paris, September 2008. http://www.oecd.org/dataoecd/52/1/41372200.pdf. Accessed 10 November 2008

Österlind K (2005) Concept formation in environmental education: 14-year-olds' work on the intensified greenhouse effect and the depletion of the ozone layer. Int J Sci Educ 27(8):891–908

Österlind K (2006) Emotionella faktorers roll i begreppsbildning/The role of emotional factors in students' concept formation. Research report no 73, Department of Education, Stockholm University, Stockholm

Palmer JA (1995) Environmental thinking in the early years: understanding and misunderstanding of concepts related to waste management. Environ Educ Res 1(1):35–45

Palmer JA (1998) Environmental education in the 21st century: theory, practice, progress and promise. Routledge, London

Payne P (1998) Children's conceptions of nature. Aust J Environ Educ 14:19–26

Pekrun R (2005) Progress and open problems in educational emotion research. Learn Instr 15(5):497–506

Pintrich PR, Marx RW, Boyle RA (1993) Beyond cold conceptual change: the role of motivational beliefs and classroom contextual factors in the process of conceptual change. Rev Educ Res 63(2):167–199

Pollard A (2003) Learning through life—higher education and the lifecourse. In: Watson D, Slowey M (eds) Higher education and the lifecourse. SRHE, Buckingham

Posner G, Strike K, Hewson P, Gertzog W (1982) Accommodation of a scientific conception: toward a theory of conceptual change. Sci Educ 66(2):211–227

Postman N, Weingartner C (1969) Teaching as a subversive activity. Dell, New York

QCA (2007) Qualifications and Curriculum Authority website: Geography key stage 3. http://www.qca.org.uk/qca_12212.aspx. Accessed 30 August 2007

Randler C, Ilg A, Kern J (2005) Cognitive and emotional evaluation of an amphibian conservation program for elementary school students. J Environ Educ 37(1):43–52

Reid A, Nikel J (2008) Differentiating and evaluating conceptions and examples of participation in environment-related learning. In: Reid A, Jensen BB, Nikel J, Simovska V (eds) Participation and learning: perspectives on education and the environment, health and sustainability. Springer, Dortrecht

Reid A, Scott W (2006a) Researching education and the environment: an introduction. Environ Educ Res 12(3/4):239–246

Reid A, Scott W (2006b) Researching education and the environment: retrospect and prospect. Environ Educ Res 12(3/4):571–587

Reid A, Jensen BB, Nikel J, Simovska V (eds) (2008) Participation and learning: perspectives on education and the environment, health and sustainability. Springer, Dortrecht

Rickinson M (1999a) The teaching and learning of environmental issues through geography: a classroom-based study. D.Phil. dissertation, University of Oxford

Rickinson M (1999b) People-environment issues in the geography classroom: towards an understanding of students' experiences. Int Res Geogr Environ Educ 8(2):120–139

Rickinson M (2001) Learners and learning in environmental education: a critical review of evidence. Environ Educ Res 7(3):207–317

Rickinson M (2006) Researching and understanding environmental learning: hopes for the next ten years. Environ Educ Res 12(3/4):445–458

Rickinson M, Lundholm C (2008) Exploring students' learning in environmental education. Cambridge J Educ 38(3):341–353

Rickinson M, Reid A (2003) What's the use of research in environmental education? Paper presented at the Annual Meeting of the American Educational Research Association, Chicago

Rickinson M, Robinson L (1999) Environmental education research in the classroom: a shared methodological reflection by the teacher and the researcher. Environ Educ Res 5(1):77–93

Rickinson M, Dillon J, Teamey K, Morris M, Choi M, Sanders D, Benefield P (2004) A review of research on outdoor learning. Field Studies Council, Shrewsbury

Roper Starch Worldwide (1994) Environmental attitudes and behaviors of American youth with an emphasis on youth from disadvantaged areas (ED 381 599). National Environmental Education and Training Foundation, Washington, DC

Rosiek J (2003) Emotional scaffolding: an exploration of the teacher knowledge at the intersection of student emotion and the subject matter. J Teach Educ 54(5):399–412

Sadler TD, Donnelly LA (2006) Socioscientific argumentation: the effect of content knowledge and morality. Int J Sci Educ 28(12):1463–1488

Sansone C, Thoman DB (2005) Does how we feel affect what we learn? Some answers and new questions. Learn Instr 15(5):507–515

Sauvé L (2005) Currents in environmental education: mapping a complex and evolving pedagogical field. Canad J Environ Educ 10:11–37

Schindler G (1993) The Environment and School Initiatives (ENSI). II: the conflict. Educ Action Res 1(3):457–469

Schnack K (2008) Participation, education, and democracy: implications for environmental education, health education, and education for sustainable development. In: Reid A, Bruun Jensen B, Nikel J, Simovska V (eds) Participation and learning: perspectives of education and the environment, health and sustainability. Springer, London

Schoenfeld AH (2004) Multiple learning communities: students, teachers, instructional designers, and researchers. J Curriculum Stud 36(2):237–255

Schommer M (1990) Effect and beliefs about the nature of knowledge and comprehension. J Educ Psychol 82(3):498–504

Schommer M (1993) Epistemological development and academic performance among secondary students. J Educ Psychol 85(3):406–411

School Council/Nuffield Humanities Project (1970) The Humanities Project: an introduction. Heinemann, London

Scott W, Gough S (2003) Sustainable development and learning: framing the issues. Routledge, London

Shanahan M, Meyer JHF (2006) The troublesome nature of a threshold concept in economics. In: Meyer J, Land R (eds) Overcoming barriers to student understanding: threshold concepts and troublesome knowledge. Routledge, London

Shapiro BL (1994) What children bring to light: a constructivist perspective on children's learning in science. Teachers College Press, London

Simmons DA (1994) Urban children's preferences for nature: lessons for environmental education. Child Environ 11(3):194–203

Sinatra G (2005) The 'warming trend' in conceptual change research: the legacy of Paul R. Pintrich. Educ Psychol 42(2):107–115

Sinatra G, Pintrich P (eds) (2003) Intentional conceptual change. Lawrence Erlbaum Associates, New Jersey

Smith-Sebasto NJ, Walker LM (2005) Toward a grounded theory for residential environmental education: a case study of the New Jersey school of conservation. J Environ Educ 37(1):27–42

Songer NB, Linn MC (1991) How do students' views of science influence knowledge integration? J Res Sci Teach 28(9):761–784

Southerland S, Sinatra G (2003) Learning about biological evolution: a special case of intentional conceptual change. In: Sinatra G, Pintrich P (eds) Intentional conceptual change. Lawrence Erlbaum Associates, New Jersey

Stanton G (2006) D&R programmes: concepts and practice. NERF Working Paper 5.6. National Educational Research Forum (NERF): London

Sterling S (2001) Sustainable education: revisioning learning and change. Green Books, Dartington

Sterling S (2004) The learning of ecology, or the ecology of learning? In: Scott W, Gough S (eds) Key issues in sustainable development and learning: a critical review. RoutledgeFalmer, London

Stevenson R, Dillon J (forthcoming) Engaging environmental education: learning, culture and agency. Sense, Rotterdam

Stradling R, Noctor M, Baines B (1984) Teaching controversial issues. Edward Arnold, London

Talbot P (2002) Geography... more than a job. Teach Geogr 27(3):140–142

TG-C Ivy, Lee CK-E, Chuan GK (1998) A survey of environmental knowledge, attitudes and behaviour of students in Singapore. Int Res Geogr Envir Educ 7(3):181–202

Thagard P, Zhu R (2003) Acupuncture, incommensurability, and conceptual change. In: Sinatra G, Pintrich P (eds) Intentional conceptual change. Lawrence Erlbaum Associates, New Jersey

Tilbury D (1998) The 'how' of environmental education. Environ Educ, Spring 1998:16–19

UNCED (1992) Agenda 21: the United Nations programme of action from Rio. http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter36.htm. Accessed 10 September 2008

UNESCO (1975) The Belgrade charter. A global framework for environmental education. http://portal.unesco.org/education/en/files/33037/10935069533The_Belgrade_Charter.pdf/The%2BBelgrade%2BCharter.pdf. Accessed 12 September 2008

UNESCO (1978) Intergovernmental conference on environmental education, Tbilisi (USSR) 24–26 October 1977. Final report. http://www.gdrc.org/uem/ee/EE-Tbilisi_1977.pdf. Accessed 12 September 2008

UNESCO (2005) United Nations decade of education for sustainable development (2005–2014): international implementation scheme. http://www.unescobkk.org/fileadmin/user_upload/esd/documents/ESD_IIS.pdf. Accessed 9 September 2008

UNESCO (2007) Highlights on Decade of Education for Sustainable Development progress to date. http://www.gaiaeducation.org/docs/Progress%20to%20Date%20JAN07.pdf. Accessed 12 October 2008

United Nations (1972) Declaration of the United Nations conference on the human environment. http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503. Accessed 28 November 2008

Uzzell D, Davallon J, Fontes PJ, Gottesdiener H, Jensen BB, Kofoed J, Uhrenholdt G, Vognsen C (1994) Children as catalysts of environmental change: report of an investigation on environmental education. Final report, European Commission, Brussels

Vare P, Scott W (2007) Learning for a change: exploring the relationship between education and sustainable development. J Educ Sustainable Dev 1(2):191–198

Wals A (1994) Nobody planted it, it just grew! Young adolescents' perceptions and experiences of nature in the context of urban environmental education. Child Environ 11(3):177–193

Wals A (ed) (2007) Social learning towards a sustainable world. Wageningen Academic Publishers, Wageningen

Watts M, Alsop S (1997) A feeling for learning: modelling affective learning in school science. Curriculum J 8(3):351–365

Wenger E (1998) Communities of practice. Cambridge University Press, Cambridge

Whatmore S (1999) Culture-nature. In: Cloke P, Crang P, Goodwin M (eds) Introducing human geographies. Arnold, London

Whatmore S (2003) Hybrid geographies. Sage, London

Williams K, Kalvin E (2007) Relevance in urban environmental education. Paper presented at the Annual Meeting of the North American Association for Environmental Education, Virginia Beach, 13–17 November

Zeidler DL (ed) (2003) The role of moral reasoning on socioscientific issues and discourse in science education. Kluwer, Dordrecht

Zeidler D, Walker K, Ackett W, Simmons M (2002) Tangled up in views: beliefs in the nature of science and responses to socioscientific dilemmas. Sci Educ 86(3):343–367

# Index

# Environmental Learning

**Mark Rickinson – Cecilia Lundholm – Nick Hopwood**

Unfortunately the Acknowledgements was missing in the printed/online version. The online version of the original article can be found under doi 10.1007/978-90-481-2956-0

---

---