RESEARCH

Improving the Understanding of Food, Farming and Land Management Amongst School-Age Children: A Literature Review

Justin Dillon, Mark Rickinson, Dawn Sanders, Kelly Teamey and Pauline Benefield

National Foundation for Educational Research and King's College London

The Countryside Agency

department for education and skills
creating opportunity, releasing potential, achieving excellence

Research Report RR422

Research Report
No 422

Improving the Understanding of Food, Farming and Land Management Amongst School-Age Children: A Literature Review

Justin Dillon, Mark Rickinson, Dawn Sanders, Kelly Teamey and Pauline Benefield

National Foundation for Educational Research and King's College London

ISBN 1 84185 988 5
May 2003

CONTENTS

Page

ACKNOWLEDGEMENTS

The research team would like to acknowledge the significant input made to this project by Information Specialists at NFER (Hilary Grayson, Lynne Harris, Alison Jones, Chris Taylor) and King's College (Jon Hunt). Their expertise in searching and cataloguing the literature was invaluable. The task of identifying relevant studies was also helped by many individuals and organisations who sent us details of recent research. Particular thanks are due to Tom Marcincowski, Florida Institute of Technology, and Daniel Desmond, University of California.

We wish to acknowledge Edith Rolfe who provided a wealth of useful background particularly for the historical section.

Special thanks are also due to a number of individuals at NFER: Ihsan Fatallah-Caillau (now at Sheffield Hallam University) for her help with the initial search activities early in the project; Sheila Stoney, for overseeing the management of this work; and Susan Stoddart for finalising the reports and for providing first-class administrative support throughout the project.

Finally, we would like to thank the representatives of the Countryside Agency, DfES and Farming and Countryside Education who provided support as members of the project's steering group.

EXECUTIVE SUMMARY

Introduction

The UK population depends heavily on the countryside for food, recreation, tourism and many other purposes. However, there is growing concern that significant proportions of the public have an inadequate understanding of many aspects of rural life. Public knowledge of environmental issues as they relate to the countryside appears to be poor. Young people's knowledge of how their food is produced and how it gets to their plate seems limited. The Policy Commission argues that 'the key objective of public policy should be to reconnect consumers with what they eat and how it is produced' (Policy Commission, 2002, p. 6). In drawing out key findings, we paid far greater attention to studies that did not show the weaknesses highlighted in Chapter 7.

In the light of such arguments, this report looks at what is known about young people's (3-19) views towards, and learning about, food, farming and land management. It draws together the findings of 190 pieces of research published internationally in English between 1960-2002. This review was commissioned by the Countryside Agency, the Department for Education and Skills (DfES) and Farming and Countryside Education (FACE). The study was carried out between November 2002 and April 2003 by a team from the National Foundation for Educational Research (NFER) and King's College London.

Key Findings

- In the literature reviewed, a range of major weaknesses was evident including: a lack of recognition of theories of learning or of links to broader conceptual frameworks; a general lack of validity or reliability; a lack of critical reflection and a lack of convincing evidence substantiating claims for better learning or improved attitudes resulting from teaching strategies.
- School-age students' knowledge and understanding about various aspects of food and farming appear to be poor.
- While young people are concerned about food issues such as genetic engineering, organic/local products, there is also evidence of ambivalence and confusion in students' views, and inconsistencies between attitudes and behaviours.
- For food and farming issues in general, some studies suggest that young people see these as less serious than other environmental issues such as ozone depletion and tropical deforestation.

- In several studies, levels of concern were found to differ between boys and girls, with girls attaching greater seriousness to issues such as food additives and pesticides, genetic engineering of farm animals, and the importance of organic/local foods.
- Young people's perceptions and experiences of the countryside are complex and varied: while some children can have a very positive attitude towards the countryside, others focus on the possibility of boredom and isolation in rural areas.
- The research on young people's knowledge and attitudes suggests that there is a strong case for improving teaching and learning about food, farming and land management.
- In terms of possible teaching strategies and learning activities, the current evidence highlights the potential of:

  - school visits to farms – which offer a wide range of learning opportunities in the affective and the cognitive domains
  - projects in school gardens and school farms – which can provide positive outcomes for young people, as well as developing a stronger community
  - other out-of-school learning associated with fieldwork, after-school programmes, camps, outdoor centres and supermarket visits
  - classroom-based curriculum strategies - such as teaching about controversial issues, electronic ('virtual') field trips and environmental games.

- Any teaching and learning initiatives need to recognise the complexity of young people's views and understandings.
- Research that provides insights into the factors that might impede or facilitate young people's learning about food, farming and land management highlights the influence of:

  - young people's emotions and attitudes, which can, for example play an important role in their learning about food production topics such as genetic engineering: affect their enthusiasm for hands on contact with mud and organisms; influence the planning and delivery of field-trip experiences; or present barriers to students being offered the experience of a farm visit
  - the ways in which teachers can help students to make connections between learning beyond the classroom and learning within the classroom
  - the impact of a young person's cultural identity on their learning needs in relation to out-of-school experiences.

- The research is rarely able to identify what aspects of a particular programme helped to yield positive impacts. In other words, while there is some evidence about the impacts of programmes, there is little evidence about programme effectiveness.

Aim of the Research

The aim of the review was to identify and appraise the extent and quality of research and statistical evidence relating to:

- school-age (3-19) children's knowledge of, and attitudes towards, food, farming and the countryside
- school-age children's learning about food, farming and land management in a range of contexts
- the impact of such learning on pupils' achievement, progression and other educational/behavioural outcomes (for all pupils and particular groups)
- how such learning experiences can be delivered most economically and effectively
- the factors that can impede or facilitate pupil learning about food, farming and land management in a range of contexts.

Background

The role of farms and gardens, whether in school or as a school journey experience, have been debated in this country for more than a century. Current government initiatives such as 'Growing Schools' and the proposed specialist Rural Schools are a part of this tradition. *'Schools and the Countryside'*, published by the Ministry of Education (1958), emphasised the importance that farm studies could bring to understanding 'the fundamental position farming occupies in the whole life and economy of even the most industrialised country' (p. 51). This report also emphasised the need for children to make several farm visits at different stages during their school life as their value was recognized as being cumulative.

The Policy Commission on the Future of Food and Farming, set up by the Prime Minister in August 2001, argued that 'the key objective of public policy should be to reconnect our food and farming industry … to reconnect consumers with what they eat and how it is produced' (2002, p. 6). This objective has implications for educational provision, both within and beyond schools.

The Policy Commission suggested a number of remedial strategies including better use of the media, labelling, the Internet, advertising, demonstration farms and exposure to schools. The need for schools to develop stronger links with farms was made explicit. The Government responded that it recognised

the importance of young people experiencing the 'outdoor classroom' and noted that 'children benefit from hands-on experiences of plants and animals, within school grounds, through visits to farms, woodlands or field study centres' (England. Parliament. HoC, 2002, p. 47).

Methodology

This study was designed to provide a comprehensive review of the main issues and barriers to improving the understanding of food, farming and land management amongst school-age (3-19) children by undertaking a systematic review of research on children's views towards, and learning about, food, farming and land management in a range of contexts. It involved critical analysis of research evidence published internationally between 1960-2002. The onus was on establishing not only what is known about these various issues, but also what is not known and how such gaps in knowledge might be addressed by future research and investigation. We were most interested in evidence relating to pupils' learning and thinking about the production of food, the origins of food and the links between producers and consumers through the food chain.

The scope of this review was determined by a series of search parameters. Empirical research and statistical evidence on school-age pupils' learning about food, farming and land management in a range of contexts, published (in English) from 1960-2002 was reviewed. Published articles, books and monographs, research thesis, statistical evidence, and government/ international publications covering early years, primary and secondary schools formed the basis of most of the review.

Relevant research literature was identified using a number of complementary search methods including: electronic bibliographic database searches; hand searches of journals and other documents; and email requests for information to students and researchers working in the field. Of 270 potentially relevant studies identified by the searches, 190 studies were eventually identified as being directly relevant.

Other Findings: Weaknesses and Gaps in the Evidence Base

In the literature reviewed, a range of major weaknesses was evident, for example:

- few studies took account of what is known about learning
- studies of students' awareness were not integrated into any wider conceptual framework, such as the food chain
- too few studies paid attention to issues of validity or reliability and many of the case studies and small-scale studies offered little more than descriptions of events

- research tended to report findings without identifying the implications for teaching and learning (although there were some exceptions to this finding).

There are also some critical gaps in the literature including:

- studies of young people's understanding of the connections between food, farming and land management in terms of the food chain
- students' perceptions of the countryside as a context for food production and land management
- changes in children's thinking about food, farming and the countryside over a period of several years resulting from one or more learning activities in a range of contexts such as farms and botanical gardens
- the sources of, and the factors that can influence and shape, young people's knowledge, attitudes and concerns about food, farming and the countryside
- teachers' aims for work in and visits to farms and school gardens
- students' learning experiences of farm visits and other food and farming-related learning activities.

Conclusions: Addressing the Weaknesses and Gaps in the Evidence Base

In order to address the weaknesses and gaps in the literature base, we suggest the following studies should be undertaken:

- research into where children learn about food, farming and land management, what they learn and what the key drivers are for maximising their learning
- what does learning and teaching about food, farming and land management look like in schools: who teaches it, how and why? There is a need for comparative international studies of curriculum organisation and implementation
- in-depth, mixed method studies of students' learning in terms of processes and outcomes from particular learning activities such as farm visits, ICT-based programmes and fieldwork
- investigations of the cost-effectiveness of particular teaching strategies, as well as research into what measures could be used to explore economic effectiveness in this context
- investigations into ways of reducing and removing the barriers to learning about food, farming and land management (at different levels: LEAs, schools, departments and in non-school contexts)
- an investigation into what progression might look like in terms of understanding food, farming and land management issues.

1. INTRODUCTION

1.1 Background

The UK population depends heavily on the countryside for food, recreation, tourism and many other purposes. Recent statistics indicate that 'farming is the major land use in England, responsible for the appearance of some 80 per cent of our countryside' (Countryside Agency, 2002). However, as the Policy Commission on the Future of Food and Farming points out, 'farming has become detached from the rest of the economy and the environment' (2002 p.6). This has important implications for public understanding of food production:

> *The past decade or two have seen the globalisation of the British shopping basket as supermarkets scour the world to satisfy our newly acquired appetite for exotic fruits or out-of-season greens ... Such global supply lines would have staggered our grandparents ... but they also mean that we know less about the way our food is produced* (Nicholson-Lord, 1997 quoted in Cook *et al.*, 1998, p. 162)

There is growing concern in the UK and elsewhere that significant proportions of the public have an inadequate understanding of many aspects of rural life. Public knowledge of environmental issues as they relate to the countryside appears to be poor, and young people's knowledge of how their food is produced and how it gets to their plate seems to be very restricted. The Policy Commission argues that 'the key objective of public policy should be to reconnect our food and farming industry … to reconnect consumers with what they eat and how it is produced' (Policy Commission, 2002, p. 6).

In the light of such arguments, this report looks at what is known about young people's views towards, and learning about, food, farming and land management in a range of contexts. This is the final report of the team carrying out a literature review on the topic of 'Improving the Understanding of Food, Farming and Land Management amongst School-Age Children'. The team was made up of personnel from the National Foundation for Educational Research (NFER) and King's College London. The project was jointly funded by the Countryside Agency, the Department for Education and Skills (DfES) and Farming and Countryside Education (FACE).

Before considering the aims of this project in more detail, it is important to outline the historical background and contemporary policy context of the current concern with young people's understanding of food, farming and land management.

1.2 An Historical Perspective

Looking historically, it is evident that the teaching of rural issues and the use of the school garden for teaching have been part of pedagogical discussions for many years (Jevremovic, 1964). School gardening first became eligible for government grants as long ago as 1895. Ten years later, amendments to the Code of Regulations controlling the work of public elementary schools required object lessons and nature study to be taught with particular reference to the school's surroundings. Observation skills were included in the 1905 Board of Education's 'Suggestions for the Consideration of Teachers' (Jenkins and Swinnerton, 1998).

Educationalists such as Froebal, Pestalozzi and Montessori, emphasised the use of gardens and outdoor settings for child-centred education. Writers, particularly women, extolled the virtues of the garden rather than the schoolroom for the study of botany (Brightwen, 1913). Organisations such as the School Journey Association, which promoted education beyond the classroom, were set up in the first half of the 20th Century.

A recurring discussion between 1905 and 1940 was the appropriateness of the same curriculum for urban and rural schools, with much of the lobbying for differentiation and rural craft skills coming from the Board of Education. The Hadow Report (1931) recommended the provision of different schemes of work in nature study for children attending rural and urban schools (Jenkins and Swinnerton, 1998). Ten years later, the Report of the Consultative Committee on the Primary School considered that nature study 'should lead to that breadth of outlook and grasp of essentials which raised the value and increased the dignity of rural occupations' (Tracey, 1966, p. 19).

'Schools and the Countryside', published by the Ministry of Education (1958), emphasised the importance that farm studies could bring to understanding 'the fundamental position farming occupies in the whole life and economy of even the most industrialised country' (p. 51). This report also emphasised the need for children to make several farm visits at different stages during their school life as their value was recognized as being cumulative. The report warned against a general procedure for farm visits by schools as 'each farm and each school presents an entirely new set of circumstances' (p. 55). Finally it offers support for 'imaginative experiments in rural education,' one such involving 'centering the curriculum and life of a school around its own farm' (p. 59).

The use of school gardens for growing vegetables during the Second World War led to an increase in their number (Bramwell, 1961). Branson (1950, p. 2) noted that for 'many children living in the urban sprawl, the garden may be almost the only place where these things may be studied'. However:

> *In practice the nature study associated with school gardening varied greatly in quality. At its best, the opportunities provided by a school garden for the systematic and long term study of part of the natural world were exploited to the full. At its worst the school garden was*

> *cultivated solely to discover who could grow the biggest turnip or produce the finest bloom or, in a few instances, to meet the culinary needs of the head teacher.* (Jenkins and Swinnerton, 1998, p. 60)

An early study, just outside the remit of this report (Davis, 1957), described how the curriculum within St Frideswide's Girls' School developed a four-year programme of study around the school's garden. The garden became an important feature of different subjects within the curriculum: art, needlework, history, English, homecraft, plant identification, growth and horticultural management, knowledge about weather patterns and individual research.

In 1964, the Food and Agricultural Organisation and UNICEF published a book on school vegetable gardens in which they stressed that 'the garden constitutes one of the best laboratories for offering the child a series of experiences tending to create in him good agricultural and food habits which will lead to a better state of health' (FAA and UNICEF, p. 41).

This brief historical outline makes clear that the role of farms and gardens, whether in school or as a school journey experience, have been a part of a continuing debate in this country for more than a century. Current government initiatives such as 'Growing Schools' and the proposed specialist Rural Schools are a part of this tradition. To understand why these initiatives have been instigated now requires a knowledge of the contemporary policy context.

1.3 Contemporary Policy Context

The Policy Commission on the Future of Food and Farming, set up by the Prime Minister in August 2001, argued that 'the key objective of public policy should be to reconnect our food and farming industry … to reconnect consumers with what they eat and how it is produced' (2002, p. 6). This objective has implications for educational provision, both within and beyond schools.

The Policy Commission suggested a number of remedial strategies including better use of the media, labelling, the Internet, advertising, demonstration farms and exposure to schools. The need for schools to develop stronger links with farms was made explicit. The Government responded that it recognised the importance of young people experiencing the 'outdoor classroom' and noted that 'children benefit from hands-on experiences of plants and animals, within school grounds, through visits to farms, woodlands or field study centres' (England. Parliament. HoC, 2002, p. 47).

The Growing Schools Innovation Fund (£500,000) brought together schools, local communities, colleges and voluntary groups to develop and disseminate good practice, including farm visits. The Growing Schools Initiative aims to:

- encourage schools to increase the level of pupil participation in learning which uses farms/growing as a resource, and preferably by direct hands-on experience
- offer teachers easier access to information, teaching resources and professional development opportunities
- identify good practice examples that illustrate: how commonly perceived difficulties can be overcome; how farms/growing can be used effectively as a teaching tool across the curriculum at each key stage; the benefits of farms/growing in terms of achievement/other outcomes; and effective support structures
- encourage teachers to explore a wider range of teaching and learning approaches so that they and their pupils have a more challenging and exciting experience.

In addition to the Growing Schools Initiative, the Government has been working with FACE and the Countryside Agency to research barriers to farm visits and to examine ways of encouraging more schools to visit farms, including through voucher or similar schemes. School visits to farms can also add value to other school-based initiatives, such as the National School Fruit Scheme and the Food in Schools programme, which aim to integrate all food-related initiatives throughout the school day. Finally, a partnership of national organisations, *Access to Farms,* was established in 2002 to promote good quality educational visits to farms (http://www.farmsforteachers.org.uk/atf/).

It would be wrong to think that these issues are only important in the United Kingdom. Desmond (1998) argues that much more work is needed to improve teaching (in the US) about the food chain in schools: 'What's needed is a new paradigm of learning about the food cycle and how it operates in our environment' (p. 18). Desmond argues that universities have a key role to play in research and development in this area. Braverman and Rilla (1991) examined the views of education policy makers in the US and concluded that 'major new educational initiatives will be required if we are to significantly improve the public's understanding of agriculture in our society' (p. 9). This review draws on research from the US and many other countries faced with similar issues and concerns.

1.4 Review Aims

In view of these recent developments, an urgent need was seen for 'a comprehensive review of the main issues and barriers to improving the understanding of food, farming and land management amongst school-age children' (Countryside Agency/DfES/FACE, 2002, p. 3). This project was designed to address this need by undertaking a systematic review of research on children's views towards, and learning about, food, farming and land management in a range of contexts. It involved critical analysis of research evidence published internationally between 1960-2002.

The aim of this review was to identify and appraise the extent and quality of research and statistical evidence relating to:

- school-age children's knowledge of, and attitudes towards, food, farming and the countryside
- school-age children's learning about food, farming and land management in a range of contexts
- the impact of such learning on pupils' achievement, progression and other educational/behavioural outcomes (for all pupils and particular groups)
- how such learning experiences can be delivered most economically and effectively
- the factors that can impede or facilitate pupil learning about food, farming and land management in a range of contexts.

The onus was on establishing not only what is known about these various issues, but also what is not known and how such gaps in knowledge might be addressed by future research and investigation.

1.5 Structure of the Report

The remainder of this report is in six chapters. Chapter 2 describes the search strategy and the methods used by the research team in identifying and reviewing sources of information. Chapter 3 provides an overview of the key terms used in the report – 'learning and the environment' and 'research'. The remaining sections summarise the project team's findings. Chapter 4 describes the research evidence on young people's knowledge and attitudes. Chapter 5 focuses on teaching strategies and their impacts, and Chapter 6 looks at factors influencing learning. Chapter 7 summarises the key messages emerging from the research and identifies weaknesses and gaps in the current evidence base. The report concludes by suggesting strategies for addressing the weaknesses and gaps.

2. SEARCH STRATEGY AND METHODS

This chapter outlines the review's search strategy and methods. Consideration is given to the selection criteria for including/excluding material, the search methods used to identify relevant research, and the review processes by which relevant studies were analysed and appraised.

2.1 Selection Criteria

The scope of this review was determined by a series of search parameters decided at the outset (Figure 1).

Figure 1: The Search Parameters

Overall focus:	Empirical research and statistical evidence on school-age pupils' learning about food, farming and land management in a range of contexts
Time scale:	Work published from 1960-2002
Age range:	Early years, primary and secondary school
Geographical scope:	International (only articles published in English)
Sources:	Published articles, books and monographs, research thesis, statistical evidence, and government/international publications

These reflected specifications given in the tender document, and were designed to provide a range of relevant research, statistical and governmental evidence. The international scope was important in order to be able to identify gaps in the UK-based research literature. The inclusion of studies from 1960 onwards was necessary in order to examine research before, as well as after, the introduction of the National Curriculum in England.

2.2 Search Methods

In accordance with the search parameters, relevant research literature was identified using a number of complementary search methods. These include:

- Bibliographic database searches of education/social science research databases, as well as more specialist records.

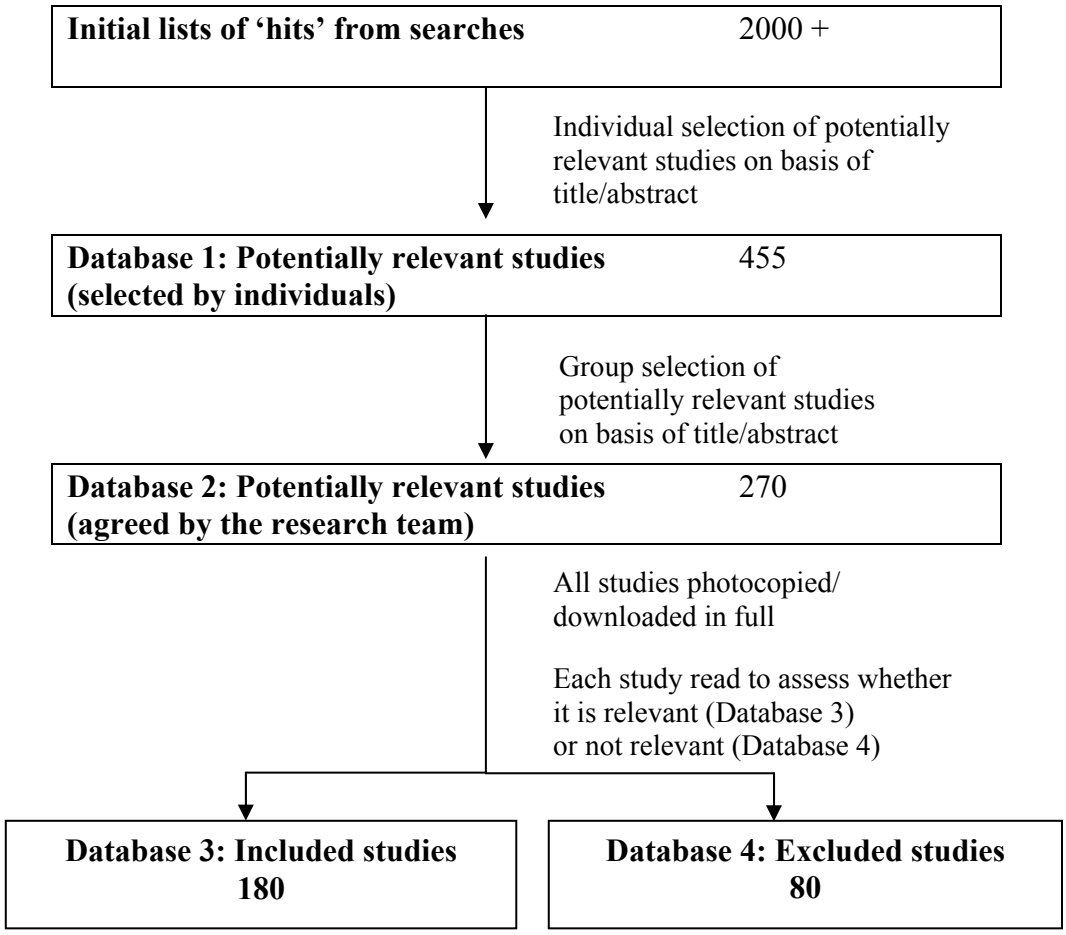
- Hand searches of key research journals relating to agricultural education, and science, geographical and environmental education.
- Hand searches of previous reviews and bibliographies of relevance to this review.
- E-mail requests to researchers working in this area through various regional, national, and international networks and organisations.

Full details of all of these search methods are given in Appendix 1.

The wide range of search terms used in the database searches reflects the breadth of the review's focus. In order to locate research on 'learning about food, farming and land management', it was necessary to search a wide range of areas, including: nutrition education; agricultural education; environmental education; outdoor education; geographical/science/technology education; food education; health education; experiential education; development education; museum education; and informal education. Similarly in order to include research on a 'wide range of contexts', it was necessary to investigate learning in schools (e.g. classrooms, school grounds, school farms), urban areas (e.g. city farms, botanical gardens, museums), and rural areas (e.g. field centres, farms, summer camps). Across these many educational areas and learning contexts, though, we were most interested in evidence relating to pupils' learning and thinking about the production of food, the origins of food and the links between producers and consumers through the food chain.

The process of selecting and identifying relevant studies involved a number of stages (Figure 2). This saw the research team (both individually and collectively) working to narrow down the initial lists of potentially relevant studies to a focused database of studies that were worth including and reviewing in detail. This process identified 270 potentially relevant studies, and this report is based on an analysis of 190 of these. It was necessary to exclude 80 of the potentially relevant studies, because, after being read in full, it was clear that they were not pertinent to the focus of the review. Examples included: evaluations of food education programmes concerned only with nutrition as opposed to food production issues; research on outdoor adventure education with no link to food and farming issues; investigations into public attitudes towards food and farming issues that were based solely on adult respondents.

Figure 2: The Selection of Relevant Literature



2.3 Review Processes

Individual research reports were categorised in terms of their likely relevance to one or more of the research questions. The literature connected with each of the research questions was then reviewed by a member of the research team. In order to ensure commonality and comprehensiveness in the review process, all publications were reviewed using a common framework (see Appendix 2). The framework was designed to generate information for three purposes:

- **Cataloguing and reporting** – Basic descriptive information (such as full publication details, geographical location and age of learners), as well as a category descriptor (concerning broad substantive focus of a study) were included in order to facilitate cataloguing and subsequent analysis and reporting of large numbers of studies;
- **Evaluation** – As well as descriptive information, this framework was also designed to generate evaluative information about the depth of detail provided about the different aspects of each study (conceptual/theoretical

framework, sample, methodology, validity measures, methods, main findings, key conclusions, and author's view of implications), and any particular strengths and potential weaknesses that were apparent to the reviewer within the work as reported. In drawing out key findings, we paid far greater attention to studies that did not show the weaknesses highlighted in Chapter 7.

- **Evidence base analysis** – The third purpose of the framework was to enable the generation of ideas about (i) the contribution that individual papers made to the evidence base (i.e. main findings, key conclusions, author's view of implications, researcher's view of implications), and (ii) cases of agreement and disagreement between the evidence generated by different papers (i.e. links).

An important part of the review process was critical analysis of the available evidence, both in terms of the validity or trustworthiness of individual studies' findings, and the strengths and weaknesses of the evidence base as a whole. The project team sought to do this by:

- **Recognising the importance of different research paradigms** – A conscious effort was made to review pieces of work from within the research tradition (or paradigm) that the research had been conceived and undertaken (see Section 3.2). For example, quantitative (pre-test/post-test) programme evaluations were considered in terms of positivistic research traditions, while qualitative case studies were examined from the perspective of interpretivistic inquiry. The concern was to examine how well the researchers had carried out what they had intended to according to the paradigm in which they were operating.
- **Distinguishing between evidence that is more conclusive and less conclusive** – Through identifying methodological strengths and weaknesses of each individual study, it was possible to make distinctions between evidence that was more reliable and conclusive, and evidence that was more questionable or preliminary. This involved distinguishing between: findings based on empirical evidence and those based on anecdotal reflection or unjustified prior assumptions; claims based on empirical findings and those based on speculation about empirical findings; statistically significant results and those based on description of trends; and survey findings based on very small samples and those based on larger representative samples.

3. CONCEPTUAL OVERVIEW

This chapter provides a brief introduction to the concepts of 'learning and the environment' and 'research'. It draws attention to a number of issues that are implicit in the research reviewed and the key messages presented.

3.1 Learning and the Environment

This report focuses on issues concerned with knowledge, skills, attitudes and behaviours as well as 'understanding'. Most of the studies reviewed draw attention to key aspects of teaching and learning in a range of contexts. Although some of the studies date from the 1950's, the majority are drawn from literature published in more recent decades. Throughout the last fifty years researchers' understanding of teaching and learning has grown substantially. Early research was driven by a belief that it was possible to discover which bits of knowledge would trigger behavioural change (see Hart and Nolan, 1999). So, for example, research was done into children's knowledge of waste and recycling with a view to finding an effective way to educating tomorrow's adults to produce less waste (see Rickinson, 2001).

However, knowledge does not always automatically change attitudes – most smokers, for example, generally know that smoking is bad for them. What people do in some situations is different to what they do in others. Sometimes attitude change follows behaviour change. As a result, although research might give us a lot of information about what children know and about their attitudes towards issues, objects or experiences, it is not always knowledge that we can do anything with (see Leeming *et al*., 1993).

In terms of children's knowledge of food, farming and land management issues, this report indicates low levels of knowledge. This does not necessarily mean that they have been not been taught enough, nor that they have been taught poorly although that might be the case. Low levels of knowledge might be due to a lack of relevance rather than an absence of teaching.

Some researchers believe that children are learning a lot of the time, irrespective of (and sometimes despite) whether they are being taught (Lave and Wenger, 1999). Effective teaching challenges children's thinking, provides motivation as well as information and matches the context to the content. If something is relevant to children's needs and experiences, chances are that it will be understood better and will stay longer than if it's irrelevant and inappropriate. However, much of what is promoted in the literature reviewed is based on belief rather than evidence. Experiential learning, learning by doing and active learning tend to have been validated (if at all)

post hoc, that is, people believed that they were effective before having enough evidence to say that they actually worked.

In the literature reviewed, the focus on education has tended to be a focus on teaching. Authors write about formal and informal education as though the learning that takes place automatically depends on the type of teaching and the context. While this is true in part, it masks a range of issues that involve a focus primarily on learning rather than on teaching.

So what do we know about learning? Vosniadou (2001), summarising much of what is known about the subject, writes that learning is primarily a complex social and cognitive process in which knowledge is actively constructed on the basis of what is already understood and believed. Sometimes prior knowledge can stand in the way of learning (Robertson, 1994). Learning takes time and requires practice to start building expertise. It is important to know what students do and don't know in terms of food, farming and land management.

What is the role of the learner? Students, according to Vosniadou's review, must know how to plan and monitor their learning, how to set their own learning goals and how to correct errors. They must learn how to solve internal inconsistencies and restructure existing conceptions when necessary. People learn by employing effective strategies that help them to understand, reason, memorize and solve problems. Any curriculum initiative must provide opportunities to learn about learning as well as simply to learn about content.

How best is learning facilitated? Learning is critically influenced by motivation and children learn best when they participate in activities that are perceived to be useful in, and applicable to, real life and are culturally relevant. Although visits might be novel, the framing and follow-up provide opportunities to embed and contextulise learning. Children learn best when their individual differences are taken into consideration and when material is organized around general principles and explanations, rather than when it is based on the memorization of isolated facts and procedures.

3.2 Research

Research on food, farming and land management education from 1960-2002 cannot be seen in isolation from wider developments in research across the social sciences. As explained in Chapter 2, the methods for appraising the quality of individual studies within this review have needed to be sensitive to the notion of research paradigms and their different criteria of quality.

Research in the social sciences has undergone dramatic change over the last forty or fifty years. Central to this has been a questioning of the appropriateness of research approaches derived from the physical sciences for use in social inquiry. Broadly speaking, quantitative methods underpinned by positivism have been challenged by a range of alternative approaches grounded in interpretivism and critical theory (Figure 3).

Figure 3: Research Paradigms

	Positivist	**Interpretivist**	**Critical**
Research	Applied science	Interpretivist	Critical social science
Knowledge	Objective	Subjective	Dialectical
Aims	Testing hypotheses/ generalising (instrumental)	Generating hypotheses/ describing (constructivist)	Social change (reconstructivist)
Purpose	Verification	Discovery	Emancipation
Data/Methods	Quantitative	Qualitative	Qualitative
Quality Criteria	Reliability, internal/external validity	Trustworthiness, credibility, transferability	Emancipatory theory, feminist theory, discourse theory

Source: Adapted from Robottom and Hart (1993, p. 27) and Denzin and Lincoln (1998, p. 27)

The authors of this review acknowledge that this table merges several research approaches particularly those contained within the 'critical column'.

The growth of interpretivist and critical approaches has brought about a far greater diversity and complexity in social science research. Most notable has been what Denzin and Lincoln (1998, p. vii) refer to as 'the qualitative revolution', whereby 'the social sciences and humanities have drawn closer together in a mutual focus on an interpretative, qualitative approach to research and theory'.

Overall, the evidence base on food, farming and land management education is characterised by two main types of research:

- quantitative (positivistic) studies such as quasi experimental (pre-test/post-test) evaluations of outdoor education programmes, and questionnaire surveys of young people's knowledge and attitudes
- qualitative (interpretivistic) studies including interview-based investigations into children's perceptions of the countryside, and ethnographic research into school-based teaching and learning about food and eating.

There is little evidence of more critical approaches within the research investigated for this review. One exception was an action research study into the teaching of science with urban homeless children which drew on critical and feminist perspectives on science and education. (Barton, 1998).

3.3 Evidence Relating to Food, Farming and Land Management

This review has identified 190 research studies relating to school-age students' thinking and learning about food, farming and land management. The evidence stemming from this research provides insights into:

- young people's knowledge and attitudes
- teaching strategies and their impacts
- factors that can impede or facilitate learning.

The research associated with each of these three areas is discussed in the ensuing three chapters. In view of the original research aims, though, it is worth stating that there was a distinct lack of research into the cost effectiveness of teaching strategies relating to food, farming and land management.

4. RESEARCH EVIDENCE ON YOUNG PEOPLE'S KNOWLEDGE AND ATTITUDES

This chapter considers the research evidence relating to young people's knowledge and attitudes. It provides information about young people's:

- knowledge and concerns about agriculture
- understanding of ecological concepts relating to agriculture
- awareness and opinions about food
- perceptions of the countryside.

4.1 Knowledge and Concerns about Agriculture

There is a considerable amount of empirical evidence on school students' agricultural knowledge and concerns. This comes from research relating to various topics, ranging from the specifics of genetic engineering and pesticides, to more general awareness about agricultural concerns relative to other environmental issues.

Agricultural Awareness and Understanding

One focus for research has been young people's awareness about agricultural production methods and their environmental impacts. In the USA, for example, Trexler (2000) investigated elementary school pupils' understandings of crop protection and pesticides. Through in-depth interviews with a small sample of children (n=9), it was found that most had little or no understanding of pests and pest protection. It was also reported that understanding was weakest amongst the urban, non-gardening pupils within the sample, which, the author suggests, emphasises the importance of 'out of school experiences' in developing agricultural understanding (ibid., p. 99). The small size of the sample, however, means that this finding is not generalisable beyond this particular study.

A lack of knowledge about agriculture was also found in a large-scale survey of 9000 secondary school students in the Netherlands (Kuhlemeier *et al.,* 1999). As part of a national investigation of 15 year olds' environmental knowledge, attitudes and behaviour, this study found that questionnaire items about farming and market gardening were poorly answered relative to those about other topics. Only half of the sample, for example, knew that more

chemical pesticides and fertilisers are used in regular agriculture than in alternative agriculture.

Similarly, a study of 464 Iowan secondary school agricultural education students' knowledge about sustainable agriculture, found that students reported only 'knowing a little' about this topic (Williams and Wise, 1997). This was echoed by a later study of a similar group of agriculture students (Williams, 2000). Concern was also expressed in a study of 1000 secondary agricultural education students in Kansas, which found awareness about international agriculture to be 'limited' (Harbstreit and Welton, 1992, p. 15).

Two other US studies underline the same point. Mabie and Baker (1994) found low levels of agricultural knowledge amongst 147 Los Angeles pupils: 'Very few children could give a basic definition of the word agriculture itself [and] most could not name crops grown by farmers in their state' (p. 77). Desmond *et al*. (1990), introducing 'new approaches for a better understanding of agriculture', point out that 'paradoxically, the United States has one of the world's most plentiful food supplies and possibly the least agriculturally-informed public' (p.151).

There is some evidence, mainly from studies in the US, to suggest that students' agricultural awareness can vary in relation to certain influencing factors. These include:

- agricultural education and work experience – Wright *et al*.'s (1994) study of 410 Grade 11 students in a range of Missouri schools found that students studying agriculture education in schools with an agriculture education programme had greater knowledge about agriculture; two large-scale studies of vocational agriculture students in Louisiana (n=1,997) and Florida (n =1,039) report significantly higher knowledge levels amongst those who had undertaken supervised occupational experience (Cheek and McGhee, 1985; Kotrlik *et al*., 1986)
- geographical location – Frick *et al.*'s (1995) survey of 1,100 high school students from rural Indiana and inner-city Michigan, reported significant differences in agricultural knowledge (rural students were more knowledgeable), but little variation in attitudes (both groups had positive perceptions of agriculture); Matthews' and Falvey's (1999) survey of 550 Year 10 students in the Australian state of Victoria found that significantly more non-metropolitan than metropolitan students felt that agriculture has a negative impact on the environment
- age – in their large-scale Kansas survey, Harbstreit and Welton (2002) found that awareness about international agriculture was higher for students in older year groups; a similar finding was reported by Cheek and McGhee (1985) with respect to vocational agriculture students in Louisiana
- socio-economic status – Kotrlik *et al*. (1986) study of 1,997 Florida vocational agriculture students reports significant differences between those from economically disadvantaged backgrounds (lower knowledge

scores) and those from advantaged backgrounds (higher knowledge scores).

Biotechnology and genetic engineering

Another focus for research has been young people's awareness and views about the use of biotechnology and genetic engineering in food production. In an exploratory study with 270 16-19 year old in north–west England, Hill *et al.* (2000) looked into students' ideas about biotechnology and genetic engineering. Using open-response questionnaires, this study found that students see these two phenomena differently, and tend to associate genetic engineering (rather than biotechnology) with agriculture. Students also had different concerns about biotechnology (that it was 'risky') than about genetic engineering (that is was 'ethically wrong'). Such concerns about genetic engineering may well have implications for their learning about food, farming and land management. Having said this, the study also found that 'many students had positive attitudes to biotechnology and genetic engineering' (ibid., p. 82).

A similar study with slightly younger students was undertaken by Lock and Miles (1993), who surveyed the knowledge and attitudes of 188 14-16 year olds in six English schools. Their findings highlighted:

- weaknesses in students' understanding – 'one third of the sample did not know what biotechnology or genetic engineering was, and nearly half could not give examples of either'
- variability in respondents' attitudes – 'attitudes were context-dependent: there was strong broad approval of genetic engineering applied to microbes and plants, but not of genetic engineering applied to animals'
- differences according to gender – 'females in the sample [were] particularly unsupportive of genetic engineering in farm animals' (ibid., pp. 267-9).

Further evidence on young people's views of genetic engineering comes from research into the public understanding of biotechnology. As part of a wider MAFF-funded study into public understanding of biotechnology, Gunter *et al*. (1998) explored the views held by 138, 16-19 year olds in north-west and south England. Through questionnaires and focus groups, they found that students:

- had fairly limited awareness about biotechnology, and wanted more information on this topic
- expressed considerable concern about possible risks, especially for genetic engineering of farm animals and food crops
- were supportive of the need for regulation and food labelling
- saw television news/documentaries, science lessons at school/college, and newspapers/magazines as their most important sources of information

- were most mistrusting of information from government, food retailers and manufacturers.

This leads the authors to argue that: 'as far as today's teenager's are concerned, reassurance is needed from food producers and retailers that food is safe to consume and that it has not been manufactured with environmentally unsafe or ethically dubious procedures' (ibid., p. 111). Further studies relating to genetically modified foods are discussed below in Section 4.3.

Concerns about food and farming

Moving from young people's awareness to young people's concerns about food and farming, Prelle and Solomon's (1996) study of English and German 14-year olds provides some insights into students' feelings about food and farming relative to other environmental issues. This study found that countries food and farming was seen as considerably less important than 'the hole in the ozone layer', and 'cutting down the rain forest'.

A US-based study of 231 10-17 year olds found that, out of 20 environmental hazards, the farming-related ones that students were most concerned about were: 'a decrease in food supply' (ranked 9th), followed by 'pesticides' (12th), 'decrease in topsoil' (17th) and 'food additives and preservatives' (20th) (Riechard and Peterson, 1998). This paper also reported that female respondents were significantly more concerned than males about food additives and pesticides.

4.2. Understanding of Ecological Concepts Relating to Agriculture

Emerging from the science education literature is a small number of studies on young people's understandings of ecological concepts such as food chains, food webs and ecosystems. These arguably provide insights into students' knowledge of the science/ecology of food, farming and land management.

Food chains and food webs

A recurring finding from the research in this area is that young people have difficulty in understanding the inter-connected nature of a food web, as opposed to the more linear concept of a food chain. Barman *et al*., (1995) undertook an interview-based study of 96 US, Australian, and Canadian high school students' conceptions of food chains and food webs. They found that students' descriptions/ representations of food chains were based on predator-prey ideas, rather than the transfer of energy. An example cited in the study was: "A food web is like a food chain. One thing eats another thing and another thing eats another thing. I guess you could say there are several food chains in a food web". (ibid., p. 778). The authors conclude that 'students do not understand the concept of energy flow through a food chain and food

web', and tend to see food webs 'as several food chains rather than an interconnecting unit' (ibid., p. 779).

These findings echo those of an earlier study undertaken with 15-19 year old biology students in South Africa (Webb and Boltt, 1990). This investigation reported a high percentage of correct responses for questions about direct links (as in a food chain) but low percentages for questions about indirect links (as in a food web). The same was found in a study of 200 secondary school students in Newfoundland, which reported that almost the entire sample interpreted food web dynamics in terms of a food chain (Griffiths and Grant, 1985). A study in Greece of 686 primary school children's environmental knowledge paints a similar picture: 'the pupils were ignorant about the significant impact of farmers on the food chain' (ibid., p. 58).

Wider misconceptions

Adeniyi's (1985) work with 232 secondary school students in Nigeria suggests that young people's misunderstandings are not restricted to food webs. Through analysis of written work and interviews with students in one school, it was found that 'students possessed several misconceptions about food chain, energy flow, pyramid of energy and the carbon cycle' (ibid., p. 315). Further support for such claims come from Munson's (1994) summary of research on 'ecological misconceptions', which concludes that 'the existence of ecological misconceptions poses a serious problem for environmental educators' (ibid., p. 34). The same might be argued for those concerned with improving young people's understanding of food, farming and land management.

4.3 Awareness and Opinions about Food

Some evidence about students' views of food and eating in English schools is provided by an ESRC-funded study entitled 'Teaching and Learning about Food and Nutrition in Schools' (Burgess and Morrison, 1995). This used ethnographic methods to explore students' perspectives on food and eating in four schools (two primary, two secondary) with contrasting rural/urban, socio-economic and cultural dimensions (Morrison, 1995, p. 241). On the basis of student and staff interviews, and lengthy in-school observation, this study found that:

- students had detailed and critical views about their school-based eating arrangements
- boys and girls voiced differing attitudes towards food and drink; vegetarianism, for example, was seen as a 'female thing' to do
- factors such as 'home, family and the media' were seen by students as more important influences on their food consumption than school, particularly by those of secondary age.

Overall, this study highlights the complexity of young people's views about food and eating. Indeed, the authors argue that 'food and drink [are] part of the props used by young people to develop and stage their self-image' (Burgess and Morrison, 1995, p. 23).

Genetically modified foods

More recent research has focused on students' knowledge and views of particular kinds of food products, such as genetically modified foodstuffs, and locally produced/organic foods. Turning first to genetically engineered foods, two studies in north-west England provide evidence about the views held by 270 16-19 year olds (Hill *et al*., 1998) and 416 11-16 year olds (Hill *et al*., 1999). These reported that students see:

- the advantages of genetically engineered food as improved storage and increased productivity, but not improved taste, reduced price or health benefits
- such foodstuffs as 'unnatural', but not necessarily unsafe for the environment or for consumers
- an important need for labelling
- more potential problems with genetically engineered *animals* than with genetically engineered *vegetables*.

The study focused on 16-19 year olds also reported significant differences relating to gender (female students were more concerned than their male counterparts), and A level biology study (A level biologists were more confident in expressing a view about genetically engineered foodstuffs than their peers). This corresponds with several other studies' reports of gender differences in young people's: food attitudes (Burgess and Morrison, 1995); concern about food additives and pesticides (Riechard and Peterson, 1998); views on genetic engineering of farm animals (Lock and Miles, 1993); and self-reported purchasing of organic/local foods (Bissonnette and Contento, 2001).

A similar piece of work with 138 16-19 year olds in North-west and South England reported that students hold 'conflicting opinions' about the value and safety of genetically engineered foods (Gunter *et al*., 1998, p. 109). Compared with adult respondents (see, for example, Grove-White *et al.*, 1997), though, young people were more willing to try such foodstuffs, and were 'more trusting of whomever it was who had responsibility for monitoring and regulating the development of such food products' (Gunter *et al*., 1998, p. 110).

Organic food products

Turning secondly to organic and locally produced foods, there is some evidence of young people's views from a recent US study (Bissonnette and Contento, 2001). This used a survey of 647 New York City high school

students to investigate adolescent views about the environmental impact of food production practices, and whether these are related to their food choices

The study found that students were:

- generally positive about organic foods, believing that they were healthier, tastier and more environmentally friendly
- less knowledgeable about the issue of locally grown foods
- in favour of organic and local food as an abstract ideal, but did not necessarily see it as important to purchase such foods themselves
- more concerned with taste and the ability to eat their favourite foods all year round, than with where or how food had been grown
- more strongly influenced by parents than friends in their food choices
- more likely to buy organic and local foods if they were female, suburban, and socially advantaged.

The study's key finding was that: while 'these adolescents were not knowledgeable about […] the environmental impacts of food production practices and were uncertain in their attitudes, […] the beliefs and attitudes that they did have about these issues were correlated with their food choices, at least to a moderate degree' (ibid., p. 81).

This, the author's argue, highlights the 'need to make salient to adolescents the environmental impact of food production practices through both cognitive and experiential approaches' (ibid., p. 72). In other words, 'adolescents should be provided with field trips to farmers' markets […] and visits to both organic and conventional farms to observe how foods are grown and to talk with farmers'. Furthermore, in view of the important influence of parents, such strategies 'should be accompanied by the involvement of parents, for example through take-home materials or through participation of parents in field trips' (ibid., p. 81).

Food additives and other concerns

Another topic for research has been young children's awareness and opinions about food additives, such as colourings and flavourings. On the basis of interviews with 75 Exeter primary school pupils aged 5-10 years, Coulson *et al*. (1996) found 44 per cent of their sample to be aware of additives in food, especially food colourings. Awareness, though, appeared to increase with age, particularly between the ages of 5-6 years and 7-8 years.

Finally, a recent survey of over 1000 young people by Birmingham City Council included some items relating to food (Birmingham City Council Education Service, 2000). When asked to select the four most important issues from a list of ten, almost one third (32.9 per cent) selected 'too much fats and sugars in what I eat'. Overall, though, this was ranked seventh out of the ten, below other issues such as litter, air pollution, crime, etc. Within the

school context, evidence from two studies suggests that catering provision is a matter of concern for students. As mentioned earlier, Burgess and Morrison's (1995) detailed study of four schools found that students had detailed and critical views about their school-based eating arrangements. This is supported by a recent NFER study of school councils, which cited catering issues as one of the topics commonly discussed by primary and secondary school councils (Taylor with Johnson, 2002).

4.4 Perceptions of the Countryside

Insights into young people's perceptions of the countryside can be drawn from recent studies, particularly in the field of rural geography, that seek to understand 'children's understandings of rurality' (McCormack, 2002), and the experience of 'growing up in the countryside' (Matthews *et al.*, 2000, p. 141). The research suggests that young people's views and experiences of the countryside are complex and varied.

Rural-urban differences

McCormack's (2002) study of 40 children (aged 8-10 years) in New Zealand presents evidence of the different ways in which urban and rural children can view the countryside. Using a variety of qualitative methods (interviews, brainstorming, drawing and diaries), McCormack found that 'children most frequently conveyed rural New Zealand through constructions of agriculture and "nature"' (ibid., p. 198). However, the ways in which these two elements were depicted was different for urban and rural children. Rural children were more likely to include agricultural images in their drawings and descriptions, while the urban children included many more depictions of 'nature', such as trees, flowers, lakes, rivers and ponds. These differences, the study suggests, can be related to urban and rural children's contrasting experiences of:

- agriculture - 'most rural children lived on a farm and therefore experienced agriculture on daily basis, [but] most urban children observed agricultural settings from a car window while travelling through rural areas'
- nature – experiences of nature for urban children involved recreational activities such as picnics at the beach and bushwalking, while 'rural children recalled recreational experiences that most often involved agricultural settings' such as eeling, riding motorbikes, and helping out on the farm
- popular and lay discourses – 'urban children drew on popular discourses such as stories and films with rural settings or characters, while rural children drew on lay discourses involving conversation with their families and friends' (ibid., p. 199).

Contrasting views of the countryside

Turning to the UK, a number of recent studies have explored young people's perceptions of rural and urban environments. One example is Cullingford's (1994) investigation into 'what children think of themselves in relation to their own environment'. This used open-ended individual interviews with 8-year old children from a variety of backgrounds in England. It found that: 'In contrast with their distaste at some elements of urban life, all the children share a romantic view of the countryside'. They see it as a place they would prefer to live, as a 'haven of peace, and the place where there are "lovely little cottages"' (ibid., p. 14).

Such notions, however, are not necessarily shared by young people who themselves live in rural areas. Davis and Ridge's (1997) interview-based study of 95 children and young people (8-19 years) in rural Somerset found marked differences of opinion. They characterised this in terms of two distinct groups:

- the 'rural bliss group' – who did not want to live in the town and had a very positive attitude towards the countryside
- the 'urban bliss group' – who were less happy with living in the countryside and would rather live in the town.

The former focused on 'popular concepts of country dwelling and the rural idyll' (peace and quiet, images of fields, tress, fresh air, space and beauty), while the latter talked of 'boredom and the feeling that there was nothing to do' as well as 'difficulties with travel and accessibility and privacy' (ibid., p. 25). This more negative side of growing up in the countryside is evidenced by two other studies, which present rich accounts of Northamptonshire teenagers' dissatisfaction with village life (Matthews *et al*., 2000), and the restricted social mobility of rural children in three parts of England and Wales (Smith and Barker, 2001).

Taken together, these studies highlight the complex (and, indeed, contested) nature of the countryside in the minds and lives of young people. They also suggest that views and experiences can vary not only with geographical location (e.g. urban versus rural), but also with age and social class. Both Matthews *et al.'s* (2000) work in Northamptonshire and Davis and Ridge's (1997) study in Somerset note similar trends relating to:

- age – teenagers were far more likely to be negative about the life in the countryside as compared with their younger counterparts
- social class – 'a very different picture of life in the countryside emerges from children and young people on a low income, with many expressing feelings of isolation, boredom and a growing conflict with parents' (Davis and Ridge, 1997, p. 67).

4.5 Key Messages about Young People's Knowledge and Attitudes

The research on young people's knowledge and attitudes can be summarised in terms of the following key messages.

- **School-age students' knowledge and understanding about various aspects of food and farming appear to be poor.** This conclusion emerges from studies in the US, the UK and the Netherlands on topics such as pests and pesticides, sustainable farming, international agriculture, genetic engineering and biotechnology. A similar picture comes from investigations in several countries into: young people's understanding of ecological concepts such as food webs, food chains, and ecosystem processes; and students' knowledge about genetically modified and organic/local foodstuffs. There is some evidence to suggest that students' agricultural awareness can vary in relation to their: agricultural education and work experience, geographical location, age and socio-economic status.
- **Young people are found to be concerned about food issues such genetic engineering, organic/local products and school meals.** Alongside this concern, however, there is also evidence of ambivalence, confusion in students' views, and differences between attitudes and behaviours. For food and farming issues in general, two studies suggest that young people see these as less serious than other environmental issues such as ozone depletion and tropical deforestation. In several studies, levels of concern are found to differ between boys and girls, with girls attaching greater seriousness to issues such as food additives and pesticides, genetic engineering of farm animals, and the importance of organic/local foods.
- **Young people's perceptions and experiences of the countryside are complex and varied.** There is some evidence to suggest that the images of rural life can differ markedly between rural and urban children. Studies of rural children and young people in the UK, however, highlight marked differences in attitudes *within* rural areas. While some children can have a very positive attitude towards the countryside, others speak of boredom, isolation and a desire to live in a town or city. This, it seems, can differ with age and social class, with teenagers and those on a low income tending to express more negative views of life in the countryside.

Overall, the research on young people's knowledge and attitudes suggests that there is a strong case for improving teaching and learning about food, faming and land management. Any teaching and learning initiatives that are developed, though, need to recognise the complexity and variability of young people's views and understandings about food and farming.

5. RESEARCH EVIDENCE ON TEACHING STRATEGIES AND THEIR IMPACT ON LEARNING

This chapter examines the research that has been undertaken on teaching and learning activities related to food, farming and land management. This review has identified evidence relating to learning resulting from activities taking place:

- on farms
- in school grounds, gardens and farms
- in other out-of-school sites
- in school classrooms.

The literature discussed in this chapter indicates that farm visits and related preparatory and follow-up activities provide opportunities for learning. However, a significant proportion of the evidence is anecdotal. Descriptive accounts by teachers and other adults portray outdoor experience as valuable, but too few rigorous empirical evaluations have been found. One reason for this is that the range of outcomes identified covers a range of both tangible and intangible factors. As well as developing knowledge and skills, experience outdoors can affect students' attitudes and their interactions with other people.

5.1 Learning Activities on Farms

Residential visits

Residential experience can involve students taking part in a wide range of activities in contexts that might be very unfamiliar and challenging. We have identified five relevant studies that have described learning impacts resulting from residential farm programmes (Lintermans, 1981; Barker, 1986; Southworth, 1990; Sutton, 1991; Bonn, 1997). Sutton (1991), for example, describes *Farms for City Children* a project that involved primary children spending a week on a farm. Sutton offers weak evidence that such visits can change students' behaviour as well as teach them something about farms. The five reports reflect findings from an earlier literature review on the affective benefits of outdoor learning (Crompton and Sellar, 1981). The impact of learning from farm visits seems to be particularly associated with the affective domain although some gains in the cognitive domain have been noted. These impacts include: developing social skills, self-confidence and initiative; improved attitudes toward countryside life; and greater discipline. Not

surprisingly, urban students seem to benefit particularly from such experiences in terms of developing new interests in countryside life and increasing their understanding of different animals and plants.

Programmes of non-residential visits

Shorter, non-residential, visits to farms can also provide learning benefits, especially when they are carefully linked to the curriculum (Weis, 1992). Carey (1990) describes a project involving 100 schools in Bedfordshire that set out to 'teach children that loaves of bread and bottles of milk come from farms, not supermarket shelves' (p. 12). Carey notes that the greatest difficulty for such schemes is finding someone to organise them but once the transport and co-ordination problems are solved, projects help to improve motivation of students and the trips are seen as much more than a day off school.

Farmlink (Groundwork, 2002a) aims to facilitate and foster long-term relationships between schools and local farms by enabling a single class or group from a school to visit a local farm up to three times during the year. By promoting understanding, *Farmlink* sought to improve relations between farmers and the whole community. Experiences have demonstrated that farm visits can help with geography learning, technological skills, knowledge about the sources and production of food (animals and plants) and how to manage and take care of the local environment.

Potential problems that schools involved in *Farmlink* encountered in making links with local farms were as identified as:

- Farmers working independently who may be isolated by the very nature of their work. For that reason they may feel that they do not have a great deal to offer that is of interest to schools.
- Many farmers are overworked and are part of a small team (or the only person) managing the farm, so they have little free time.
- Teachers often know little about farming. Scare stories about disease and factory farming can put people off. This problem had been exacerbated by recent BSE and Foot and Mouth reports.
- Transport costs to get children to the farms may be prohibitive.
- Funding is a problem especially after the first year of links.

In a rare quantitative evaluation of a farming education programme, aimed at gifted and talented secondary school students (n=112) in Wolverhampton, evidence was presented of learning across a range of skills (FACE, 2002). During the six field visits undertaken, students noted that they learned about different animals and the countryside, developed their knowledge of working farms and how milk is made, saw how technology is used on farms, looked at how cow waste is treated to help us and examined the costs of upkeep of farms. Students also developed meta-cognitive skills of thinking about areas of their knowledge.

Outdoor learning in farm settings has been shown to be particularly beneficial for students with special educational needs (Farnham and Mutrie, 1997). A study by English (1980) highlighted two children with special needs whose learning and development had been significantly altered by their experience in a year-long programme on a 20-acre farm on Long Island, New York. In the UK, a study by Thrive set out to determine the resource and knowledge implications of working with students with special needs in organisations conducting activities in horticultural and gardening activities. Reporting on the study, Marsden (2003) found that most organisations were not prepared for working with such students. A key barrier was the lack of priority given to the issue despite the widespread availability of resources.

Individual visits

Another strategy involving a visit to a farm took place in a pre-school in Greece, where teachers developed the curriculum around a prime facet of the local economy, namely wool production (Margioridou and Takantza, 1992). The teaching and learning process was patterned around the transformation of the wool and included a visit to a local farm to see sheep being sheared. The teaching was designed to correspond with the children's cognitive development by influencing their sensory functions and by connecting language and thought. It is not clear, however, what was the impact of the strategy on the students.

Finally, in a study comparing primary school students' learning and conversations while visiting a zoo and a farm, Tunnicliffe (1998) found that both sites were valuable educationally although there was potential for greater learning gains than were actually achieved.

5.2 Learning Activities in School Grounds, Gardens and Farms

School grounds

School grounds have been the focus of several UK projects including work supported by Learning through Landscapes and Groundwork. External evaluations of the work of both organisations have been noticeable by their absence. The first significant evaluation of Groundwork's educational activities took place only recently: 'Despite the fact that Groundwork has been delivering educational activity for 21 years, this was the first survey or study to attempt to quantify and assess the scope, character or impact of this work' (Groundwork, 2002b: Section 1 – unnumbered page). According to the evaluation, which was commissioned by Groundwork, the organisation, through its constituent trusts, delivered projects in 3,857 schools and more than 350,000 students had been active participants. An estimated 2 million young people had benefited from and been influenced by their schools' involvement in community projects and work in school grounds and more than 12,500 teachers had developed new skills.

The evaluation examined whether Groundwork's activity in schools was effective in terms of a) changing attitudes and behaviours, and b) developing knowledge and understanding and c) having a long-term impact on children's learning. Key practices, which led to success, were identified, e.g. working with the LEA; building capacity in schools; the innovative nature of Groundwork projects; the focus on experiential learning; Groundwork staff who were knowledgeable, innovative, responsive and enthusiastic. Through questionnaires distributed to all 48 Groundwork Trusts, and focus group seminars with teachers, parents, community members and students, the review found that the practical environmental activities that Groundwork staff provided had helped children better experience their local community. The initiatives had helped to develop students' interests and concerns about the circumstances in which they live. The upkeep of school grounds sent a clear and powerful message of motivation and improved deprived neighbourhoods. Students had developed greater 'real-life' awareness of environmental issues and practical solutions toward solving them. One of Groundwork's core strengths in its education area, according to the evaluation, is the involvement of the whole school in its activities. This extra-curricular involvement helped to combat exclusion and assist disaffected students in re-engaging in education.

Research by the Education Development Center in Boston (2000) showed that high quality school grounds can lead to greater recreation and physical education, social development and academic learning, most often through the use of school gardens. In the UK context, Learning through Landscapes (2003) conducted a widespread quantitative and qualitative study of 91 of the 198 schools in London that received awards in a scheme to improve their school grounds and create space for school gardens, artwork, theatres and improved play space. Some of the qualitative findings revealed that the new space relieved tension and frustrations of both students and teachers. The scheme also led to improved student behaviour, increased links to the local community, increased parental involvement, new outdoor teaching space, as well as encouraging students to work with outside horticultural organisations such as Roots and Shoots. The schemes also gave the whole school a new sense of ownership in its local environment. Quantitative results (from questionnaires given to students and teachers) demonstrated that:

- 94 per cent of students enjoyed and had fun on the newly improved school grounds;
- 90 per cent of students perceived an improved quality of the environment;
- 60 per cent of teachers believed the grounds had improved attitudes towards learning;
- 72 per cent of teachers observed an improvement in parental and community involvement;
- 57 per cent of teachers noticed an improvement in student self-esteem, based on participation in the gardens;

- 84 per cent of teachers observed improved social interaction among students.

Moore and Wong (1997), in a detailed study of the impact of the development of the schoolyard in a US school, examined the views of the children originally involved, over a long period. Interviews were carried out with 37 4th graders who graduated in 1977; with six members of the class who were interviewed again in 1982 (age 14) and with two who were interviewed again in 1995 (in their late 20's). The authors noted that:

> *The academic performance of the Washington children, as measured by standardized tests, was highly competitive with that of students from other schools. The repertoire of children's behaviour broadened enormously with the increase in physical diversity of the school site. From this we concluded that opportunities for learning and development also increased.* (Moore and Wong, 1997, p. 181)

School gardens

Bilton (1993), in a study that examined three nursery classes in Berkshire and their use of an attached garden, concluded that having the garden available throughout a teaching session alleviated many of the problems that teachers reported. Bilton also reported that teacher attitude to, and appreciation of, the garden was crucial to its success.

Further evidence of the value of school gardens comes from Mabie and Baker's (1996a and b) investigation into the impacts on US students' science process skills of three agricultural teaching approaches: experiential in-class project work (n=56); experiential work in the school garden (n=57); and traditional classroom instruction (n=31). The results demonstrated that, while students from all three groups increased their knowledge base, only those groups who participated in the experiential activities had increases in science processing skills, and these gains were greatest for the school garden group.

Skelly and Zajicek (1998) compared the environmental attitudes between students that had participated in a school gardening project (n=153) and those that had only experienced traditional classroom instruction (n=84). They concluded that students participating in the gardening project had higher positive environmental attitudes than the control group. It was also indicated that the students gained most of their environmental knowledge at school rather than at home or through the media.

Morris *et al.* (2002, p. 175) describe 'an innovative approach to nutrition education that accurately and effectively ties nutrition and gardening lessons together in one program'. The series of nine activities which linked a gardening activity with nutrition education led to significant changes to students' reported eating behaviours.

Some school garden programmes have also demonstrated substantial increases in community and parental involvement (Elliott, 1983; Alexander *et al.*, 1995; Canaris, 1995; Fang, 1995; Halvorsen, 1995; Morris *et al.*, 2000; Brynjegard, 2001). These increases have been linked with improved motivation, pride in the school and its locality, as well as increased leadership skills, sense of responsibility and respect for others. With a large supply of healthy available snacks, school gardens can also provide greater nutritional awareness and consequential positive changes in eating habits for students, their families, teachers and the community at large (Alexander *et al*., 1995; Canaris, 1995; Morris, *et al.*, 2000; Brynjegard, 2001). Another benefit has been greater academic learning through outdoor practice and harvesting that is relevant to the curriculum (Konoshima, 1995).

A particularly interesting study described the benefits to students at an inner-city school which used local 'master gardeners' (Alexander *et al*., 1995). Using a range of videotaped interviews, five main themes emerged involving the values of the school garden: moral development, academic learning, parent/child interaction, pleasant experiences, and the positive influence of the master gardener as a community role model. In an ethnographic study of inner-city gardening conducted in Boston, Andrews (2001) found that the young people involved in the summer gardening programme experienced a transformative learning experience by developing problem-solving skills and stronger community sense through a deep relationship with the plants and the gardeners.

Rahm (2002) conducted a participatory action research study of learning opportunities for inner-city youth (n=6) in a summer gardening programme called City Farmers. She actively participated with the students and recorded their conversations in order to identify the types of learning that different students experienced. The unstructured questions initiated by the youth led to the development of inadvertent deeper scientific understandings of the food cycle, evolution and environmental management; science learning was accomplished though not as an end in itself. The programme relied on shared knowledge and distributed expertise and encouraged sense-making through shared discourse; learning emerged not solely in the gardening work but from the participants' active sense-making. By doing the planting, harvesting and the marketing in teams under adult guidance, the young people learned first hand what gardeners and marketers do on a daily basis. The study highlighted the educational value of a school science programme that is driven by its consumers rather than being imposed upon them.

The Farm in the City project brought in adolescents from a local school to care for, and manage, a community garden in a former derelict public park (Wasescha and Ness, 1998). The success of the garden brought the young people closer to their community and gave them a sense of pride in their local environment. Older teenagers working in the garden became leaders and role models for younger children working with them. The participants gained experience and knowledge about organic farming and nutritional benefits from the fruit and vegetables that they grew.

School farms

School farms, proportionately more common in the US than in the UK, have also been researched. Two studies, which had similar findings to those relating to school gardens, have focused on learning in school farms. The experience of guiding a class of 6-7 year olds to design and build a small farm on the Laboratory school grounds in Georgia, USA, led to the whole curriculum being touched by the farm (Poulsen, 1992). Eden (1998) wrote about six New England private schools that have working farms on their site. These school farms were beneficial in terms of providing academic enrichment, nourishment from the gardens, and psychological/spiritual growth.

Aqua-culture programmes are an alternative type of school farm and focus on the husbandry of fish and other aquatic animals in a controlled environment. In a qualitative review of 13 secondary schools across 12 New England states that have active aqua-culture projects, Wingenbach *et al.* (1999) sought to determine the maths, science and general life skills students gained from this type of agriculture. Respondents (n=60) developed skills in problem-solving, team work, responsibility, communication and leadership, as well as science skills in chemistry and biology and maths skills (measurement and engineering). Many of the students and parents had fought hard to convince their local school districts of the educational benefits of their aqua-culture programmes which were initially discredited due to a lack of outside understanding.

'Kahn (1998) and his colleagues use the information gleaned on a tour of farm schools to design a school on the Montessori philosophy that adolescents want to experience roles in society outside the family and that education must include manual and intellectual work. Another US study focusing on the design of an educational facility – a Mien-American Garden House - this time on a school's premises, is described by Hammond (2001: 997): 'Community-based science projects have great potential for involving language minority families, not only in science but in the school community in general'. This is because for 'people living in apartment complexes, these gardens provide families with an important connection to the rural lives they once led, as well as to food they need' (ibid.).'

Finally, it is worth noting that educational facilities, such as urban farms can provide an alternative, potentially sustainable participatory food production system, as well as an arena of opportunity for environmental education and action (Donahue, 1994).

5.3 Learning Activities in Other Out-of-school Sites

A range of sites have been used for school visits across the age range. Sites might be a local park, a field centre, a museum, a botanical garden or a zoo. Learning activities might be very structured or students might have more freedom to explore and to investigate. Fieldwork has been part of the curriculum for some subjects including geography and biology.

The role of fieldwork

Fieldwork has many advocates across the curriculum (see, for example, Rillo, 1985; Pearce, 1987). Bitgood (1989) states with authority that 'much of the literature on school field trips has focused on: whether or not students learn; what they learn; or methods of conducting field trips. A review of the literature provides a convincing argument that students can learn as much or more on a field trip as in the classroom' (p. 6).

In a more recent summary of research on the role of fieldwork in students' learning, Nundy (2001) highlights three major benefits associated with fieldwork:

- a positive impact on long-term memory due to the memorable nature of the fieldwork setting;
- affective benefits of the residential experience, such as individual growth and improvements in social skills;
- reinforcement between the affective and the cognitive, with each influencing the other and providing a bridge to higher order learning.

In earlier papers, Nundy (1998, 1999a and b) explored the role and effectiveness of residential fieldwork upon upper primary school students in the UK and found a strong relationship between the principal learning domains – that improvements in the affective domain can lead to improvements in cognitive outcomes. His findings concerning long-term memory retention from fieldwork experiences echo an earlier study by Dierking and Falk (1997), that found that 96 per cent of a group (128 children and adults) could specifically recall school field trips taken during the early years of school. The most frequently recalled field trips were to natural sites and nature centres and farms.

Other studies using quite different methodological approaches provide a picture of how outdoor fieldwork can benefit learning in the classroom. Research by the California State Education and Environment Roundtable (SEER, 2000) found that secondary students from eleven schools undertaking outdoor environmental learning, scored higher in 72 per cent of the academic assessments (reading, science, maths, higher attendance rates and grade point averages) as compared with students from traditional schools. Eaton (2000) found that outdoor learning experiences are more effective for developing cognitive skills than classroom-based learning. In a quantitative study using a control and experimental group, Kern and Carpenter (1986) determined that students participating in outdoor field activities (n=33), as part of an Earth Science course, scored significantly higher in higher-order learning (comprehension, application, analysis and synthesis) than did students who did not engage in outdoor learning over the same unit (n=39).

A note of caution about making too many assumptions about the relative permanency of attitudinal changes is sounded by Uzzell and colleagues (Uzzell *et al*., 1995; Uzzell, 1999) who report on an investigation into what it

is that children learn from a hands-on experiential encounter with the environment. In examining young people's perceptions of the severity of environmental problems at both local and global levels, they studied female Year 10 students' views about environmental problems at the 'You', 'Town', 'Britain' and 'World' levels. Groups of students were asked about their perceptions before a field visit, just after it and six weeks after. At first, children were more concerned about problems at a global level than at a local level. Afterwards there was an increase in perceived severity but after 6 weeks the levels went back to below the original concerns. The point that the studies highlight is that environmental attitudes are fairly well entrenched. 'What they learn … both in the classroom and in the field, only serves to strengthen their views and perhaps heighten their sense of action paralysis'.

Finally, a range of specific strategies have been reported in the literature for enhancing learning through fieldwork including:

- making videos with sixth form students that can be used for the benefit of younger students unable to go out of school (Hardcastle and Duffield, 1988);
- creating partnerships between teacher educators, field study centres, and schools (Ferry, 1995); and,
- the use of a ratio of 1 adult to 4/6 children for visits (to the Eden Project) (Bowker, 2002).

Environmental science fieldwork

Knapp and Barrie (2001) evaluated the impact of two different environmental science field trips on US elementary students' knowledge and attitude toward the resource site they were visiting. Approximately 500 students (Grades 4-6) were taken on field trips from three urban school districts in Indiana. The data indicate that the focus of the study of the programme (ecology or environmental issues) did not significantly alter the way students responded to the knowledge section of the evaluation instruments. The post-visit evaluation showed that there was little impact on students' attitudes towards the park site or to the related subject matter following either presentation type. It did not seem to matter what students did on the field trip – the impact on their knowledge was the same in both cases. For most students, the trips had a negligible impact on attitudes. Knapp and Poff (2001) showed that students taking part in a one-day visit to a US Forest Service site forgot most of what they had learned within four weeks of the trip. However, the visit had a strong positive impact on students' attitudes toward the site.

Wilby, in a study of teachers' (n=42) experiences of fieldwork in the UK noted that: 'It is as if our intentions were academic and exam orientated, whereas the outcomes are pupil-centred, related to personal and social development' (1984, p. 13). He also noted that 'there is certainly a need for more careful evaluation of the outcomes of this very expensive activity and the extent to which it is available to the whole of the school population' (p. 13).

Farmer and Wott (1995) examined the impact of 'Field Trips and Follow-Up Activities' on 'Fourth Graders in a Public Garden'. The study, which involved 111 students, compared the impact of follow-up activities carried out two-weeks after the visit, on students' knowledge. The authors' claim that the follow-up activity reinforced some of the concepts presented during the field trip and argued that follow-up activities could be more effective if led by museum teachers.

A quantitative study of Bavarian students (aged 11 – 13) (n=700) was conducted to evaluate how one-day and five day versions of a long-established ecology programme in a national park affected learning and behaviours (Bogner, 1998). Pre-test and post-test results revealed that the five-day programme explicitly provoked favourable shifts in individual behaviour, both actual and intended.

Camps provide another context for outdoor learning. Two camps in the Pacific Northwest of the USA were examined for their impact on 13 – 19 year-old students (n=200) participating in natural resource management learning (Carlson and Baumgartner, 1974). The results revealed that the students became more favourable towards commodity use of timber harvesting in national forests and hunting as a result of their experiences.

Doyle and Krasny (2003), in a thorough and carefully researched study linked to the Cornell University 'Garden Mosaics' program, investigated the use of Participatory Rural Appraisal (PRA): 'Fundamental to PRA is the use of hands-on methods such as participatory mapping and diagramming resources flows, which are thought to overcome communications barriers'. Through the project, young people learnt about ethnic gardening practices in urban community gardens using research methods adapted from PRA. The project involved 31 educators and 85 youth in conjunction with 26 gardeners at community and home gardens. The authors noted that:

> *Although youth and educators experienced a number of challenges in facilitating the more hands-on activities (e.g. participatory mapping, drawing diagrams of resource flows), the PRA approach does offer valuable insights for environmental educators whose goals include incorporating ethnic diversity and engaging youth in research leading to community action.* (p. 91).

Doyle and Krasny are of the opinion that: 'environmental educators who seek to engage youth in investigations and meaningful community action may find PRA tools useful. In particular PRA may serve as a basis for developing comprehensive environmental education programs that incorporate diverse audiences' (2003, p. 110) (see also Krasny and Doyle, 2002).

Frequency of fieldwork

Despite its espoused educational value, the quantity of fieldwork experienced by school students has decreased substantially in recent years. Barker *et al.* (2002) consider that this is, at least in part, due to changes in perceptions, attitudes and values of those working with and within biology. The changes

result partly from growing concerns about health and safety issues which continue to occupy newspaper and television headlines (Atkins, 2000; BBC News, 2000). Fisher (2001), writing about research into fieldwork in science based on interviews with teachers and administrators in 30 secondary schools in South West England, noted that:

> *For students aged 11-16 years, structured scientific fieldwork away from the school grounds may now be rare. For students aged 16-18 years ... fieldwork has become regarded as a luxury and is usually limited to the minimum required by the examination scheme and to the extent students can fund these activities themselves'* (p. 76).

Although the blame for the decrease in school visits is often laid at the door of the National Curriculum, it is worth noting the views of Cooper and Latham (1988) at the time when the National Curriculum was implemented, who commented that: 'The picture [of provision] is not one of unconstrained expansion. Less than half of the schools were able to make as many visits as they wished, the main constraints being timetabling, finance and staff shortages' (p. 73).

Outdoor education

Palmberg and Kuru (2000) made a qualitative study designed to determine the affective learning outcomes that primary school students develop through different types of environmental education programmes in Finland. They found that activities such as hiking trips in forests, farm visits, canoe trips and skiing led to improved action skills and higher self-esteem. The students developed more empathy toward the environment and exhibited better social behaviour and higher moral judgements than they did prior to the activities. In the UK, Barber (1993) found that students in Year 10 (n=600) who participated in an outdoor residential programme enjoyed the experience, both personally and socially. When interviewed, participants were able to describe the new skills they had gained through working in groups and reported improved relationships with their teachers.

Cooper (1991) believes that there is little evidence to suggest that outdoor centres are succeeding in encouraging a greater awareness and concern for the environment and advocates the greening of field centres to promote education for the environment. Hunt (2003) is more positive about field centres. Her evaluation of *Inspiration for Action*, a project to enable young people, subject to social exclusion, to have a positive learning experience in the Peak District National Park, found that activities such as farm visits, environmental art and quarry visits were popular with most of the primary school students and their teachers. The report, however, contains little hard evidence and was carried out by one of the project facilitators.

Chan Lai (2000) conducted a qualitative study on the affective learning outcomes from a geography field trip in Hong Kong that involved adventurous outdoor experiences of rock climbing and sailing on rough seas. He found that the experience left deep impressions on the students and provided them with a

profound sense of physical and emotional accomplishment. In a meta-analysis of 96 previously researched outdoor adventure studies in Australia, Hattie *et al.* (1997) found that the most positive effects on participants (n=12,057) were on dimensions of leadership, cognitive skills, independence, assertiveness, emotional stability, time management and flexibility.

Supermarket visits and after-school clubs

The learning impacts, in terms of understanding of different types of foods through taking curriculum-based lessons into a local supermarket, were studied by Hobden (2000) though few conclusions were drawn about the impact. Bergstrom and O'Brien (2001) conducted a study on after-school programmes built around themes such as nature, cooking and community involvement. Such programmes were found to provide meaningful experiences that improved students' attitudes to school, reinforced basic academic skills (by building bridges across subject content areas), fostered a sense of accomplishment, and improved test scores. Other wider benefits included increased attendance and engagement in school activities, increased parental involvement, and the creation of an environment after school hours that prevented delinquent behaviour.

Mylne and Linley (1998) describe an agricultural education programme aimed at upper primary students. At the 'Ag-Ed' day, presentations were made to students by representatives from the farming industry. The project offered an opportunity for primary producers to have first-hand contact with children - explaining the importance of what is produced on their farms.

Museums and zoos

Birney (1995) compared the kind of information that children (n=48) acquired during a visit to a museum and a zoo. Generally she found that in either type of visit:

> *Children remembered a lot. Zoo children's remarks contained more references to behavior and were more positive in their assessment of what animals could do. Museum children made more references to environmental elements and issues such as human impact'* (p. 171).

Birney collected data using 45 minute, in-depth interviews with the pupils because 'children acquire information about wildlife on visits to museums and zoos which may not be revealed through formal tests of scientific knowledge' (p. 185).

Linking learning in school to learning on the way to school

One of the largest evaluations of school-focused ecological work was carried out in Switzerland by Lindemann-Matthies (2002). More than 4,000 children from 248 classes participated in a project known as *Nature on the Way to School*. Questionnaires were sent to 525 schools: 38 per cent returned the pretest and 31per cent the posttest. Bigger gains were noted for the students

that had taken part in the learning activities. The experimental group noticed more and could identify more taxa than the control group students on their way to school. Strong correlation between teaching time and children's perception of new taxa were identified. However, the study is somewhat flawed in design, as the author points out: 'It is impossible to attribute the observed positive effects to species perception to specific activities' (p. 29). It is also the case that the teachers who took part in the programme might well have been more committed to biodiversity than those in the control group classes.

5.4 Learning Activities in School Classrooms

Agricultural and horticultural education

As was noted in Chapter 4, students have limited knowledge of how sustainable agriculture relates to water quality, food safety and the preservation of natural resources (Williams, 2000). There is evidence to suggest that classroom-based programmes can yield beneficial learning outcomes, depending upon the content and pedagogical approach.

Rothenberger and Stewart (1995) demonstrated the value of actually using a greenhouse for horticultural instruction of poinsettia production as opposed to simply being taught about its use. Students who received a greenhouse laboratory experience (n=107) scored significantly higher on a knowledge test than did those students who received only classroom instruction (n=61). In a quantitative study comparing teaching approaches to learning styles for high school agricultural education students, Dyer and Osborne (1995) found that students taught using the problem-solving approach exhibited higher mean scores on achievement tests than students in classes taught using traditional teaching methods. There was no significant difference in achievement based upon the learning style of the student. An evaluation of *The Guide to Food Fibre System Literacy*, which provides a curriculum framework for agricultural literacy, suggested that, if implemented consciously, the guide may influence students' learning about agriculture and the environment (Hubert *et al*., 2000). Meunier *et al*. (2002) conducted a quantitative study with 4th grade students (n=736) and teachers (n=39) and determined that hands-on educational materials had a positive impact on student learning associated with an agricultural incubator unit in the classroom.

In a quantitative study to determine the effectiveness of teaching science through an agricultural-based curricula, Balschweid (2002) found that more than 90 per cent of the students (n=531) agreed that participating in a biology class that used agriculture as the context helped them to better understand the relationship between science and agriculture and also to appreciate the importance of agriculture. Over 80 per cent of the students agreed that they appreciated the complex nature of animal agriculture as a result of taking the class and that raising animals for food and/or being a farmer is a noble profession. Roegge and Russell (1990) found similarly positive results about

integrating agricultural science into the biology curriculum; students produced higher overall applied biology achievement and exhibited a more positive attitude toward the learning experience.

Connors and Elliot (1995) found that the integration of agricultural concepts of plant science, animal science and natural resources contributed to positive science learning outcomes for high school seniors (aged 16 – 18 years) in the classroom. Conversely, Randell *et al*. (1993) found that the level of practical skills in agriculture gained by students participating in a ninth grade Agricultural Science course in Florida (n=149) was not relevant to whether students received classroom instruction, supervised agricultural experience outside the classroom or participated in the Future Farmers of America youth organisation. They recommended further studies be undertaken to investigate the conflicting results between this study and previous studies.

Research has shown that using agriculture as a topic in teaching can improve the acquisition of basic science and maths process skills amongst primary school pupils (Mabie and Baker, 1996a; Conroy *et al*., 1999). In Kenya and Burundi, schooling has been found to have a small, but significant effect on agricultural productivity, especially in the production of food crops (Eisemon, 1989). In a study conducted in Nigeria on the learning environment of Nigerian agricultural science classes, Idiris and Fraser (1993, 1994) suggested that higher scores on environment scales were associated with more positive attitudes and higher enquiry skills.

Whaley and Lucero (1993) focused on a US educational activity – agricultural education programmes - that might have implications for the UK. 'Based on case studies involving an urban and a semi-urban school, they argued that supervised agricultural experience is educationally valuable. They reported a range of successful strategies including: providing students with a wide variety of project choices; maximising student access to existing resources, such as laboratories; encouraging students to work on projects collaboratively; and actively promoting projects in the local community'.

Biotechnology and genetic engineering

As mentioned previously, biotechnology and genetic engineering are issues of concern to students and topics of relevance within the National Curriculum. Through a quantitative study into the teaching and learning of these topics in school classrooms, Lock *et al*. (1995) found that teaching activities impacted positively on students' knowledge levels. They also noted that classroom teaching helped students to be less uncertain in their attitudes about such issues.

Nutrition education

Curry and Williams (1975) postulated that gathering and preparing wild foods can furnish valuable experiences and knowledge for all age groups. Holmes (1993) found that food can be used as a learning tool to encourage small group co-operative learning. Cason (2001) found that food can be used a valuable

learning tool for developing pre-school children's identification of fruits and vegetables and promoting healthy eating habits.

In the UK, links between a secondary school home economics department and local primary schools enhanced the learning opportunities available to younger children (Heath, 1988). Hague (1992), comparing education in Iceland with that in England, expressed concern that as technology replaces home economics on the curriculum, nutrition education will be pushed to the periphery of design topics. Geen (1991) writing about the post-16 curriculum, as seen through the eyes of staff and students from schools and colleges, is more positive about the opportunities on offer.

In arguing for greater coherence across the curriculum, Morrison (1996) described observations made during her research in four primary and secondary schools:

> *So in art classes observed during my fieldwork students continued to design new containers for burgers, while being instructed to question the links between burger production and agricultural land use in geography lessons, and partake in a daily diet of burgers in the school cafeteria* (pp. 56-7).

This highlights the need for coherence not only between different curriculum subjects but also in institutional arrangements.

Curriculum design has often been taken as unproblematic whereas the opposite is often the case. St Maurice, in a rare philosophical study, examined an undergraduate environmental education course in terms of implicit or explicit representations of nature. St Maurice pointed out that the curriculum fits 'the religious, cultural, political and intellectual contexts within which the course was designed and implemented' (1996, p. 147). That is to say, any new curriculum tends to reflect a range of influences rather than simply being a logical set of content and skills based on learners' needs.

Alternative strategies: apprenticeships, ICT and games

Agnew and Cole (2001), reporting on the study of the potential of an agricultural production and management youth apprenticeship programme in the US, noted that youth apprenticeships in agriculture can help meet the unique needs of the agriculture industry and youth. They provided trained employees and gave young people the unique opportunity to begin preparing for a career while in high school.

Given the diminishing opportunities for school students to make visits outside of their immediate environment, some work has gone into studying what information and communications technology (ICT) has to offer by way of a substitute. Worthington and Ellefson (2002), Tuthill and Klemm (2002) and Stainfield *et al*. (2000) describe electronic field trips. Taylor and Disinger (1997) found a large sample (n=192) of environmental educators generally

accepted virtual reality as a teaching tool. The four most common barriers to inhibit the use of virtual reality were reported as: lack of funds; fear that the virtual experience would replace real experience; a lack of technical training; and, lack of evidence of the effectiveness of virtual reality.

Hewitt (1997) examined the impact of environmental games on a large sample of upper primary students in the US. The games had an impact, particularly on boys, which was attributed to the classroom atmosphere created which led to increased participation in learning.

5.5 Key Messages about Teaching Strategies and their Impact on Learning

The research in this chapter can be summarised in terms of these emerging messages:

- Research on fieldwork suggests that it can aid long-term memory, bring about affective benefits and reinforce academic learning. Farm visits, particularly those supported by appropriate preparatory and follow-up activities, offer a wide range of learning opportunities in different domains. In the affective domain, students have been seen to show greater enthusiasm, self-confidence, motivation, discipline, self-respect, respect for other people's property and tenderness toward the environment as a result of farm visits. Within the cognitive domain, students have developed their understanding of farm and countryside life, made connections between foods and their sources, improved their scientific and numeracy skills, made connections between different subject areas and reflected on their own knowledge. As well as farms, after-school programmes, camps, outdoor centres and supermarket visits can enhance school learning.
- However, much of the evidence base for the effectiveness of school visits to farms and other sites is weak and too often relies on anecdotes. Future research should go beyond asking the simple question. For example, more attention should be paid to: (i) taking advantage of the unique qualities of the field-trip setting; (ii) determining the most effective ways to prepare students and teachers for the experience; (iii) studying how to best structure the on-site experience; (iv) determining how follow-up activities can be used to facilitate the experience; and (v) studying alternative approaches to field trip evaluation (Bitgood, 1989, p. 6).
- What evidence there is about the effectiveness of field trips suggests that the focus of the programme (ecology or environmental issues) does not significantly alter students' learning if there is inadequate preparatory or follow-up work. Follow-up activity, in particular, appears to have a positive impact on learning. There is scope for research into the long-term effects of different strategies on cognitive and affective outcomes.
- There is growing evidence, however, that the amount of fieldwork done by school students has decreased substantially in recent years, part due to

changes in perceptions, attitudes and values of those working with and within biology. Those changes result partly from growing concerns about health and safety issues. Research into the types of out-of-school visits, the frequency with which they take place and their cost-effectiveness is lacking.

- School gardens provide a wide range of learning opportunities and an immediate source of nutrition. They provide a space for community togetherness – within the school and with the larger community, and can facilitate the inclusion of parents. Outcomes for young people include increased motivation, self-initiative, pride, and enjoyment as well as improved nutritional awareness and eating habits. More systematic research into the factors that facilitate or impede learning in school gardens is needed particularly at the secondary school level.
- Curriculum innovation can provide opportunities to learn about controversial issues, such as biotechnology and genetic engineering, and topics such as food and fibres which are relevant to young people's daily lives. There is some evidence that environmental games can have an impact on learning, particularly for boys. The impact of a range of teaching strategies on children's knowledge and skills is limited and it is not clear what works, when and why.
- Electronic field trips might provide opportunities and experiences similar to some aspects of traditional field trips. Research into the design of software environments and students' use of software are both weak.

6. RESEARCH EVIDENCE ON FACTORS THAT CAN IMPEDE OR FACILITATE LEARNING

This chapter explores what is known about the factors that can impede or facilitate students' learning about food, farming and land management. It presents the available evidence in terms of four main foci:

- emotions, fears and phobias
- teacher planning and training
- learners' motivational and identity factors
- the effects of settings.

6.1 Emotions, Fears and Phobias

Impediments to learning often reside within individual teachers and learners rather than within the topic itself. Fears and phobias, for example, were mentioned by several studies of both teachers (Simmons, 1998), and pupils (Bixler *et al.*, 1994). Both groups, in these studies, had a strong fear of getting lost in unfamiliar locations. In the teacher study, poisonous plants were primary fears whereas pupils feared snakes and insects with dirt and mud and touching phobias also rated quite highly.

Bixler *et al.* (1994) state that, if you subscribe to the belief of a 'critical period of exposure' (Marks, 1987) to wilderness settings, children and young people need more experience than they appeared to have been getting at an early age to diminish their fears. It is important to recognise that what children said and felt in the Bixler *et al.* study was collected by nature study centre educators/interpreters. This filtering of the data by an adult mediator might undermine the validity of the study.

Teachers' perceptions and values were also examined in a study of 59 kindergarten and primary school teachers in Chicago (Simmons, 1998). The teachers' perceptions of nature often determined whether students were given the chance to experience natural areas. For example, teachers viewed sites with streams or lakes positively. Teachers associated particular settings with specific educational activities automatically restricting the use of some settings.

Disgust factors have implications for participation in activities that involve handling organisms and/or organic matter. Bixler and Floyd (1999), in a study

of 450 middle-school students in Texas, noted a correlation between feelings for handling organisms and preferences for fieldwork settings. Students with high disgust sensitivity were significantly more likely to prefer activities that did not involve handling organic matter, and fieldwork sites with clear water, no algae and easy lakeshore access. Bixler and Floyd (1999) reported that aversions to slugs, snails and crawling insects are primarily due to disgust sensitivity rather than fear factors. They suggest that further work should be done to test whether disgust sensitivity is predictive of actual behaviour of students participating in 'hands-on' fieldwork.

Alsop (2001), in partnership with a class teacher, utilised a video on food webs to look at how science studies can engage with emotions. Key conclusions were that:

- The arousal of emotions has an impact on class culture: the teacher reported a sense of 'diminishing remoteness' in pupil engagement with the subject. This influenced classroom discussions to develop, as the teacher commented, a 'sense of involvement and attachment' (ibid., p. 65).
- Emotional engagement levels varied in relation to pupils' gender - girls were 'much more likely to display *hot* emotions and boys *cool* emotions' (ibid, p. 66).
- Emotionally unappealing content could serve as a barrier to learning.

Simmons (1994), in a study of urban children's preferences for nature, commented on the complexity of perceptions that children bring to a setting, and on how they might serve as a barrier to learning. One example she uses in her study is children's responses to an image of 'deep woods'. Children often exhibited conflicting feelings and ideas about how they would feel in such places. The positive comments from children included 'good hiding places' and 'trees to climb'. The negative comments were primarily fearful concerns about poisonous plants, wild animals and the 'wildness' of the place.

Anderson and Moss (1993), in a study of 183 British children from infants and junior schools, looked at children's perceptions of wetland habitats. They found that 'a wealth of evidence does suggest that wetlands are negatively portrayed in junior and adult fiction, but more positively in that written for infants' (ibid., p. 473). In their study, attitudes of infant school children towards bogs and marshes were consistently more positive than those of juniors. The study suggests that children's literature can have a negative impact on attitudes and the authors stress the key role that junior school teachers have to play in 'attempting positively to counteract the insidious influences of sources of misinformation' (ibid., p. 472). The implications of these findings, in the context of this review, is that the teachers' role is a key factor in planning and disseminating for positive images of habitats and the wider countryside through the curriculum.

Fears, phobias and emotions concerning real and imagined interactions with both subject and place, present specific impediments to learning in outdoor

settings. Research evidence that sets out to unravel the nature of these feelings and their implications for learning is important and might lead to effective teaching strategies particularly for teachers in novel surroundings.

On a related note, Schneekloth (1989) is concerned about anecdotal evidence from a college student group and a group of environmental educators that vegetation is perceived as 'nothing'. She argues, through the use of drawings as evidence, that vegetation is 'something' in people's perceptions even though it might not be represented as such in their language.

6.2 Teacher Planning and Training

An American study of elementary teachers (Ham and Sewing, 1987, p. 22) concluded that the 'primary barrier to teaching environmental education, as perceived by … elementary teachers, is time'. The authors noted that the teachers divided the time barrier into two divisions:

- time to find time to teach environmental education in the current curriculum
- time to plan for teaching environmental education.

Another issue related to planning, which was noted as significant in several studies, is the extent to which teachers considered the relationship between their planned learning activities and the fieldwork setting. Orion and Hofstein (1994), for example, concluded from a study of 296 grade 9-11 pupils on 1-day geology fieldtrips in Israel that three key factors might impact on the quality of learning:

- the place of the field trip within the curriculum
- parameters of students' novelty space
- the field trip programme.

Openshaw and Whittle (1993, p. 63-64) comment upon the need for teachers to balance 'the students' desire for a structure within which they can feel comfortable and not threatened and the added excitement caused by the unexpected'.

Teachers' lack of familiarity with the field-trip setting is a common theme explored by several studies. Martin *et al.* (1981) concluded that novel environments make learning demands that have not been adequately considered by educators. This concern could necessitate a perceptual shift for teachers, but also suggests the need for a stronger interface between educators and researchers working in this field.

Tunnicliffe *et al.* (1997) identify a lack of framing of the educational experience by primary teachers on field trips to a natural history museum and

zoo. They suggest that the trip becomes a missed opportunity to 'talk science'. Tunnicliffe (2001) highlights another missed opportunity in reporting that botanic gardens present a learning opportunity not always used in depth by teachers. Unfortunately her study does not develop a dialogue with teachers to provide evidence as to *why* this might be the case.

In summary, planning is a key issue for out-of-school learning and it is a complex process that brings new challenges and issues for teachers. If these challenges are *not* met, planning issues such as creating time to consider and plan for new learning settings can present serious impediments.

The need for adequate education and training in order for teachers to feel and be prepared and motivated to take children outdoors has been made by a range of authors (see, for example, McKenzie *et al.*, 1986). The need to inform teachers through training in order to broaden their 'comfort zones' around environmental education settings was highlighted by Simmons (1998). Such training might take place during a teacher's career through direct experience of outdoor education. For example, a case study of two Wigan LEA outdoor education centres in the Lake District (Cooper, 1996) emphasised the importance of close partnerships between outdoor centre workers and visiting teachers in order to enhance the quality of the experience for both teachers and pupils.

McKeon (2001) describes how a group of pre-service teachers (n=50) worked in small groups to prepare websites based on their visit to one of the exhibits at the Science Museum in London. The author argues that use of the Internet can increase the learning potential of a visit to a science museum.

Walker (1997) comments on the impact of practitioner's individual curriculum theories. She concludes that conflicting curriculum theories can serve as an obstacle to the inclusion of environmental education in the school curriculum. Walker argues for the need to devise a less unilateral, more cohesive approach. Her paper examines how teachers' individual curriculum theories can impede the development of a cohesive framework for subject content and delivery. This, she notes, is a specific problem for cross-curricular themes and is therefore an issue pertinent to teacher's conceptual interaction with topical issues such as food, farming and land management.

Rutland (1993) is concerned about teachers' gender bias and how it can affect the teaching and learning of food and food technology subjects. 'It is the more experienced teachers and senior people in education, including parents, who retain outdated views based on their experiences at school and at home. They continue to hold traditional views on the roles of women, particularly concerned with the 'cooking' of food' (ibid, p. 246).

6.3 Learners' Motivational and Identity Factors

Several papers examined motivational factors and/or questions of identity as elements that can influence the learning process within a range of relevant settings. For example, in a US study of high school agriculture students, Turner and Herren (1997) concluded that educators must provide agricultural learning opportunities that are informed by different motivation factors and the culture of motivation. For example, female students are motivated to participate in different ways than male students. Crucially, they also acknowledge differences in motivation between urban and rural students.

The impact of previous fieldwork on students can be a factor in assisting student engagement with study topic. Openshaw and Whittle (1993) in their study of fieldwork in the UK comment upon the role that experiences in previous settings have in facilitating learning on field trips: 'If students have been accustomed to a diet of "experiments", based on well tried recipes that "work"; then real practical ecology is likely to prove a difficult experience for them' (p. 64).

Both Barton (1998), in her study on teaching science with homeless children, and Vicenti-Henio and Torres (1998), in their study on 'Field dependence-independence of American Indian students enrolled in secondary agricultural education', consider the cultural identities that learners bring to the both the subject and the context of learning. Vicenti-Henio and Torres affirm that students have a range of learning styles and that cultural identity may have a role in defining this. Importantly they warn against oversimplification and generalisation of culture. Barton's (1998, p. 387) study stresses the potential for subject content and process to 'grow out of the children's experiences'. She cites one group of children's neighbourhood plan for 'picking up neighbourhood trash, for planting vegetables and flowers, and for recycling' (ibid, p. 387).

6.4 The Effects of Settings

Several studies commented upon responses by learners to the characteristics of settings. For example Simmons (1994) suggests from her study of urban children, that the content, vegetation and topology of a setting and its spatial arrangements such as openness or density of vegetation have implications for learners' responses. Children of 8 and 9 years old, in her study, identified water as being 'too weedy' and 'too muddy'. Associated with these perceptions was a feeling of there being a potential hazard.

Cooper (1996) affirmed (from anecdotal evidence) the positive impacts on learners that different environments for learning offered by outdoor education centres can have on disaffiliated and under-achieving learners.

In a Canadian study (Chipeniuk 1995) on childhood foraging, two groups of teenagers in two distinct landscapes were given the opportunity to forage for

artefacts. The study highlighted foraging as a process which enabled children and young people to come into contact with local biodiversity. However, the author was concerned at the possible gaps in research on 'megalopolitan' children and their relationships with nature and the process of foraging. He questioned whether 'some environments are too artificial to develop children's sense of biodiversity properly' (ibid., p. 507). He goes on to cite Nabhan and Trimble (1994) in sharing his concern: 'Children deprived of extensive contact with natural things, including foraging may grow up with an ungrounded conservation ethic' (ibid, p. 509). In conclusion he noted that agro-industrial-urban cultures 'might gain an understanding of nature and themselves if they were to recognise the advantages of providing ample foraging opportunities for their children' (ibid., p. 509).

Settings of museums and galleries have been researched by some authors. Xanthoudaki (1998) identified models of museum and gallery education programmes which appeared to influence differently the 'three-part unit' of preliminary work, visit to the institution and follow-up activities in the classroom. Model 1 has the gallery in the role of classroom resource: Model 2 has the gallery acting as a teacher about its own collection. The author argues that institutions need to think about which model fits their institution because Model 2 makes it difficult for teachers to utilise visits effectively.

Finally, with respect to school culture, Keirle and Thomas' (2000) comparative study of understanding and practice of healthy eating in two Welsh secondary schools, concludes that changing behaviours needs to be part of a broader policy based culture and practice in schools *not* simply the result of 'a few lessons'.

6.5 Key Messages about Factors that Can Impede or Facilitate Learning

The emerging messages arising from this review provide a framework for considering the factors that might impede or facilitate the quality of young people's learning about food, farming and land management in a range of contexts:

Emotions, fears and phobias

- A person's emotions may play an important role in terms of learning about food production topics, especially ones that are controversial.

- Young people's fear of mud and of touching some objects or environments could have implications for farm visits and 'hands-on' horticultural experiences.
- Teachers need to take account of their own and of learners' fears of organisms in planning and delivering field trip experiences.

Teacher planning and training

- Teacher preparation for field trips appears key to the impact of fieldtrips on learning.
- Teachers' views of learning opportunities offered by field-trips have not been well researched.
- Teachers not having time to plan for work in new learning settings can serve as a barrier to outdoor learning contexts.

Learners' Motivational and Identity Factors

- The impact of a young person's cultural identity on their learning needs to be considered in planning out-of–school experiences. This is particularly so if learning about food, farming and land management are to be appropriate and meaningful experiences for the multicultural urban communities present in many inner city schools.

The effects of settings

- There is some evidence that young people do not see aspects of the environment in the way that adults might assume.
- There is some evidence that urban settings may limit young people's opportunities to forage and in doing so inhibit their ability to develop empathy for flora and fauna.

7. STRENGTHS, WEAKNESSES AND GAPS IN THE EVIDENCE BASE

This chapter draws together the findings of the review as a whole. It summarises the key messages from the research and then highlights gaps and weaknesses in the current evidence base. The chapter ends with some suggestions for how these gaps and weaknesses might be addressed by future research.

7.1 Key Messages from the Research

The research on young people's knowledge and attitudes suggests that there is a strong case for improving teaching and learning about food, faming and land management. School-age students' knowledge and understanding about various aspects of food and farming appear to be poor. This conclusion emerges from studies in the US, the UK and the Netherlands on topics such as pests and pesticides, sustainable farming, international agriculture, genetic engineering and biotechnology. A similar picture comes from investigations in several countries into: young people's understanding of ecological concepts such as food webs, food chains, and ecosystem processes; and students' knowledge about genetically modified and organic/local foodstuffs.

Any teaching and learning initiatives, though, need to recognise the complexity of young people's views and understandings. In particular, it needs to be noted that:

- While young people are concerned about food issues such genetic engineering, organic/local products, there is also evidence of ambivalence, confusion in students' views, and differences between attitudes and behaviours.
- For food and farming issues in general, two studies suggest that young people see these as less serious than other environmental issues such as ozone depletion and tropical deforestation.
- In several studies, levels of concern are found to differ between boys and girls, with girls attaching greater seriousness to issues such as food additives and pesticides, genetic engineering of farm animals, and the importance of organic/local foods.
- Young people's perceptions and experiences of the countryside are complex and varied: while some children can have a very positive attitude towards the countryside, others focus on the possibility of boredom and isolation in rural areas.

In terms of possible teaching strategies and learning activities, the current evidence highlights the potential of:

- school visits to farms – which offer a wide range of learning opportunities in the affective and cognitive domains
- projects in school gardens and school farms – which can provide positive outcomes for young people, as well as developing a stronger community
- other out-of-school learning associated with fieldwork, after-school programmes, camps, outdoor centres and supermarket visits
- classroom-based curriculum strategies - such as teaching about controversial issues, electronic ('virtual') field trips and environmental games.

In highlighting these strategies, though, it is important to recognise that a considerable amount of the research into these has been undertaken in countries other than the UK (most notably in the US). Another challenge is that the research is rarely able to identify what aspects of a particular programme helped to yield positive impacts. In other words, while there is some evidence about the impacts of programmes, there is little evidence about programme effectiveness.

Having said this, there is research that provides insights into the factors that might impede or facilitate young people's learning about food, farming and land management. These studies highlight the influence of:

- young people's emotions and attitudes, which can play an important role in their learning about food production topics such as genetic engineering
- young people's fear of mud and touching organic materials, which may have implications for farm visits and 'hands-on' horticultural experiences
- teachers' and learners' fears of organisms, which can influence the planning and delivery of field trip experiences or present barriers to students being offered the experience of a farm visit
- the ways in which teachers can help students to make connections between learning beyond the classroom and learning within the classroom
- the impact of a young person's cultural identity on their learning needs in relation to out-of-school experiences.

Taken together, these emphasise the need for the careful planning and sensitive delivery of food and farming-focused educational initiatives.

7.2 Weaknesses and Gaps in the Evidence Base

In the literature reviewed, a range of major weaknesses is evident. It is worth pointing out that many of these are not unique to food, farming and land management education research, but represent challenges for many areas of educational and social science research. They can be summarised as follows:

- Few studies acknowledged previous work or took account of what is known about learning.
- Studies of students' awareness of genetically modified foods, sustainable farming practices, etc. were not integrated into any wider conceptual framework, such as the food chain.
- Too few studies paid attention to issues of validity or reliability. Ethnographic studies, in particular, rarely displayed adequate rigour and many made unjustifiable inferences from the data.
- Many of the case studies and small-scale studies were uncritical and offered little more than descriptions of events.
- Research claiming to show 'cognitive improvement' rarely substantiated the claims with valid evidence beyond testing short term recall.
- Research into students' knowledge and attitudes tended to report findings without identifying the implications for teaching and learning (although there are some exceptions to this finding).

There are also a number of important gaps evident within the literature reviewed. These can be thought of as under-researched topics and overlooked contexts.

In terms of topics, there is a distinct lack of research evidence on:

- young people's understanding of the connections between food, farming and land management in terms of the food chain
- students' perceptions of the countryside as a context for food production and land management
- changes in children's thinking about food, farming and the countryside over a period of several years resulting from one or more learning activities in a range of contexts such as farms and botanical gardens
- the sources of, and the factors that can influence and shape, young people's knowledge, attitudes and concerns about food, farming and the countryside
- teachers' aims for work in and visits to farms and school gardens, especially in the UK
- students' learning experiences of farm visits and other food and farming-related learning activities

- the ways in which learners' fears, phobias and prior understanding can influence their experiences of, and outcomes from, food and farming education
- the nature and extent of food and farming-focused education in different UK school sectors since the 1980s
- the efficacy of school-based activities related to food, farming and land management, particularly the use of role plays, simulations, ICT and school gardens
- what constitutes 'effective' learning in terms resulting from educational activities relating to food and farming, both within and beyond the school
- the cost-effectiveness of teaching strategies such as farm visits, fieldwork and the use of ICT.

In terms of contexts, very little research appears to have been undertaken on:

- food and farming contexts in urban areas, such as farmers' markets, and city farms
- curriculum-focused learning activities, especially in the secondary school context
- contemporary food and farming education within the UK.

The last of these means that there are few studies that relate to the current situation in the UK, both in terms of the contemporary educational framework of curriculum, assessment and inspection, and the changing nature of educational experiences available in centres (e.g. the Eden Project), museums, farms and industrial locations.

7.3 Addressing the Weaknesses and Gaps in the Evidence Base

In order to address the weaknesses and gaps in the literature base, we suggest the following studies should be undertaken:

- Research into where children learn about food, farming and land management, what they learn and what the key drivers are for maximising learning. In-depth, focused studies offer much potential for developing our understanding of these key issues.
- What does learning and teaching about food, farming and land management look like in schools: who teaches it, how and why? There is a need for comparative international studies of curriculum organisation and implementation. Such studies might focus on what is transferable from one system to another and from one part of a system to another.
- In-depth, mixed method studies of students' learning in terms of processes and outcomes from particular learning activities such as farm visits, ICT-

based programmes and fieldwork. Organisations in the area might consider funding external evaluations of any projects and programmes that they support.

- Investigations of the cost-effectiveness of particular teaching strategies, as well as research into what measures could be used to explore economic effectiveness in this context. Such research might form part of any evaluation of programmes funded by external bodies.
- Investigations into ways of reducing and removing the barriers to learning about food, farming and land management (at different levels: LEAs, schools, departments and in non-school contexts).
- An investigation into what progression might look like in terms of understanding food, farming and land management issues. This theoretical study might have significant implications for curriculum design and for the implementation of teaching and learning environments.

APPENDIX 1 Search Procedure Details

The search strategy combined a number of sources to identify potentially relevant studies.

Handsearches

Key journals in the field were handsearched to identify articles that had been missed in the database searches.

- *Children's Environments Quarterly*
- *Environmental Education Research*
- *Journal of Agricultural Education*
- *Journal of Environmental Education*
- *Journal of Rural Studies*
- *Learning Environments*
- *Primary Science Review*
- *School Science Review*
- *Studies in Science Education*
- *Teaching Geography*

Hand searches were also undertaken of several previously-published reviews and bibliographies. These related to: geographical education/fieldwork (Foskett and Marsden, 1998); environmental learning (Rickinson, 2001); environmental education (Hart and Nolan, 1999); and young people's attitudes to education and training (Morris *et al*., 1999).

E-mail requests to networks, organisations and individuals

A request for information about relevant research was sent to the following research networks and practitioner organisations.

- Action for Biology in Education (Virginia Purchon)
- Australian Environmental Education Network (Daniella Tilbury)
- Black Environment Network (Judy Ling Wong)
- Biodiversity Education Practitioners Association
- Council for the Environment in New York City (Mike Zamm)
- CRU/Youth Research Group (Glen Smith)
- Environmental Education list serve (Alan Reid)
- FERN Environmental Education Research Network
- Groundwork UK (Christine Southwood)

- Henry Doubleday Research Association (Maggi Brown)
- Learning through Landscapes (Barbara Chillman)
- North American Association for Environmental Education (Tom Marcincowski)
- OFSTED (Leszek Iwaskow)
- Rural Education Special Interest Group, American Education Research Association (Stephen Swidler)
- Swedish Education and Sustainable Development Network (Per Wickenburg)
- The Food Programme, BBC Radio 4 Website
- The Kid's Cookery School
- US Food, Land and People Organisation (Deena Wright)

In addition personal contacts were made to approximately 40 students and researchers working in this area.

- Tom Bean, King's College London
- Robyn Baker, New Zealand Educational Research Institute
- Mark Bhatti, Brighton University
- Tony Binns, University of Sussex
- Richard Bisgrove, University of Reading
- Rachel Bolsted, New Zealand Council for Educational Research
- Ian Cook, University of Wales, Lampeter
- Judy Culbertson, California Foundation for Agriculture in the Classroom
- Amy Cutter-Mackenzie, Central Queensland University
- Daniel Desmond, University of California
- Andrew Fearne, Imperial College at Wye
- James Furse-Roberts, University of Reading
- Jeff Griffiths, Education Management Information Exchange
- Julia Hawley, ADAS Management Consultancy Ltd
- Vicky Healing, Imperial College at Wye
- Sam Hillyard, University of Nottingham
- Sue Johnson, Institute of Education, University of London
- Jacqueline Jones, University of Massachusetts
- Verity Jones, University of Wales, Aberystwyth
- Rebecca Lines-Kelly, Wollongbar Agricultural Institute
- Marianne E. Krasny, Cornell University

- Mary Ellen Lewis, State University of New York
- Kate Lloyd-Bostock, University of Reading
- Cecilia Lundholm, University of Stockholm
- Tom Marcinkowski, Florida Institute of Technology
- John Morgan, University of Bristol
- Jonathan Osborne, King's College London
- Christine Pascal, University of Worcester
- Peggy Sears, California State Polytechnic University
- Pam Smith, Botanic Garden at Winterbourne, University of Birmingham
- Martin Stanisstreet, University of Liverpool
- Richard Statham, Museum of English Rural Life and Rural History Centre
- Kathy Stewart, Royal Botanic Gardens Sydney
- Janice Stubbings, Fairfield City Farm
- Daniella Tilbury, Maquarie University, Sydney
- Arjen Wals, Wageningen University
- Nick Walton, University of Portsmouth
- Rendel Williams, University of Sussex

Database searches

A range of different educational, sociological and psychological databases were searched. Search strategies for all databases were developed by using terms from the relevant thesauri (where these were available), in combination with free text searching. The same search strategies were adhered to as far as possible for all the databases. The NFER Library's own internal databases were also searched, as well as CERUK (Current Educational Research in the United Kingdom).

The database searches were supplemented by scanning the reference lists of relevant articles, thus identifying further studies.

The team also searched relevant websites and downloaded documents and publications lists.

The bibliographic details of all papers identified through database searches and the potentially relevant papers found by hand, website and bibliography searching and through personal contact were entered onto a ProCite bibliographic database.

The keywords used in the database searches, together with a brief description of each of the databases searched, are outlined below.

APPLIED SOCIAL SCIENCES INDEX AND ABSTRACTS (ASSIA)

ASSIA is an index of articles from over 600 international English language social science journals. The database provides unique coverage of special educational and developmental aspects of children. Searches date from 1987-2002.

Terms relating to Farming and Land Management

#1 Farm Visits (ft)
#2 Agricultural Education (ft)
#3 Field Trips (ft)
#4 Outdoor Education
#5 Museum Education
#6 Visitor Centre* (ft)
#7 Visitor Centre* (ft)
#8 Experiential Learning
#9 Extracurricular Activities
#10 Community Garden* (ft)
#11 City Farm* (ft)
#12 School Grounds (ft)
#13 Out of School Time
#14 Summer Camp* (ft)
#15 Organic Farming (ft)

Terms relating to Food

#16 Food Education (ft)
#17 Nutrition Education (ft)
#18 Eating Habits (ft)
#19 Organic Food* (ft)
#20 GM Food* (ft)

ft Denotes free-text searching
* Denotes truncation of search terms to account for plurals (e.g. garden, gardens)

AUSTRALIAN EDUCATION INDEX (AEI)

AEI is produced by the Australian Council for Educational Research. It is an index to materials at all levels of education and related fields. Source documents include journal articles, monographs, research reports, theses, conference papers, legislation, parliamentary debates and newspaper articles. Searches date from 1978 to 2002.

Terms relating to Age Range 3-18

#1 Early Childhood Education
#2 Preschool Education
#3 Elementary Education
#4 Primary Education
#5 Lower Primary Years
#6 Middle Primary Years
#7 Upper Primary Years
#8 Primary Secondary Education
#9 Secondary Education
#10 Lower Secondary Years
#11 Upper Secondary Years
#12 #1 **or** #2 **or** #3 **or** #4 **or** #5 **or** #6 **or** #7 **or** #8 **or** #9 **or** #10 **or** #11

Terms relating to Farming and Land Management

#13 Farm Visits
#14 Agricultural Education
#15 Agriculture
#16 Agricultural Production
#17 Farm Management
#18 Farming
#19 #14 **or** #15 **or** #16 **or** #17 **or** #18
#20 #19 **and** #12
#21 Field Trips
#22 Outdoor Education
#23 Land Use
#24 Land Management
#25 Countryside
#26 #21 **or** #22 **or** #23 **or** #24 **or** #25
#27 #26 **and** #12
#28 Museums
#29 Visitor Centre$ **or** Visitor Centre$
#30 Environmental Education
#31 #30 **and** #12
#32 Development Education
#33 Non Formal Education
#34 Experiential Learning
#35 #32 **or** #33 **or** #34
#36 #35 **and** #12
#37 Extracurricular Activities
#38 Community Garden$ (ft)
#39 Botanical Garden$ (ft)
#40 City Farm$ (ft)
#41 Schools Grounds (ft)
#42 Out of School Learning (ft)
#43 Out of School Club$ (ft)
#44 Summer Camp$ (ft)

#45 #37 **or** #38 **or** #39 **or** #40 **or** #41 **or** #42 **or** #43 **or** #44
#46 #45 **and** #12
#47 Organic Farming (ft)
#48 4H (ft)

Terms relating to Food

#49 Food
#50 Food Service
#51 Food Standards
#52 Nutrition
#53 #49 **or** #50 **or** #51 **or** #52
#54 #53 **and** #12
#55 Food Education
#56 Food Instruction
#57 Nutrition Education
#58 Catering Education
#59 Home Economics
#60 #55 **or** #56 **or** #57 **or** #58 **or** #59
#61 #60 **and** #12
#62 Health Education
#63 Attitudes
#64 #62 **and** #63
#65 #64 **and** #12
#66 Eating Habits
#67 #66 **and** #12
#68 GM Food$ (ft)
#69 Organic Food$ (ft)

$ Denotes truncation of search terms to account for plurals (e.g. club, clubs)
ft Denotes free-text searching

BRITISH EDUCATION INDEX (BEI)

BEI provides bibliographic references to 350 British and selected European English-language periodicals in the field of education and training, plus developing coverage of national report and conference literature. Searches date from 1986 to 2002. A second search was carried out on the major sets without the age limits to maximise retrieval of relevant references.

Terms relating to Age Range 3-18

#1 Preschool Education
#2 Nursery School Education
#3 Infant School Education
#4 Primary Education
#5 Primary Secondary Education

#6 Middle School Education
#7 Secondary Education
#8 Sixth Form Education
#9 Sixteen to Nineteen Education
#10 #1 **or** #2 **or** #3 **or** #4 **or** #5 **or** #6 **or** #7 **or** #8 **or** #9

Terms relating to Farming and Land Management

#11 Farm Visits
#12 Agricultural Education
#13 Agriculture
#14 Agricultural Production
#15 Farm Management
#16 Farming
#17 #11 **or** #12 **or** #13 **or** #14 **or** #15 **or** #16
#18 #17 **and** #10
#19 Field Trips
#20 Outdoor Education
#21 Land Use
#22 Countryside
#23 #19 **or** #20 **or** #21 **or** #22
#24 #23 **and** #10
#25 Museums
#26 Visitor Centre$
#27 #25 **or** #26
#28 #27 **and** #10
#29 Field Studies
#30 Environmental Education
#31 #29 **or** #30
#32 #31 **and** #10
#33 Development Education
#34 Non Formal Education
#35 #33 **or** #34
#36 #35 **and** #10
#37 Extracurricular Activities
#38 Community Garden$ (ft)
#39 Botanical Garden$ (ft)
#40 City Farm$ (ft)
#41 School Grounds (ft)
#42 Out of School Learning (ft)
#43 Out of School Clubs (ft)
#44 Summer Camp$ (ft)
#45 #37 **or** #38 **or** #39 **or** #40 **or** #41 **or** #42 **or** #43 **or** #44
#46 #45 **and** #10
#47 Organic Farming (ft)
#48 4H (ft)

Terms relating to Food

#49 Food
#50 Food Service
#51 Food Standards
#52 Hunger
#53 #49 **or** #50 **or** #51 **or** #52
#54 #53 **and** #10
#55 Food Education
#56 Food Instruction
#57 Nutrition Education
#58 Catering Education
#59 Home Economics
#60 Nutrition
#61 #55 **or** #56 **or** #57 **or** #58 **or** #59 **or** #60
#62 #61 **and** #10
#63 #62 **not** #53
#64 Health Education
#65 #64 **and** #10
#66 #65 **not** (#53 **or** #61)
#67 Eating Habits
#68 #67 **and** #10
#69 #67 **not** (#53 **or** #61 **or** #65)
#70 GM Food$ (ft)
#71 Organic Food$ (ft)

ft Denotes free-text searching
$ Denotes truncation of search terms to account for plurals (e.g. club, clubs)

CANADIAN BUSINESS AND CURRENT AFFAIRS (CBCA)

CBCA provides indexing and full text access to the principal educational literature publications in Canada, covering all significant reports of government departments, faculties of education, teachers' associations, large school boards and educational organisations. Over 150 educational periodicals, plus educational articles in over 700 general journals and newspapers are indexed. Searches date from 1976 to 2002. The terms "Environmental Education", "Development Education" and "Extra Curricular Activities" were excluded from this search strategy as the results they produced were too broad.

Terms relating to Farming and Land Management

#1 Farm Visits (ft)
#2 Agricultural Education (ft)
#3 Agriculture (ft) **not** #2
#4 Agricultural Production (ft)
#5 Farm Management (ft)

#6 Farming **not** (#2 **or** #3)
#7 Field Trips **or** Field Studies
#8 Outdoor Education
#9 Land Use (ft)
#10 Countryside (ft)
#11 Museum***** **not** #7
#12 Visitor Centre*
#13 Non Formal Education (ft)
#14 Community Garden* (ft)
#15 Botanical Garden* (ft)
#16 City Farm* (ft)
#17 School Grounds (ft)
#18 Out of School Learning (ft)
#19 Out of School Club* (ft)
#20 Summer Camp* (ft)
#21 Organic Farming (ft)
#22 4H (ft)

Terms relating to Food

#23 Food
#24 Food Service
#25 Food Standards
#26 #23 **or** #24 **or** #25
#27 Food Instruction (ft)
#28 Food Education (ft)
#29 Nutrition Instruction (ft)
#30 Cooking Instruction (ft)
#31 Nutrition
#32 #27 **or** #28 **or** #29 **or** #30 **or** #31
#33 Health Education and Attitudes
#34 Eating Habits
#35 GM Food* (ft)
#36 Organic Food* (ft)
#37 Genetically Modified Food* (ft)

ft Denotes free-text searching
* *Denotes truncation of search terms to account for plurals (e.g. garden, gardens)*

COPAC

COPAC is a union catalogue which provides access to the merged online catalogues of 23 of the largest university research libraries in the UK and Ireland, plus the British Library.

Terms relating to Farming and Land Management

#1 Farm Visits
#2 Field Trips
#3 Extra Curricular Activities
#4 Community Gardens

Terms relating to Food

#5 Food Education
#6 Nutrition Education
#7 Catering Education
#8 Eating Habits
#9 GM Food
#10 Organic Food

DISSERTATION ABSTRACTS

This database contains more than 1.7 million doctoral dissertations and master's theses. Searches date from 1960. The following terms were searched.

Terms relating to Farming and Land Management

#1 Farm Learning
#2 Farm Education
#3 Farm Primary Education
#4 Agricultural Education Secondary
#5 Agricultural Education Primary
#6 Field Trips
#7 Land Management Learning
#8 Future Farms of America
#9 4H Learning
#10 Food Learning
#11 Learning On Farms
#11 Education Farm Contexts
#12 School Gardens
#13 Outdoor Education
#14 Food Education
#15 Food Learning
#16 City Farms
#17 Urban Gardens
#18 Garden Learning
#19 Agricultural Learning
#20 Outdoor Learning
#21 Educational Gardens
#22 Biotechnology Education

EDUCATIONAL RESEARCH ABSTRACTS (ERA)

ERA comprises 21,000 abstracts from seven international abstracting journals, covering topics such as educational management, educational technology, multicultural education and sociology of education. Coverage starts from 1995.

Terms relating to Farming and Land Management

#1 Farm Visits
#2 Agriculture
#3 Agricultural Education
#4 Agricultural Production
#5 Farm Management
#6 Farming
#7 Land Use
#8 Countryside
#9 Field Trip*
#10 Outdoor Education
#11 Field Studies
#12 Museum*
#13 Visitor Centre* **or** Visitor Centre*
#14 Environmental Education
#15 Development Education
#16 Non Formal Education
#17 Extracurricular Activities
#18 Community Garden*
#19 Botanical Garden*
#20 City Farm*
#21 School Grounds
#22 Out of School Learning
#23 Out of School Club*
#24 Summer Camp*
#25 Organic Farming
#26 4H

Terms relating to Food

#27 Food
#28 Food Service
#29 Food Standards
#30 Nutrition
#31 Food Education (ft)
#32 Food Instruction (ft)
#33 Nutrition Education
#34 Catering Education
#35 Home Economics

#36 Health Education
#37 Eating Habits
#38 GM Food*
#39 Organic Food*
#40 Genetically Modified Food

ft Denotes free-text searching
* *Denotes truncation of search terms to account for plurals (e.g. garden, gardens)*

ERIC

ERIC is sponsored by the United States Department of Education and is the largest education database in the world. It indexes over 725 periodicals and currently contains more than 7,000,000 records. Coverage includes research documents, journal articles, technical reports, program descriptions and evaluations and curricula material. Searches date from 1985 to 2002. An attitudinal set of search terms was used when searching ERIC as the searches produced a large number of references.

Terms relating to Attitudes

#1 Attitudes
#2 Opinions
#3 Beliefs
#4 Expectations
#5 Experience
#6 Perception
#7 Awareness
#8 Understanding
#9 Access to Information
#10 Information Dissemination
#11 Informal Education
#12 Experiential Learning
#13 #1 **or** #2 **or** #3 **or** #4 **or** #5 **or** #6 **or** #7 **or** #8 **or** #9 **or** #10 **or** #11 **or** #12

Terms relating to Age Range 3-18

#14 Early Childhood Education
#15 Preschool Education
#16 Elementary Secondary Education
#17 Elementary Education
#18 Primary Education
#19 Intermediate Grades
#20 Secondary Education
#21 Middle Schools

#22 Junior High Schools
#23 High Schools
#24 #14 **or** #15 **or** #16 **or** #17 **or** #18 **or** #19 **or** #20 **or** #21 **or** #22 **or** #23

Terms relating to Farming and Land Management

#25 Farm Visits
#26 Agricultural Education
#27 Agriculture
#28 Agricultural Production
#29 Farm Management
#30 #25 **or** #26 **or** #27 **or** #28 **or** #29
#31 #30 **and** #13 **and** #24
#32 Field Trips
#33 Outdoor Education
#34 #32 **or** #33
#35 #34 **and** #13 **and** #24
#36 Field Studies
#37 Museums
#38 Visitor Centre$ (ft)
#39 #36 **or** #37 **or** #38
#40 #39 **and** #13 **and** #24
#41 Sustainable Development
#42 Environmental Education
#43 #41 **or** #42
#44 #43 **and** #13 **and** #24
#45 Community Garden$ (ft)
#46 Botanical Garden$ (ft)
#47 City Farm$ (ft)
#48 School Grounds (ft)
#49 Out of School Learning (ft)
#50 Out of School Club$ (ft)
#51 Summer Camp$ (ft)
#52 #45 **or** #46 **or** #47 **or** #48 **or** #49 **or** #50 **or** #51
#53 #52 **and** #13 **and** #24
#54 Organic Farming (ft)
#55 4H (ft)

Terms relating to Food

#56 Food
#57 Food Service
#58 Food Standards
#59 #56 **or** #57 **or** #58
#60 #59 **and** #13 **and** #24
#61 Food Instruction
#62 Nutrition Instruction
#63 Cooking Instruction
#64 Nutrition

#65 #61 **or** #62 **or** #63 **or** #64
#66 #65 **and** #13 **and** #24
#67 Health Education
#68 #67 **and** #13 **and** #24
#69 Eating Habits
#70 #69 **and** #13 **and** #24
#71 GM Food$
#72 Organic Food$

ft Denotes free-text searching

INTERNATIONAL BIBLIOGRAPHY OF THE SOCIAL SCIENCES (IBSS)

IBSS is one of the largest and most comprehensive social science databases in the world with coverage dating from 1951 onwards. Current data is taken from over 2400 selected international social science journals and around 7000 books per annum.

Terms relating to Farming and Land Management

#1 Farm Visit*
#2 Agricultural Education
#3 Field Trip*
#4 Outdoor Education
#5 Field Studies
#6 Environmental Education
#7 Non Formal Education
#8 Extra Curricular Activities
#9 Community Garden*
#10 Botanical Garden*
#11 Out of School Learning
#12 Out of School Clubs
#13 Summer Camp*
#14 Organic Farming

Terms relating to Food

#15 Food Education
#16 Nutrition Education
#17 Catering Education
#18 Home Economics
#19 Eating Habits
#20 GM Food*
#21 Organic Food*

* *Denotes truncation of search terms to account for plurals (e.g. garden, gardens)*

PSYCINFO

This is an international database containing citations and summaries of journal articles, book chapters, book and technical reports, as well as citations to dissertations in the field of psychology and psychological aspects of related disciplines, such as medicine, sociology and education. Searches date from 1966-2002.

Terms relating to Age Range 3-18

#1 Infancy
#2 Preschool Age
#3 School Age
#4 Childhood
#5 Adolescence
#6 #1 **or** #2 **or** #3 **or** #4 **or** #5

Terms relating to Farming and Land Management

#7 Agricultural Education (ft)
#8 #7 **and** #6
#9 Educational Field Trips
#10 #9 **and** #6
#11 Environmental Education
#12 Environmental Attitudes
#13 #11 **or** #12
#14 #13 **not** #9
#15 #14 **and** #6
#16 Experiential Learning
#17 #16 **not** (#9 **or** #13)
#18 Community Garden* (ft)
#19 Botanical Garden* (ft)
#20 City Farm* (ft)
#21 School Grounds (ft)
#22 Out of School Learning (ft)

Terms relating to Food

#23 Food
#24 Nutrition
#25 #23 **or** #24
#26 #25 **and** #6
#27 Nutrition Education **not** #25
#28 #27 **and** #6
#29 Eating Attitudes
#30 #29 **not** #25
#31 #30 **and** #6

#32 GM food* (ft) **or** Genetically Modified Food* (ft) **or** Organic Food*

(ft) ft Denotes free-text searching
* *Denotes truncation of search terms to account for plurals (e.g. garden, gardens)*

REGARD

Regard is an online database containing information on social science research funded by the Economic and Social Research Council (ESRC). It contains over 75,000 records dating back to the mid 1980s.

Terms relating to Farming and Land Management

#1 Farm_Visit*
#2 Agricultural_Education
#3 Farming
#4 Field_Trip*
#5 Study_Trip*
#6 Outdoor Education
#7 Countryside
#8 Museum*
#9 Visitor_Centre*
#10 Field Studies
#11 Environmental_Education
#12 Non_Formal_Education
#13 Extracurricular_Activities
#14 Community_Garden*
#15 Botanical_Garden*
#16 Out_of_School_Learning
#17 Out_of_School_Clubs
#18 Summer_Camp*
#19 Organic Farming

Terms relating to Food

#20 Food_Education
#21 Nutrition_Education
#22 Food_Instruction
#23 Catering_Education
#24 Home_Economics
#25 Nutrition
#26 Health_Education
#27 Eating_Habits
#28 GM_Food*
#29 Organic_Food*

* *Denotes truncation of search terms to account for plurals (e.g. garden, gardens)*

SYSTEM FOR INFORMATION ON GREY LITERATURE IN EUROPE (SIGLE)

SIGLE is a bibliographic database covering European non-conventional (grey) literature in the fields of humanities, social sciences, pure and applied natural sciences and technology, and economics. Searches date from 1980-2002.

Terms relating to Farming and Land Management

#1 Farm Visits
#2 Agricultural Education
#3 Field Trips
#4 Study Trips
#5 Educational Field Trips
#6 Outdoor Education
#7 Museum Education
#8 Visitor Centres
#9 Environmental Education
#10 Experiential Learning
#11 Extracurricular Activities
#12 Botanical Gardens
#13 City Farms
#14 School Grounds
#15 Out of School learning
#16 Organic Farming

Terms relating to Food

#17 Food Education
#18 Nutrition Education
#19 Catering Education
#20 Eating Habits

APPENDIX 2: Framework for Reviewing Research Publications

Reference:

Date of review:
Learning context: brief description of the learning setting
Learning content: brief description of the focus of the learning
Research question relevance: 1 2 3 4 5 6
Country of Origin: country(ies) where the work was undertaken
Age of learners:

Research aims	a summary of the aims of the research study as reported by the researcher in their paper
Project details	name and funding details of any broader research project (if mentioned)
Conceptual/ theoretical approach	summary of the key conceptual and/or theoretical assumptions that underpin the work reported (but only in so far as these are explicated and acknowledged by the author)
Sample	details of sample sizes, sample characteristics, and selection procedures and rationale
Methodology	the broader epistemological and theoretical framework that surround and underpin the methods of the study (but again only in so far as these are explicated and acknowledged by the author)
Validity measures	any measures aimed at ensuring validity or reliability (howsoever conceived) that are reported by the author
Methods (data collection and analysis)	summarised details of the reported procedures of data collection, and of data analysis
Main findings	summary of the study's main findings as reported by the researcher
Key conclusions	summary of the main conclusions drawn from the study's findings by the researcher
Author's view of what findings tell us	summary of the key implications and lessons that the researcher draws from the study
Reviewer's view of what findings tell us	reviewer's view of the key implications and lessons emerging from the study
Strengths and weaknesses	aspects of the study that the reviewer perceives as particularly valuable or potentially problematic/limited
Links	brief notes about any points of commonality or divergence between this and other studies in the review e.g. similar or very different findings on a similar topic, methodological links or conflicts etc.

REFERENCES

ADENIYI, O.E. (1985). 'Misconceptions of selected ecological concepts held by some Nigerian students', *Journal of Biological Education*, **19**, 4, 311–16.

AGNEW, D.M. and COLE, K. (2001). 'Apprenticeships in agriculture', *The Agricultural Education Magazine*, **73**, 6, 24–5.

ALEXANDER, J., NORTH, M-W. and HENDREN, D.K. (1995). 'Master Gardener Classroom Garden Project: an evaluation of the benefits to children', *Children's Environments*, **12**, 2, 256–63.

ALSOP, S. (2001). 'Seeking emotional involvement in science education: food-chains and webs', *School Science Review*, **83**, 302, 63–8.

ANDERSON, S. and MOSS, B. (1993). 'How wetland habitats are perceived by children: consequences for children's education and wetland conservation', *International Journal of Science Education*, **15**, 5, 473–85.

ANDREWS, D. (2001). Growing sites: the use of gardening and farming in youth development projects. Unpublished thesis [online]. Available: http://www.cityfarmer.org/youthDevelopment.html [18 February, 2003].

ATKINS, L. (2000). 'Playing safe on the farm', *The Guardian* [online]. Available: http://www.guardian.co.uk/parents/story/0,3605,231607,00.html [18 November, 2002].

BALSCHWEID, M.A. (2002). 'Teaching biology using agriculture as the context: perceptions of high school students', *Journal of Agricultural Education*, **43**, 2, 56–67.

BARBER, L. (1993). An investigation to establish whether a short period of outdoor activities in a residential setting would promote personal and social development in an individual. Unpublished MA Thesis, University of Southampton.

BARKER, R. (1986). 'The farm experience: its importance in a child's life.' Paper presented at the North American Montessori Teachers' Association Educational Regional Conference, 24 February.

BARKER, S., SLINGSBY, D. and TILLING, S. (2002). *Teaching Biology Outside the Classroom: Is it Heading for Extinction? A Report on Biology Fieldwork in the 14-19 Curriculum* (FSC Occasional Publication 72). Shrewsbury: Field Studies Council.

BARMAN, C.R., GRIFFITHS, A.K. and OKEBUKOLA, P.A.O. (1995). 'High school students' concepts regarding food chains and food webs: a multinational study', *International Journal of Science Education*, **17**, 6, 775–82.

BARTON, A.C. (1998). 'Teaching science with homeless children: pedagogy, representation, and identity', *Journal of Research in Science Teaching*, **35**, 4, 379–94.

BILTON, H. (1993). 'The nursery class garden - problems associated with working in the outdoor environment and their possible solutions?' *Early Child Development & Care*, **93**, 15–33.

BIRMINGHAM CITY COUNCIL EDUCATION SERVICE (2000). *Year of the Environment: Survey of the Views and Concerns of Young People.* Birmingham: City Council Education Service.

BIRNEY, B.A. (1995). 'Children, animals and leisure settings', *Society and Animals*, **3**, 2, 171–87.

BISSONNETTE, M.M. and CONTENTO, I.R. (2001). 'Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: application of a psychosocial model', *Journal of Nutrition Education*, **33**, 2, 72–82.

BITGOOD, S. (1989). 'School field trips: an overview', *Visitor Behavior*, **4**, 2, 3–6.

BIXLER, R.D., CARLISLE, C.L., HAMMITT, W.E. and FLOYD, M.F. (1994). 'Observed fears and discomforts among urban students on field trips to wildland areas', *Journal of Environmental Education*, **26**, 1, 24–33.

BIXLER, R.D. and FLOYD, M.F. (1999). 'Hands on or hands off? Disgust sensitivity and preference for environmental education activities', *Journal of Environmental Education*, **30**, 3, 4–11.

BOGNER, F.X. (1998). 'The influence of short-term outdoor ecology education on long-term variables of environmental perspective', *Journal of Environmental Education*, **29**, 4, 17–29.

BONN, C. (1997). 'Sowing the seeds', *Country Life*, **191**, 28, 86–8.

BOWKER, R. (2002). 'Getting the most out of Eden', *Primary Science Review*, **75**, 4–7.

BRAMWELL, R.D. (1961). *Elementary School Work 1900-1925*. Durham: University of Durham, Institute of Education. Cited in: JENKINS, E.W. and SWINNERTON, B.J. (1998). *Junior School Science Education in England and Wales Since 1900: From Steps to Stages.* London: Woburn Press.

BRANSON, J.M. (1950). 'The garden as a teaching aid', *The School Nature Study Journal,* **178**, 45, 2–3.

BRAVERMAN, M.T. and RILLA, E.L. (1991). 'How California educators and CE directors view "agricultural literacy" programs', *California Agriculture*, **45**, 6, 4-5, 8–9.

BRIGHTWEN, E. (1913). *Glimpses into Plant-Life Fisher.* London: Unwin.

BRITISH BROADCASTING CORPORATION (2000). *Schools Warned of Farm Trip Risks* (BBC News Online*:* Education) [online]. Available: http://news.bbc.co.uk/1/hi/education/607295.stm [20 January, 2003].

BRYNJEGARD, S. (2001). *School Gardens: Raising Environmental Awareness in Children.* San Rafael, CA: Dominican University of California, School of Education.

BURGESS, R.G. and MORRISON, M. (1995). *Teaching and Learning About Food and Nutrition in Educational Settings* (Final Report). Swindon: ESRC.

CANARIS, I. (1995). 'Growing foods for growing minds: integrating gardening and nutrition education into the total curriculum', *Children's Environments*, **12**, 2, 264–70.

CAREY, A. (1990). 'Giving farming a human face', *Report*, **12**, 5, 12–13.

CARLSON, J.E. and BAUMGARTNER, D. (1974). 'The effects of natural resource camps on youths', *Journal of Environmental Education*, **5**, 3, 1–7

CASON, K.L. (2001). 'Evaluation of a pre-school nutrition education program based on the theory of multiple intelligences', *Journal of Nutrition Education*, **33**, 3, 161–4.

CHEEK, J.G. and McGHEE, M.B. (1985). 'Assessment of competencies possessed by students enrolled in applied principles of agribusiness and natural resources education', *Journal of the American Association of Teacher Educators in Agriculture*, **26**, 4, 55–65.

CHIPENIUK, R. (1995). 'Childhood foraging as a means of acquiring competent human cognition about biodiversity', *Environment and Behavior*, **27**, 4, 490–512.

CONNORS, J.J. and ELLIOT, J.F. (1995). 'The influence of agriscience and natural resources curriculum on students' science achievement scores', *Journal of Agricultural Education*, **36**, 3, 57–63.

CONROY, C.A., TRUMBULL, D.J. and JOHNSON, D. (1999). 'Agriculture as a rich context for teaching and learning, and for learning mathematics and science to prepare for the workforce of the 21st century.' Paper presented at the 'Transitions from Childhood to the Workforce Teaching and Learning' Conference, Cornell University, Ithaca, NY, 17-19 September.

COOK, I., CRANG, P. and THORPE, M. (1998). 'Biographies and geographies: consumer understandings of the origins of foods', *British Food Journal*, **110**, 3, 162–7.

COOPER, C. and LATHAM, J. (1988). 'Visits out of school', *Teaching Geography*, **13**, 2, 72–3.

COOPER, G. (1991). 'The role of outdoor and field study centers in educating for the environment', *Journal of Adventure Education & Outdoor Leadership*, **8**, 2, 10–11.

COOPER, G. (1996). 'Assessing the value of outdoor education programmes provided by residential centres', *Journal of Adventure Education & Outdoor Leadership*, **13**, 4, 12–15.

COULSON, N., EISER, J.R. and EISER, C. (1996). 'Children's awareness of additives in food', *Health Education Journal*, **55**, 4, 375–81.

THE COUNTRYSIDE AGENCY (2002). *Farming* [online]. Available: http://www.countryside.gov.uk/farming [28 March, 2003].

THE COUNTRYSIDE AGENCY. DEPARTMENT FOR EDUCATION AND SKILLS and FARMING AND COUNTRYSIDE EDUCATION (2002). *Improving the Understanding of Food, Farming and Land Management Amongst School-Age Children. Invitation to Tender*. London: DfES.

CROMPTON, J.L. and SELLAR, C. (1981). 'Do outdoor education experiences contribute to positive development in the affective domain?' *Journal of Environmental Education*, **12**, 4, 21–9.

CULLINGFORD, C. (1994). 'The attitudes of children to their environment', *Cambridge Journal of Education*, **24**, 1, 7–19.

CURRY, A.D. and WILLIAMS, R.A. (1975). 'Gathering and preparing wild foods', *Journal of Environmental Education*, **7**, 2, 44–7.

DAVIS, G. (1957). 'Schools and their gardens: St. Frideswide's secondary modern girls' school', *Gardener's Chronicle Gardening Illustrated*, **141**, 4, 89.

DAVIS, J. and RIDGE, T. (1997). *Same Scenery, Different Lifestyle: Rural Children on a Low Income*. London: The Children's Society.

DENZIN, N.K. and LINCOLN, Y.S. (Eds) (1998). *Strategies of Qualitative Inquiry.* Thousand Oaks, CA: Sage .

DESMOND, D.J. (1998). 'Connecting children to the land: a review of programs in agricultural literacy in California.' In: BRAVERMAN, M.T., CARLOS, R.M. and STANLEY, S.M. (Eds) *Advances in Youth Development Programming: Reviews and Case Studies from the University of California.* Oakland, CA: University of California, Division of Agriculture and Natural Resources, Communication Services.

DESMOND, D.J., LEISING, J.G., KING, N.J., RILLA, E.J. and COPPOCK, R. (1990). 'New approaches for a better understanding of agriculture.' In: CARTER, H.O. and NUCKTON, C.F. (Eds) *Agriculture in California: On the Brink of a New Millennium*. Davis, CA: University of California, Davis, Agricultural Issues Center.

DIERKING, L.D. and FALK, J.H. (1997). 'School field trips: assessing their long-term impact', *Curator*, **40**, 3, 211–8.

DONAHUE, T.P. (1994). 'Community-supported agriculture: opportunities for environmental education', *Journal of Environmental Education*, **25**, 2, 4–8.

DOYLE, R. and KRASNY, M. (2003). 'Participatory rural appraisal as an approach to environmental education in urban community gardens', *Environmental Education Research*, **9**, 1, 91–115.

DYER, J.E. and OSBORNE, E. (1995). 'Effects of teaching approach on problem solving ability of agricultural education students with varying learning styles', *Journal of Agricultural Education*, **37**, 3, 43–51.

EATON, D. (2000). 'Cognitive and affective learning in outdoor education', *Dissertation Abstracts International - Section A: Humanities and Social Sciences*, **60**, 10-A, 3595.

EDEN, E.S. (1998). 'Digging down deep: educational experiences with the earth in a gardening/farming context', *NAMTA Journal*, **23**, 1, 322–32.

EDUCATION DEVELOPMENT CENTER (2000). *Schoolyard Learning: the Impact of School Grounds* [online]. Available: http://www.edc.org/GLG/schoolyard.pdf [23 January, 2003].

EISEMON, T.O. (1989). 'The impact of primary schooling on agricultural thinking and practices in Kenya and Burundi', *Studies in Science Education*, **17**, 5–28.

ELLIOTT, C. (1983). *Growing in the City: Employment, Education and Recreation in Australian City Farms and Community Gardens* (Community Economic Development Series 2). Armidale, NSW: Social Impacts Publications.

ENGLAND. PARLIAMENT. HOUSE OF COMMONS (2002). *Response to the Report of the Policy Commission on the Future of Farming and Food by HM Government* (Cm. 5709). London: The Stationery Office.

ENGLISH, D. (1980). 'A farm experience for learning disabled children', *Communicator*, **11**, 1, 2–5.

FANG, W. (1995). *The Case for More High School Gardens* (Research Paper: Urban Agriculture Notes) [online]. Available: http://www.cityfarmer.org/highschool77.html [18 February, 2003].

FARMER, A.J. and WOTT, J.A. (1995). 'Field trips and follow-up activities: fourth graders in a public garden', *Journal of Environmental Education*, **27**, 1, 33–5.

FARMING AND COUNTRYSIDE EDUCATION (2002). *Farm in the City: Evaluation by Participating Students* (Gifted and Talented) [online]. Available: http://www.face-online.org.uk/resources/gifted/pupileval.htm [23 January, 2003].

FARNHAM, M. and MUTRIE, N. (1997). 'The potential benefits of outdoor development for children with special needs', *British Journal of Special Education*, **24**, 1, 31–8.

FERRY, B. (1995). 'Enhancing environmental experiences through effective partnerships among teacher educators, field study centers, and schools', *Journal of Experiential Education*, **18**, 3, 133–7.

FISHER, J.A. (2001). 'The demise of fieldwork as an integral part of science education in United Kingdom schools: a victim of cultural change and political pressure?' *Pedagogy, Culture & Society*, **9**, 1, 75–96.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS and UNITED NATIONS INTERNATIONAL CHILDREN'S EMERGENCY FUND (1964). *Nuestra Huerta Escolar: Manual de Nutrición y Horticultura.* Mexico: FAO and UNICEF. Cited in: FOOD AND AGRICULTURE ORGANISATION OF THE

UNITED NATIONS (1971). *Food and Nutrition Education in the Primary School: a Guide for its Introduction* (FAO Nutritional Studies No.25). Rome: FAO

FOSKETT, N. and MARSDEN, B. (Eds) (1998). *A Bibliography of Geographical Education 1970-1997.* Sheffield: The Geographical Association.

FRICK, M.J., BIRKENHOLZ, R.J., GARDNER, H. and MACHTMES, K. (1995). 'Rural and urban inner-city high school student knowledge and perception of agriculture', *Journal of Agricultural Education*, **36**, 4, 1–9.

GEEN, A. (1991). 'Home economics from 16 to 19: some views from the classroom', *Modus*, **9**, 6, 188–91.

GRIFFITHS, A.K. and GRANT, B.A.C. (1985). 'High school students' understanding of food webs: identification of a learning hierarchy and related misconceptions', *Journal of Research in Science Teaching*, **22**, 5, 421–36.

GROUNDWORK UK (2002a). *Farmlink: Connecting Children with the Countryside* [online]. Available: http://www.groundwork.org.uk/what/doc/farmlink.doc [25 March, 2003].

GROUNDWORK UK (2002b). *Groundwork: 21 Years of Action in Schools 1981-2002* [online]. Available: http://www.groundwork.org.uk/what/doc/review.doc [25 March, 2003].

GROVE-WHITE, R., MACNAGHTEN, P., MAYER, S. and WYNNE, B. (1997). *Uncertain World.* Lancaster: Lancaster University, Centre for the Study of Environmental Change.

GUNTER, B., KINDERLERER, J. and BEYLEVELD, D. (1998). 'Teenagers and biotechnology: a survey of understanding and opinion in Britain', *Studies in Science Education*, **32**, 81–112.

HAGUE, M. (1992). 'Nutrition in education in Iceland?' *Modus*, **10**, 7, 205–6.

HALVORSEN, K.V. (1995). 'Steps in the Plantain Project: the ideas, activities and experiences of the Plantain Project, a scheme to safeguard children and their environment', *Children's Environments Quarterly*, **12**, 4, 444–56.

HAM, S.H. and SEWING, D.R. (1987). 'Barriers to environmental education', *Journal of Environmental Education*, **19**, 2, 17–24.

HAMMOND, L. (2001). 'Notes from California: an anthropological approach to urban science education for language minority families', *Journal of Research in Science Teaching*, **38**, 9, 983–99.

HARBSTREIT, S.R. and WELTON, R.F. (1992). 'Secondary agriculture student awareness of international agriculture and factors influencing student awareness', *Journal of Agricultural Education*, **33**, 1, 10–16.

HARDCASTLE, L. and DUFFIELD, P. (1988). 'Recording a first for farm case studies in the lower school', *Teaching Geography*, **13**, 4, 172–3.

HARLEN, W. (2000). 'Food and farming: "explanatory stories"', *Primary Science Review*, **62**, 4–5.

HART, P. and NOLAN, K. (1999). 'A critical analysis of research in environmental education', *Studies in Science Education*, **34**, 1–69.

HATTIE, J., MARSH, H.W., NEILL, J.T. and RICHARDS, G.E. (1997). 'Adventure education and outward bound: out-of-class experiences that make a lasting difference', *Review of Educational Research*, **67**, 1, 43–87.
HEATH, J. (1988). 'Starting them young', *Modus*, **6**, 2, 52–4.

HEWITT, P. (1997). 'Games in instruction leading to environmentally responsible behaviour', *Journal of Environmental Education*, **28**, 3, 35–7.

HILL, R., STANISSTREET, M. and BOYES, E. (1999). 'Genetically engineered foodstuffs: school students' views', *International Journal of Environmental Studies*, **56**, 785–99.

HILL, R., STANISSTREET, M. and BOYES, E. (2000). 'What ideas do students associate with "biotechnology" and "genetic engineering"?' *School Science Review*, **81**, 297, 77–83.

HILL, R., STANISSTREET, M., BOYES, E. and O'SULLIVAN, H. (1998). 'Reactions to the new technology: students' ideas about genetically engineered foodstuffs', *Research in Science & Technological Education*, **16**, 2, 203–16.

HOBDEN, J. (2000). 'Science in the supermarket', *Primary Science Review*, **62**, 17–19.

HOLMES, R. (1993). 'Curricula and the integration of food as a learning tool', *Curriculum and Teaching*, **8**, 2, 45–51.

HUBERT, D., FRANK, A. and IGO, C. (2000). 'Environmental and agricultural literacy education', *Water, Air and Soil Pollution*, **123**, 1, 525–32.

HUNT, H. (2003). "Inspiration for Action" with South East Sheffield EAZ Report of Pilot Visits. Unpublished report.

IDIRIS, S. and FRASER, B.J. (1993). 'Determinants and effects of learning environments in agricultural science classrooms in Nigeria.' Paper presented at the Annual Conference of the Australian Association for Research in Education, Fremantle, 22-25 November [online]. Available: http://www.aare.edu.au/93pap/idirs93.296 [23 January, 2003].

IDIRIS, S. and FRASER, B.J. (1994). 'A study of learning environments in agricultural science classrooms in Nigeria.' Paper presented at the Annual Conference of the Australian Association for Research in Education, University of Newcastle, 27 November-1 December [online]. Available: http://www.aare.edu.au/94pap/idirs94.334 [23 January, 2003].

JENKINS, E.W. and SWINNERTON, B.J. (1998). *Junior School Science Education in England and Wales Since 1900: From Steps to Stages*. London: Woburn Press.

JEVREMOVIC, H. (1964). *Objet et Organisation des Jardins Scolaires Document, Semi-Naire de Nutrition.* Porto-Novo, Dahomey: FAO and UNICEF. Cited in: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (1971). *Food and Nutrition Education in the Primary School: a Guide for its Introduction* (FAO Nutritional Studies No.25). Rome: FAO.

KAHN, D. (1998). 'Erdkinder under construction: what the farm schools showed us', *NAMTA Journal*, **23**, 1, 284–321.

KEIRLE, K. and THOMAS, M. (2000). 'The influence of school health education programmes on the knowledge and behaviour of school children towards nutrition and health', *Research in Science & Technological Education*, **18**, 2, 173–90.

KERN, E.L. and CARPENTER, J.R. (1986). 'Effect of field activities on student learning', *Journal of Geological Education*, **34**, 3, 180–3.

KNAPP, D. and BARRIE, E.U. (2001). 'Content evaluation of an environmental science field trip', *Journal of Science Education & Technology*, **10**, 4, 351–7.

KNAPP, D. and POFF, R. (2001). 'A qualitative analysis of the immediate and short-term impact of an environmental interpretive program', *Environmental Education Research*, **7**, 1, 55–65.

KONOSHIMA, H. (1995). 'Participation of school children in agricultural activities at school farms in Shiga Prefecture', Acta Horticulturae, **391**, 217–22.

KOTRLIK, J.W., PARTON, G. and LELLE, M. (1986). 'Factors associated with knowledge level attained by vocational agriculture 11 students', *AATEA*, **27**, 2, 34–43.

KRASNY, M.E. and DOYLE, R. (2002). 'Participatory approaches to program development and engaging youth in research: the case of an inter-generational, urban community gardening program', *Journal of Extension*, **40**, 5 [online]. Available: http://www.joe.org./joe/2002October/a3.shtml [19 February, 2003].

KUHLEMEIER, K., VAN DEN BERGH, H. and LAGERWEIJ, N. (1999). 'Environmental knowledge, attitudes and behavior in Dutch secondary education', *Journal of Environmental Education*, **30**, 2, 4–14.

LAI, K.C. (2000). 'Affective focused geographical fieldwork: what do adventurous experiences field trips mean to pupils?' In: GERBER R. and CHUAN, G.K. (Eds) *Fieldwork in Geography: Reflections, Perspectives and Actions.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

LAVE, J. and WENGER, E. (1999). 'Legitimate peripheral participation.' In: MURPHY, P. (Ed) *Learners, Learning and Assessment*. London: Paul Chapman.

LEARNING THROUGH LANDSCAPES IN LONDON (2003). *Grounds for Celebration: Measuring the Impact of School Grounds Projects in London. Report from the London Electricity Group and Learning Through Landscapes in London Reception at the House of Commons, 23 January.* London: LTL in London.

LEEMING, F.C., DWYER, W.O., PORTER, B.E. and COBERN, M.K. (1993). 'Outcome research in environmental education: a critical review', *Journal of Environmental Education*, **24**, 4, 8–21.

LINDEMANN-MATTHIES, P. (2002). 'The influence of an educational program on children's perception of biodiversity', *Journal of Environmental Education*, **33**, 2, 22–31.

LINTERMANS, T. (1981). 'Down on the farm', *Educational Magazine*, **38**, 1, 36–9.

LOCK, R. and MILES, C. (1993). 'Biotechnology and genetic engineering students' knowledge and attitudes', *Journal of Biological Education*, **27**, 4, 267-72.

LOCK, R., MILES, C. and HUGHES, S. (1995). 'The influence of teaching on knowledge and attitudes in biotechnology and genetic engineering contexts: implications for teaching controversial issues and the public understanding of science', *School Science Review*, **76**, 276, 47–59.

MABIE, R. and BAKER, M. (1994). 'Strategies for improving agricultural literacy and science process skills of urban fifth and sixth graders in the Los Angeles unified school district.' Paper presented at the Annual Western Region Agricultural Education Research Meeting, Honolulu, HI.

MABIE, R. and BAKER, M. (1996a). 'A comparison of experiential instructional strategies upon the science process skills of urban elementary students', *Journal of Agricultural Education*, **37**, 2, 1–7.

MABIE, R. and BAKER, M. (1996b). 'The influence of experiential instruction on urban elementary students' knowledge of the food and fiber system', *Journal of Extension*, **34**, 6 [online]. Available: http://www.joe.org/joe/1996december/rb1.html [23 January, 2003].

MARGIORIDOU, C. and TAKANTZA, E. (1992). *Cognitive Development Through the Study of the Environment: from Sheep to Jumper, from Popular Tradition to Modern Ways of Production.* Greece: Aristotle University of Thessaloniki, Department of Early Childhood Education.

MARKS, I. (1987). 'Development of normal fear: a review', *Journal of Child Psychology and Psychiatry*, **28**, 5, 667–97. Cited in: BIXLER, R.D., CARLISLE, C.L., HAMMITT, W.E. and FLOYD, M.F. (1994). 'Observed fears and discomforts among urban students on field trips to wildland areas', *Journal of Environmental Education*, **26**, 1, 24–33.

MARSDEN, D. (2003). *Observations on the Use of Horticulture, Gardening and Environmental Work in Learning and Caring Establishments that Work with Children and Young People with Special Educational Needs (SEN).* Reading: Thrive.

MARTIN, W.W., FALK, J.H. and BALLING, J.D. (1981). 'Environmental effects on learning: the outdoor field trip', *Science Education*, **65**, 3, 301–9.

MATTHEWS, B. and FALVEY, L. (1999). 'Year 10 students' perceptions of agricultural careers: Victoria (Australia)', *Journal of International Agricultural and Extension Education*, **6**, 1, 55–67.

MATTHEWS, H., TAYLOR, M., SHERWOOD, K., TUCKER, F. and LIMB, M. (2000). 'Growing-up in the countryside: children and the rural idyll', *Journal of Rural Studies*, **16**, 2, 141–53.

McCORMACK, J. (2002). 'Children's understandings of rurality: exploring the interrelationship between experience and understanding', *Journal of Rural Studies*, **18**, 2, 193-207.

McKENZIE, G.D., UTGARD, R.O. and LISOWSKI, M. (1986). 'The importance of field trips', *Journal of College Science Teaching*, **16**, 1, 17–20.

McKEON, F. (2001). 'Enhancing museum visits through webpage development', *School Science Review*, **83**, 303, 85–9.

MEUNIER, R.A., TALBERT, B.A. and LATOUR, M.A. (2002). 'Evaluation of the incubators in the classroom program: does it increase fourth grade students' knowledge of agriculture-related science concepts?' *Journal of Agricultural Education*, **43**, 3, 49–59.

MINISTRY OF EDUCATION (1958). *Schools and the Countryside* (Pamphlet No.35). London: HMSO.

MOORE, R.C. and WONG, H.H. (1997). *Natural Learning: the Life of an Environmental Schoolyard. Creating Environments for Rediscovering Nature's Way of Teaching*. Berkeley, CA: MIG Communications.

MORRIS, J., BRIGGS, M. and ZIDENBERG-CHERR, S. (2000). 'School-based gardens can teach kids healthier eating habits', *California Agriculture*, **54**, 40–6.

MORRIS, J.L., KOUMJIAN, K.L., BRIGGS, M. and ZIDENBERG-CHERR, S. (2002). 'Nutrition to grow on: a garden-enhanced nutrition education curriculum for upper-elementary schoolchildren', *Journal of Nutrition Education and Behavior*, **34**, 3, 175–6.

MORRIS, M., NELSON, J., RICKINSON, M. and STONEY, S. with BENEFIELD, P. (1999). *A Literature Review of Young People's Attitudes Towards Education, Employment and Training* (DfEE Research Report 170). London: DfEE.

MORRISON, M. (1995). 'Researching food consumers in school. Recipes for concern', *Educational Studies*, **21**, 2, 239–63.

MORRISON, M. (1996). 'A curriculum for food: places left at the school table?' *Curriculum Journal*, **7**, 1, 51–73.

MUNSON, B.H. (1994). 'Ecological misconceptions', *Journal of Environmental Education*, **25**, 4, 30–4.

MYLNE, E. and LINLEY, J. (1998). 'What is Ag-Ed?' *Education in Rural Australia*, **8**, 1, 11–15.

NABHAN, G.P. and TRIMBLE, S. (1994). *The Geography of Childhood: Why Children Need Wild Places*. Boston: Beacon Press.

NICHOLSON-LORD, D. (1997). 'A fair exchange', *Sainsbury's: The Magazine*, **47**, 58–62. Cited in: COOK, I., CRANG, P. and THORPE, M. (1998). 'Biographies and geographies: consumer understandings of the origins of foods', *British Food Journal*, **110**, 3, 162–7.

NUNDY, S. (1998). The fieldwork effect: an exploration of fieldwork at KS2. Unpublished PhD, University of Southampton.

NUNDY, S. (1999a). 'The fieldwork effect: the role and impact of fieldwork in the upper primary school', *International Research in Geographical Land Environmental Education*, **8**, 2, 190–8.

NUNDY, S. (1999b). 'Thoughts from the field: in their own words….', *Horizons*, **4**, 20–2.

NUNDY, S. (2001). *Raising Achievement Through the Environment: the Case for Fieldwork and Field Centres*. Doncaster: National Association of Field Studies Officers.

OPENSHAW, P.H. and WHITTLE, S.J. (1993). 'Ecological field teaching: how can it be made more effective ?' *Journal of Biological Education*, **27**, 1, 58–66.

ORION, N. and HOFSTEIN, A. (1994). 'Factors that influence learning during a scientific field trip in a natural environment', *Journal of Research in Science Teaching*, **31**, 10, 1097–119.

PALMBERG, E.E. and KURU, J. (2000). 'Outdoor activities as a basis for environmental responsibility', *Journal of Environmental Education*, **31**, 4, 32–6.

PEARCE, T. (1987). 'Teaching and learning through direct experience.' In: BAILEY, P. and BINNS, T. *Case for Geography*. Sheffield: Geographical Association.

POLICY COMMISSION ON THE FUTURE OF FARMING AND FOOD (2002). *Farming & Food: a Sustainable Future* [online]. Available:// http://www.cabinet-office.gov.uk/farming/index/CommissionReport.htm [25 March, 2003].

POULSEN, K. (1992). 'Chickens across the curriculum: an experiment in experiential learning.' Paper presented at the Annual Meeting of the American Association of Colleges for Teacher Education, San Antonio, Texas, 25-28 February .

PRELLE, S. and SOLOMON, J. (1996). 'Young people's "general approach" to environmental issues in England and Germany', *Compare*, **26**, 1, 91–101.

RAHM, I. (2002). 'Emergent learning opportunities in an inner-city youth gardening program', *Journal of Research in Science Teaching*, **39**, 2, 164–84.

RANDELL, R.S., CHEEK, J.G. and ARRINGTON, L.R. (1993). 'The relationship of supervised agricultural experience program participation and student achievement in agricultural education', *Journal of Agricultural Education*, **35**, 2, 1–5.

RICKINSON, M. (2001). 'Learners and learning in environmental education: a critical review of the evidence' (Special Issue), *Environmental Education Research*, **7**, 3, (whole issue).

RIECHARD, D.E. and PETERSON, S.J. (1998). 'Perception of environmental risk related to gender, community socioeconomic setting, age, and locus of control', *Journal of Environmental Education*, **30**, 1, 11–9.

RILLO, T.J. (1985). *Outdoor Education: Beyond the Classroom Walls*. Bloomington, IN: Phi Delta Kappa Educational Foundation.

ROBERTSON, A. (1994). 'Toward constructivist research in environmental education', *Journal of Environmental Education*, **25**, 2, 21–31.

ROBOTTOM, I. and HART, P. (1993). *Research in Environmental Education: Engaging the Debate.* Geelong, Australia: Deakin University Press.

ROEGGE, C.A. and RUSSELL, E.B. (1990). 'Teaching applied biology in secondary agriculture: effects on student achievement and attitudes', *Journal of Agricultural Education*, **31**, 1, 27–31.

ROTHENBERGER, B.H. and STEWART, B.R. (1995). 'A greenhouse laboratory experience: effects on student knowledge and attitude', *Journal of Agricultural Education*, **36**, 1, 24–30.

RUTLAND, M. (1993). 'Food in the curriculum: an entitlement to a quality education', *Modus*, **11**, 8, 244–52.

SCHNEEKLOTH, L.H. (1989). '"Where did you go?" "The forest." "What did you see?" "Nothing"', *Children's Environments Quarterly*, **6**, 1, 14.

SIMMONS, D. (1993). 'Facilitating teachers' use of natural areas: perceptions of environmental education opportunities', *Journal of Environmental Education*, **24**, 3, 8–16.

SIMMONS, D. (1998). 'Using natural settings for environmental education: perceived benefits and barriers', *Journal of Environmental Education*, **29**, 3, 23–31.

SIMMONS, D.A. (1994). 'Urban children's preferences for nature: lessons for nature: lessons for environmental education', *Children's Environments*, **11**, 3, 194–203.

SKELLY, S. and ZAJICEK, J. (1998). 'The effect of an interdisciplinary garden program on the environmental attitudes of elementary school students', *Hortechnology*, **8**, 4, 579–83.

SMITH, F. and BARKER, J. (2001). 'Commodifying the countryside: the impact of out of school care on rural landscapes of children's play', *Area*, **33**, 2, 169–76.

SOUTHWORTH, S.A. (1990). 'The farm school, (Athol, Massachusetts)', *Instructor*, September [online]. Available: http://www.findarticles.com/cf_0/m0STR/2_109/55778247/p1/article.jhtml?term=the+farm+school [25 March, 2003].

ST. MAURICE, H. (1996). 'Nature's nature: ideas of nature in curricula for environmental education', *Environmental Education Research*, **2**, 2, 141–8.

STAINFIELD, J., FISHER, P., FORD, B. and SOLEM, M. (2000). 'International virtual field trips: a new direction?' *Journal of Geography in Higher Education*, **24**, 2, 255–62.

STATE EDUCATION AND ENVIRONMENT ROUNDTABLE (2000). *The Effects of Environment-based Education on Student Achievement* [online]. Available: http://www.seer.org/pages/csap.pdf [19 November, 2002].

SUTTON, P. (1991). 'Offering new experience - farms for city children', *Education Review*, **5**, 1, 65–8.

TAYLOR, G.L. and DISINGER, J.F. (1997). 'The potential role of virtual reality in environmental education', *Journal of Environmental Education*, **28**, 3, 38–43.

TAYLOR, M. with JOHNSON, R. (2002). *School Councils: Their Role in Citizenship and Personal and Social Education*. Slough: NFER.

TRACEY, G.W. (1966). 'Some aspects of the teaching of nature-study in English schools 1900-60', *Natural Science in Schools*, **4**, 1, 18–22.

TREXLER, C.J. (2000). 'A qualitative study of urban and suburban elementary student understandings of pest-related science and agricultural education benchmarks', *Journal of Agricultural Education*, **41**, 3, 89–102.

TUNNICLIFFE, S.D. (1998). 'Down on the farm: the content of conversations generated by school children viewing live animals as exhibits and on a farm', *Journal of Elementary Science Education*, **10**, 1, 1–17.

TUNNICLIFFE, S.D. (2001). 'Talking about plants - comments of primary school groups looking at plant exhibits in a botanical garden', *Journal of Biological Education*, **36**, 1, 27–34.

TUNNICLIFFE, S.D., LUCAS, A.M. and OSBORNE, J. (1997). 'School visits to zoos and museums: a missed educational opportunity?' *International Journal of Science Education*, **19**, 9, 1039–56.

TURNER, J. and HERREN, R.V. (1997). 'Motivational needs of students enrolled in agricultural education programs in Georgia', *Journal of Agricultural Education*, **38**, 4, 30–41.

TUTHILL, G. and KLEMM, E. (2002). 'Virtual field trips: alternatives to actual field trips', *International Journal of Instructional Media*, **29**, 4, 453–68.

UZZELL, D. (1999). 'Education for environmental action in the community: new roles and relationships', *Cambridge Journal of Education*, **29**, 3, 397–413.

UZZELL, D.L., RUTLAND, A. and WHISTANCE, D. (1995). 'Questioning values in environmental education.' In: GUERRIER, Y., ALEXANDER, N., CHASE, J. and O'BRIEN, M. (Eds) *Values and the Environment: a Social Science Perspective*. Chichester: John Wiley and Sons.

VICENTI-HENIO, V.D. and TORRES, R.M. (1998). 'Field dependence-independence of American Indian students enrolled in secondary agricultural education', *Journal of Agricultural Education*, **39**, 3, 1–10.

VOSNIADOU, S. (2001). *How Children Learn.* Brussels: International Academy of Education.

WALKER, K. (1997). 'Environmental education and the school curriculum: the need for a coherent curriculum theory', *International Research in Geographical and Environmental Education*, **6**, 3, 252–5.

WASESCHA, A. and NESS, K. (1998). 'Involving children in children's gardens: farm in the city St Paul, Minnesota.' Paper presented at the Annual Meeting of the American Community Gardening Association, 19 September [online]. Available: http://www.cityfarmer.org/AnnaW.html [18 February, 2003].

WEBB, P. and BOLTT, G. (1990). 'Food chain to food web: a natural progression?' *Journal of Biological Education*, **24**, 3, 187–90.

WEIS, L. (1992). 'Food for America - a day at the farm for third graders', *The Agricultural Education Magazine*, **64**, 11, 5–6.

WHALEY, D. and LUCERO, D. (1993). 'Barriers to successful supervised agricultural experience programs in semi-rural and urban high school agricultural education programs', *Rural Educator*, **14**, 3, 7–10.

WILBY, P. (1984). 'Evaluating the role of fieldwork.' In: ORRELL, K. and WIEGAND, P. (Eds) *Evaluation and Assessment in Geography*. Sheffield: Geographical Association.

WILLIAMS, D.L. (2000). 'Students' knowledge of and expected impact from sustainable agriculture', *Journal of Agricultural Education*, **41**, 2, 19–24.

WILLIAMS, D.L. and WISE, K.L. (1997). 'Perceptions of Iowa secondary school agricultural education teachers and students regarding sustainable agriculture', *Journal of Agricultural Education*, **38**, 2, 15–20.

WINGENBACH, G.J., GARTIN, S.A. and LAWRENCE, L.D. (1999). 'Students' perceptions of aquaculture education in the northeast region', *Journal of Agricultural Education*, **40**, 1, 14–22.

WORTHINGTON, V. and ELLEFSON, N. (2002). *Electronic Field Trips* [online]. Available: http://commtechlab.msu.edu/sites/letsnet/noframes/bigideas/b1/b1theor.html [15 January, 2003].

WRIGHT, D., STEWART, B.R. and BIRKENHOLZ, R.J. (1994). 'Agricultural awareness of eleventh grade students in rural schools', *Journal of Agricultural Education*, **35**, 4, 55–60.

XANTHOUDAKI, M. (1998). 'Is it always worth the trip? The contribution of museum and gallery educational programmes to classroom art education', *Cambridge Journal of Education*, **28**, 2, 181–95.

Copies of this publication can be obtained from:

DfES Publications
P.O. Box 5050
Sherwood Park
Annesley
Nottingham
NG15 0DJ

Tel: 0845 60 222 60
Fax: 0845 60 333 60
Minicom: 0845 60 555 60

Produced by the Department for Education and Skills

ISBN: 1 84185 988 5
Ref No: RR422

www.dfes.go.uk/research